



European Commission

ISSN 1831-9947

No 1 April 2011

# research<sup>eu</sup>

## RESULTS MAGAZINE

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### Special feature



*Blue sky research: a funding lifeline*  
*Interview with Professor Tommaso Calarco of AQUTE*

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Publications Office

**Published by**  
CORDIS Unit  
Publications Office of the European Union  
2, rue Mercier  
2985 Luxembourg  
LUXEMBOURG  
E-mail: [research-eu-results-magazine@publications.europa.eu](mailto:research-eu-results-magazine@publications.europa.eu)

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

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

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## The novelty of wonder

*Curiosity has long been the origin of some of humanity's most crowning achievements. Driven by wonder and imagination, scientists have often initiated the first step towards a spellbinding discovery. Centuries ago, mathematicians working by candle light laid the foundation for modern computing. And few could ever have imagined how far their research has changed the world today.*

*Blue sky research builds upon innovation and the pursuit of knowledge. Its final outcome can never really be known in advance. There is only one real objective — to discover. In Europe, the tradition of blue sky research is most apparent in the pursuit of the elusive Higgs boson particle at the Large Hadron Collider in CERN. That pursuit alone has already netted some extraordinary and unexpected results.*

*Europe is financing a growing number of blue sky related research projects. Last year, as part of its commitment towards science, the European Commission announced its biggest-ever investment in research and innovation. The extra funding will advance scientific boundaries and help solve societal challenges such as climate change, energy and food security, health and an ageing population.*

*Therefore, we decided to highlight some of these projects in this issue of research\*eu results magazine. Our theme is 'Blue sky research: a funding life line'. We talk in depth with Tommaso Calarco, coordinator for the EU-funded 'Atomic quantum technologies' (AQUTE) project. AQUTE is working to develop quantum technologies based on atomic, molecular and optical systems, including quantum processing chips which could be integrated into the first functional quantum computers.*

*Also in this issue, the biology and medicine section we explore a relatively new discipline of systems biology known as metabolic engineering.*

*The energy and transport section leads with an article on an EU-funded project that is looking ten years into the future of flight design. They hope to design quieter, cleaner and more efficient passenger jets.*

*The top story in the environment and society section looks at using new technologies to tackle pollution with microbes.*

*In our IT and telecommunications section, we see how virtual organisations are able to coordinate the business acumen of distant and distinct SMEs who work together on a project or product.*

*The industrial technology section leads with a story on a project that is coordinating efforts for a united research community in Europe necessary to develop the 45 nm, 32 nm and smaller CMOS technologies*

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

*We would also like to inform our readers that the research\*eu results supplement has been renamed to research\*eu results magazine to better reflect its role.*

*We look forward to receiving your feedback on this issue and on the research\*eu publications in general. Send questions or suggestions to: [research-eu-results-magazine@publications.europa.eu](mailto:research-eu-results-magazine@publications.europa.eu)*

The editorial team



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Thank you to Prof. Tommaso Calarco of AQUTE for his contribution to the 'special' dossier in this issue

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## Frequent acronyms

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



## The promise of metabolic engineering

*A relatively new discipline in biology is enabling researchers to fully understand — and manipulate — microorganisms in food and medicine.*

The turn of the century has brought with it important advances in cell biology. The emergence of newer, high-tech disciplines in life sciences or bioscience generally fall under the name of systems biology.

*'Sysinbio has improved on techniques required for metabolic engineering such as metabolomics, fluxomics and identification of mutations in evolved strains.'*

One branch of systems biology is known as metabolic engineering — the practice of optimising regulatory and genetic processes of cells to increase production of specific substances. Metabolic engineering also focuses on developing new cell factories or improving existing ones. Cell factories represent equipment designed for large-scale cell culture and production of biomaterials such as antibodies and vaccines.

Metabolic engineering is considered an enabling science, i.e. it is not genetic engineering in itself but exploits advanced analytical tools and mathematical models to identify targets for genetic engineering. Much of metabolic engineering focuses on computer models to optimise cell factories.

In this vein, the EU-funded 'Systems biology as a driver for industrial biotechnology' (Sysinbio) project is coordinating European activities in the field of model-driven metabolic engineering. It is also investigating other technologies required for state-of-the-art metabolic engineering. These include metabolomics (chemical fingerprints that specific cellular processes leave behind) and fluxomics (a mathematical method for analysing metabolism).

The main aim for Sysinbio is to act as a driver for industrial biotechnology.

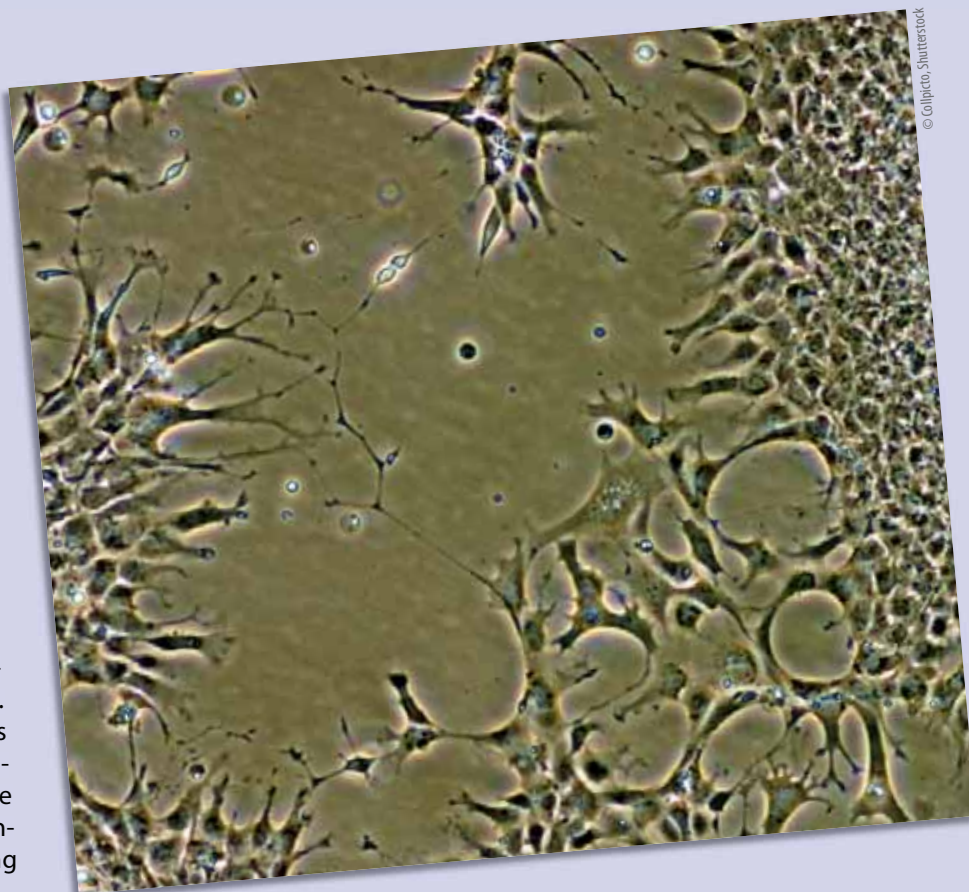
An important achievement of the Sysinbio project is establishing a database containing metabolic models for different important microorganisms for industrial purposes. This could have an impact on several industries and their products, such as beer, cheese, wine and pharmaceuticals, among other products related to biotechnology. The database also contains different simulation tools required to identify metabolic engineering targets, as well as to analyse emerging models and their data.

Summaries of methods for these disciplines have already been drafted, and recommendations for employing these techniques are being elaborated.

Sysinbio has also been coordinating education and training activities in the field of metabolic engineering in Europe. This has encouraged students to participate in key conferences and courses related to systems biology.

Funded under the FP7 programme Cooperation under the theme 'Knowledge based bio-economy.'

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## Hunting a mysterious mood manipulator

*Inflammation is a hidden and mysterious cause of some major mood disorders, at least partially. New research is giving European scientists a better understanding of the problem, and its treatment.*



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Bipolar disorder, major depressive disorder and postpartum psychosis are mysterious, widespread and totally devastating conditions suffered by millions of people across the globe. One of the most crippling aspects of these conditions is that the victims often feel guilty that they are sick, and cannot understand why it should affect them when it does not affect other people. New research offers relief, at least from guilt. Hopefully it will offer a treatment as well.

Scientists discovered that these major mood disorders (MMD) and many others are to some degree linked to the susceptibility of the patient to inflammation, the first line of immune response. 'Proneness to inflammation in MMD patients is based on abnormally activated immune cells, including the immune cells in the brain, the microglia. This alters the architecture of certain brain areas, such as the limbic system,' says Dr Hemmo Drexhage, coordinator of the Moodinflammation<sup>(1)</sup> project and professor of medical immunology at the Erasmus University Medical Centre in Rotterdam.

'The limbic system influences stress biology reactions, how people react to real or perceived stress with an alteration in their mood and behaviour. Moreover, the abnormally activated brain immune cells alter the

metabolism of tryptophan, an important precursor for serotonin, a neurotransmitter,' he explains.

'In this way, the mild chronic inflammation of the limbic system is linked to a defective stress responsiveness and a shortage of serotonin in certain brain areas in patients with a major mood disorder. In our view,

MMDs are thus largely caused by a sort of mild chronic inflammation of certain brain areas important for mood regulation, such as the limbic system,' notes Dr Drexhage.

The project is halfway through a research programme that studies the 'early diagnosis, treatment and prevention of mood disorders and is targeting the inflammatory response system.' It started out with three primary objectives. Firstly, the research team is taking blood tests and brain scans to determine the proneness to inflammation in patients and its consequences for brain function. Secondly, the project studies useful rodent models. The rodent models are characterised by abnormally activated immune cells, abnormal tryptophan breakdown and depressive-like behaviour. Production of serotonin, the happiness hormone, requires tryptophan, a protein. Characterisation of animal models will allow the researchers to advance study of the mechanisms and consequences of low-grade brain inflammations. Finally, as their understanding of the role of inflammation improves, they want to look at the therapeutic potential of using anti-inflammatory medicines as a treatment for mood disorders.

### Huge effort

The project is huge. The consortium consists of 18 institutions from

10 countries pursuing 5 strategic approaches across 11 work packages. Moodinflammation has an enormous budget of EUR 13.73 million, EUR 10.24 million provided by the European Commission. Moodinflammation has already racked up a considerable number of achievements. It has set up logistics to collect and test the blood of patients, which number 300 so far, and it has a high-throughput system in place to establish the inflammatory state of immune cells.

This was a good result. Early Moodinflammation data shows that 'inflammation fingerprints' are reliable indicators for inflammation and this is important for the development of reliable tests. Their research has also demonstrated that certain hormones, neurotransmitters, bacterial products and drugs can create such inflammatory fingerprints.

High performance liquid chromatography (HPLC) systems were created to track tryptophan, another important factor in inflammation-related mood disorders. HPLC separates biochemical compounds and then the chroma, or colour, identifies the material. It is a reliable, but complex test. Currently the team is developing a simpler, faster method.

The consortium has identified a marker for use with a positron emission tomography (PET) scan to identify inflamed regions of the brain. The team has also developed two further platforms that can detect the presence of particular intracellular proteins associated with inflammation.

A particularly interesting result was the discovery of abnormal expression of specific steroid resistant genes, known as a  $\beta$ -glucocorticoid receptor. 'This explains the well-known steroid resistance of MMD patients. These studies will be continued and expanded,' notes Dr Drexhage.

The rodent models are known as NOD, OBX and GS and characterisation studies are well under way. Work with the NOD mouse is the most advanced and shows a depressive-like behaviour and a pro-inflammatory fingerprint like that found in MMD patients. The researchers have taken samples from the OBX



rat and studies are underway to identify pro-inflammatory markers. Meanwhile the GS rat model has been validated and the project will soon take samples.

Systems for lab-based brain culture studies and their interactions with activated microglia are up and running and yielding data that indicates inflammation affects synaptic transmission and neuronal outgrowth, a big hint that Moodinflamm is on the right track.

The project wasted no time in its search for potential treatments. COX-2 inhibitors are non-steroidal anti-inflammatory drugs (NSAID), a family of extremely useful drugs, some of which

have demonstrated great effectiveness for other inflammation treatments. Moodinflamm has shown that COX-2 inhibitors had an anti-depressive effect in normal rats and it will soon be tested in the project's three animal models.

Moreover, in a clear illustration of the project's brisk pace, Moodinflamm has taken first steps for a COX-2 inhibitor trial in fingerprint-positive patients. The group has established a protocol and has received approval from some agencies and is now waiting for final approval to begin the study.

A lot more work remains to be done over the coming years. But Dr Drexhage

believes they will reach their ambitious targets: 'We are confident that we will be able to detect, using the developed tests, some MMD patients and also individuals who are at risk of MMD, who would benefit from an intervention strategy with anti-inflammatory drugs.'

The Moodinflamm project received funding from the Health programme of the EU's Seventh Framework Programme (FP7) for research.

(1) 'Early diagnosis, treatment and prevention of mood disorders targeting the activated inflammatory response system'.

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## Study finds genes not environment behind Parkinson's

*An EU-wide study has found five new genetic variants for Parkinson's disease. The research was funded in part by the 'Network of European funding for neuroscience research' (Neuron) initiative, a coordinated action funded under the ERA-NET scheme of the EU's Sixth Framework Programme (FP6) to the tune of EUR 2.7 million.*

Participating in Neuron were experts from Austria, Finland, France, Germany, Israel, Italy, Luxembourg, Poland, Romania, Spain, Sweden and the UK. The research was recently published in *The Lancet* journal.

Most researchers thought that environmental factors were wholly responsible for Parkinson's disease. Since 2007, however, scientists have identified six genetic variants or loci that increase the risk of developing the condition. Scientists have now found a further five loci, leading them to suggest that

genetic, rather than environmental factors as previously believed, may be the key cause of the disease.

'This study provides evidence that common genetic variation plays an important part in the cause of Parkinson's disease,' the scientists say. 'We have confirmed a strong genetic component to Parkinson's disease, which, until recently, was thought to be completely caused by environmental factors.' They concluded that 'the identification of additional common and rare risk variants for Parkinson's disease will probably revise our estimate of the genetic component of disease upward.'

The research team came to these conclusions after conducting what they described as the largest genetic analysis of Parkinson's disease ever undertaken. The study involved a meta-analysis of five genome-wide association studies (GWAS) from the US and Europe covering some 7.7 million possible genetic variants. Common variants previously identified in the microtubule associated protein tau (MAPT) and synuclein

— alpha non A4 component of amyloid — (SNCA) precursor genes were shown to contribute the majority of the estimated genetic risk identified.

The researchers found that the 20 % of patients with the highest number of risk variants at the 11 identified loci were 2.5 times more likely to develop Parkinson's than the 20 % possessing the least number of genetic risk factors. Although this suggests substantively more genetic risk than previous studies, the authors cautioned that these risk profiles were not yet of clinical validity. However, they said these data highlighted new genes on which to focus future research, and described their findings as a launching point into further investigations into the pathophysiology of this debilitating condition.

In a linked comment, Drs Christine Klein and Andreas Ziegler from the University of Lübeck in Germany, say: 'Clinically, the most burning question is whether these findings will bear on patients' care.' They said there was 'no simple answer' to this question and urged caution on the potential for screening for possible cases of Parkinson's based on this study.

'Although genetic testing for monogenic Parkinson's disease might be useful to minimise further work-up, clarify treatment approaches, and assist with future family planning, the clinical validity of risk single-nucleotide polymorphisms (SNPs) is currently questionable at best,' they note.



However, they agreed that 'the consortium's confirmation and discovery of potentially causal SNPs for the disease hold great promise for establishing causal hypotheses', adding that 'this landmark study also serves another important purpose in that it provides a comprehensive stock-check on where

we stand on our way towards clinical use of GWAS data in Parkinson's disease.'

Drs Klein and Ziegler conclude: 'While being cautious to avoid overstating the value of association findings in terms of personalised medicine, with this

confluence of new research leads and impressive technical advances there is good reason for optimism that these advances will be translated into direct benefits for our patients.'

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## Diabetes, new insights into insulin resistance

*Lack of the hormone insulin brings on diabetes, a chronic condition that affects a growing number of people around the world. An innovative EU-funded project is developing computer-based tools to study the role of the cell's mitochondria in insulin resistance (IR).*

Diabetes is a metabolic disorder in which high-blood sugar levels in the form of glucose occur due to insufficient insulin, a glucose lowering hormone produced by the body. The condition can also be caused by cells not responding properly to the insulin that is produced. A common feature of disorders such as diabetes and obesity is the development of IR, where the body's cells become less sensitive to the hormone. This phenomenon is being studied by the MITIN <sup>(1)</sup> project.

The MITIN consortium is investigating the interaction between the insulin signalling pathway, which governs cell activity and mitochondria function. This can help to identify the mechanisms behind the onset of IR. Mitochondria are structures found within the cell that help provide them with energy and have been implicated in some metabolic disorders.

Project partners are developing a combination of computer-based tools and biomolecular techniques as part of an interdisciplinary approach to the IR challenge. Computational tools enable

the study of complex biological systems that integrate different regulatory networks within the body. This can help interactions between insulin signalling pathways and mitochondria to be predicted and the results tested on mice cells and fruit fly model organisms.

Researchers are building a computational framework that integrates data on all parts of the insulin signalling pathway and mitochondrial processes, and the relationships within and between both systems. The framework can be improved by generating data about specific actions known to selectively modify insulin signalling and/or mitochondrial function.

The consortium will also determine the feasibility of applying this new-found knowledge to human diabetes and other related diseases. Data from the MITIN project can help develop new treatments for diabetes and other metabolic disorders, thereby improving the quality of life for sufferers and boosting the competitiveness of the EU's pharmaceutical sector.



(1) 'Integration of the system models of insulin signalling and of mitochondrial function and its application in the study of complex diseases'.

Funded under the FP7 specific programme Cooperation under the theme Health.  
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## Finding the elusive cure for Leishmaniasis

*The parasitic disease known as Leishmaniasis has plagued man for centuries. Because of its severity — sometimes with fatal consequences — the EU is stepping up efforts to find a cure.*

Visceral *Leishmaniasis* is a severe infection caused by *Leishmania* parasites. The parasites live on the skin and may even migrate to inner organs. The disease causes unsightly lesions and many strains can be fatal.

The parasites have developed resistance to some of the current treatments available, and the World Health Organisation has been pressing researchers to find more effective drugs. But this is not as simple as it sounds.

In response, the EU has jointly funded the Leishdrug <sup>(1)</sup> project which, through a highly interdisciplinary approach, is developing new ways to treat the disease. Researchers are identifying molecules associated with a key stage in the development of *Leishmania* parasites — the amastigote stage. Using innovative drug-screening concepts, which have never been applied on



Beyond *in vitro* study, the research is being supported *in silico* (i.e. through computer modelling), using novel bioinformatic analysis developed by consortium members. During the first 18 months of the project, the consortium made important progress in perfecting

the testing system. In the second funding phase of the Leishdrug project, the consortium aims to pinpoint the most optimal drugs to combat *Leishmaniasis*. It will undoubtedly be a very important moment for the project and the EU as a whole when these new, highly effective drugs will make this virulent and deadly global disease a thing of the past.

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

*The liver may play an important role in fertility, according to researchers from the University of Milan in Italy. The research was funded in part by two EU-funded projects: 'Estrogens and women ageing' (EWA) and 'Diagnostic molecular imaging' (DIMI).*

Previous studies have suggested that diet may have an impact on fertility, but this latest research provides new insight into the important role of the liver in fertility. The study showed that oestrogen receptors in the liver are critical for maintaining fertility, and that the expression of those receptors is under the control of dietary amino acids, the building blocks of proteins.

These findings, made during experiments with mice, may have important implications for some forms of infertility and for metabolic changes that come with menopause, according to the researchers. 'This is the first time it has been demonstrated how important the liver is in fertility,' said Professor Adriana Maggi from the Pharmacology and Biotechnology unit and Director of the Centre of Excellence on Neurodegenerative Diseases at the University of Milan. 'The idea that diet may have an impact on fertility isn't totally new of course, but this explains how diet, and especially a diet poor in protein, can have a direct influence.'

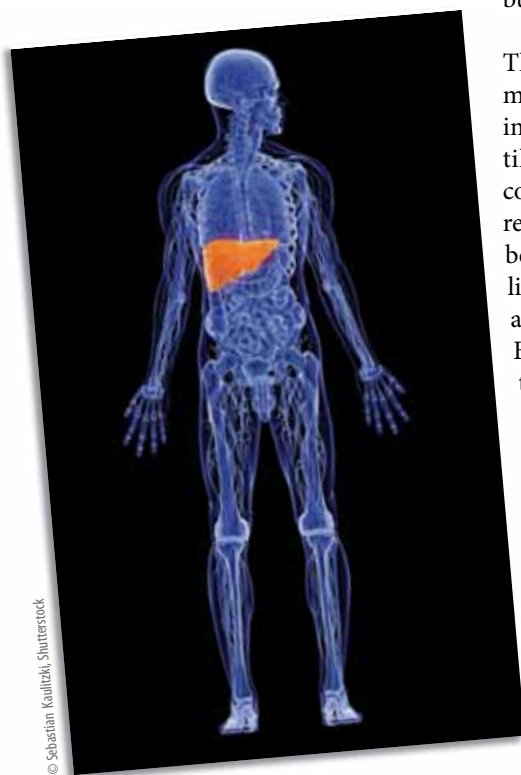
Scientists had known that the liver expressed oestrogen receptors and that those receptors played some role in metabolism. But Prof. Maggi said those receptors had

not garnered a lot of attention, explaining that her group only became interested in them by accident. During the murine studies 'we saw that the organ that always had the highest activation of oestrogen receptor was the liver,' she said. Initially they thought it was a mistake and disregarded it, but over time they began to think maybe the mice were telling them something.

The researchers discovered that the expression of those oestrogen receptors depends on dietary amino acids. Mice on a calorie-restricted diet and those lacking oestrogen receptors in their livers showed a decline in an important hormone known as IGF-1.

The scientists showed that the blood levels of the hormone dropped to levels inadequate for the correct growth of the lining of the mice's uteruses and normal progression of the oestrous cycle. However, when the calorie-restricted mice were given more protein, their reproductive cycles got back on track. Dietary fats and carbohydrates, on the other hand, had no effect on the oestrogen receptors or fertility.

The researchers suggested that this connection between amino acids, oestrogen receptor signalling in liver and reproductive functions may have clinical implications. For instance, Prof. Maggi said this may explain why people who are anorexic are generally infertile, while it also suggests that diets loaded with too many carbohydrates and too little protein may hinder fertility.



Moreover, the results provide new clues for understanding the increased risk of metabolic and inflammatory disease in menopausal women. Prof. Maggi said those changes may be explained in part by the lack of oestrogen action in their livers and its downstream consequences.

Today, given concerns about hormone replacement therapy, menopausal women are often treated with drugs that target one organ or another to protect against specific conditions, such as atherosclerosis or osteoporosis. Given the liver's role as a central coordinator of metabolism and producer of many

other important hormones, she said drugs that 'target only the liver may solve all the problems.'

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## Study finds link between blood-clotting protein and cancer

*Groundbreaking research from Germany shows how stressed cells increase the production of thrombin, an important clot performer. Presented in the journal Molecular Cell, the study provides new insight into how cancer cells may be profiting from this process. Researchers could use this information to develop novel ways to treat various disorders.*

In the past, stress was a sign of imminent danger, which in turn could result in loss of blood. Our body learnt to deal with stress by accumulating blood-clotting factors, experts say. Researchers from the Molecular Medicine Partnership Unit (MMPU), a partnership launched in 2002 between the European Molecular Biology Laboratory (EMBL) and the University of Heidelberg Medical Centre in Germany, say their findings will not only help physicians fight cancer but also *septicaemia*, a condition that refers to the presence of pathogenic organisms in the bloodstream (blood poisoning). The result is increased blood clotting, which experts say is one of the biggest causes of death.

determined that people with activated blood coagulation have a higher chance of developing cancer than those who don't. Also, recent studies revealed that anti-coagulants could fight and prevent cancer. But no one had found the connection between cancer progression and blood clots. This is where the German researchers entered the picture.

'For the first time, we have something in hand that might explain this enigmatic relationship between enhanced pro-coagulatory activities and the outcome of cancer,' explained MMPU's Sven Danckwardt.

The amount of thrombin produced by the body's cells is determined by two types of protein: proteins that accelerate production and proteins that slow it down. The researchers say both protein types act by binding to the cellular machinery that synthesises thrombin. In normal cases, thrombin levels are kept low by production-slowing proteins.

This study found that another protein, mitogen-activated protein kinase (p38 MAPK), kicks into action when

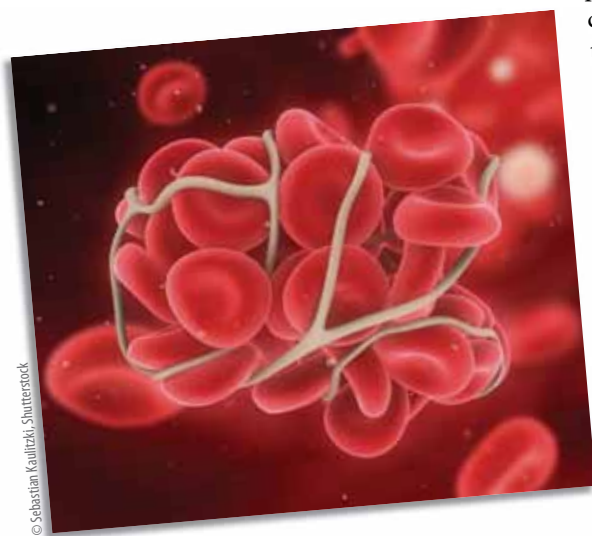
thrombin-synthesising machinery. This enables the proteins that speed up production to take control.

The team said inflammation triggered by cancer could result in increased thrombin levels and, as thrombin is a blood-clotting agent, this could explain why cancer patients have a higher risk of suffering from blood clots. This novel mechanism of gene regulation may apply to other genes as well, according to them.

'Knowing the exact molecules involved, and how they act, has implications for treatment, especially as drugs that inhibit p38 MAPK are already being tested in clinical studies for other conditions,' said Matthias Hentze, Associate Director of EMBL and co-director of MMPU. 'Those drugs could be good candidates for potential cancer or septicaemia therapies.'

Studying liver samples from septicaemic mice, the Heidelberg team found that p38 MAPK affects thrombin production during *septicaemia*. Besides its influence as a blood-clotting agent, thrombin helps the development of new blood vessels and can degrade the extracellular matrix that keeps cells together.

The team said there's a chance that the cancer cells are boosting thrombin production to help the tumour spread, by making it easier to invade healthy tissue and creating blood vessels to supply the new tumour cells. This could be the reason people with blood-clotting problems are more likely to develop cancer.



Patients suffering from cancer are at a higher risk of blood clot formation. This was first described by French physician Armand Trousseau in the 19th century. Doctors have recently

cells are under stress from inflammation. P38 MAPK adds a chemical tag to the slow-producing proteins. The result? Production-slowing proteins have a hard time to bind to the

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## Worming our way through cancer

*The simple roundworm may be the answer to mapping cancer genes and tailoring effective treatments for humans. Arguably one of the most elusive diseases in medical history is cancer.*

It is a baffling disease that results from diverse changes in the genome — the entirety of an organism's hereditary information. So far, some 300 genes have been identified as cancer-causing ones, with many more crucial genes needing to be identified in order to develop effective drug treatments.

While many research teams around the world are mapping cancer genes, many of these studies have not been validated. The mapping or 'sequencing' can be done on other organisms and the results can be used to understand cancer in humans. One of these organisms is *Caenorhabditis elegans*, a microscopic roundworm which lives in the soil. Because of its simple cell structure, quick reproductive abilities and

transparent nature, *C. elegans* is perfect for studying cancer. It is ideally suited for identifying the combination of defects in the genome.

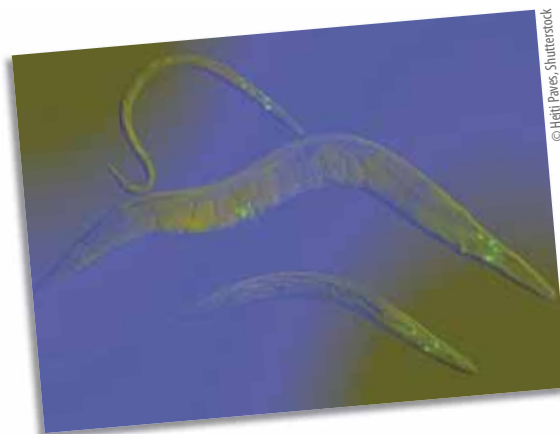
With this in mind, the 'Modelling cancer in *Caenorhabditis elegans*' (Canceromics) project has set out to pinpoint the intricacies of cancer genes in *C. elegans* and report on them. This four-year initiative has been fully funded by the EU, and ends in October 2011.

The project's team has participated in several conferences on the subject and unveiled its findings so far, although many more results are expected to

emerge at later stages. Eventually, the project hopes to produce a functional map for cancer genes that will shed light on how cancer develops and what treatments could be effective against it.

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

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## Fresh technology for new cell creation

*Severe injuries from fire result in over 320 000 deaths each year, the World Health Organisation (WHO) says. Experts believe that most of these deaths could be avoided with surgery. But surgical intervention becomes complicated when there isn't enough skin left to graft on the most damaged part of the burn victim's body.*

New skin must be grown from the patient's own skin cells, a lengthy process that could lead to dehydration and infection. Scientists discovered that polymeric material, which is renowned for its extensive range of properties and found in plastics, biopolymers and proteins, can be used to grow and multiply human cells but with inefficient results.

Enter the Modpoleuv <sup>(1)</sup> project, which brought together Czech, Austrian and

Polish researchers to successfully develop a novel yet easy way to create nano-structured materials that would facilitate human cell development. Modpoleuv is supported by the European Platform for Research and Development (Eureka).

'About 10 years ago, scientists discovered the important influence that nano-structures had on the way a line of cells would develop,' explained Professor Johannes Heitz from the University of Linz, the coordinator of Modpoleuv. 'It was the beginning of an entire new scientific field, somewhere between medicine and nanotechnology.'

The Poland-based Military University of Technology of Warsaw led the development of the new laser-brand technology, called extreme

ultraviolet (EUV), which was to create nano-structured polymer surfaces. Reflex of the Czech Republic developed a mirror that formed a beam of EUV light, directed on a surface that enables new polymeric materials to be created.

Thanks to this innovative technique, researchers can ensure a very high degree of precision, from 10 to 20 nanometres. The best traditional techniques can give is a precision level of 100 nanometres.

'One of the newest theories in the field of cell growing is that the smaller the structure, the wider the possibilities to manipulate the cells,' Prof. Heitz said. A major plus with the EUV technique is that the material's structure is conserved. Conventional methods usually fail in this aspect.

'A regular structure is essential if the material is to be used for the purpose of growing human cells,' explained Prof. Henryk Fiederowicz from the Military University of Technology.

It should be noted that EUV-generated nanostructures can impact the behaviour of organic cells. Growing other





types of cells can be improved and accelerated depending on the type of polymer surface used, according to the team. What material is used to grow human stem cells will determine how cells will transform into another human cell type. 'Using one type of polymer material or another will help you grow different types of muscle, nerves, cells

adapted to a human heart, bone or any other part of the human body,' Prof. Heitz said.

The partners said this new technique can be applied in many different fields including biotechnology, microelectronics and integrated optics. While the cell-growing technology is still in a

testing phase, the team says the results are 'very encouraging so far'.

(1) 'Modification of polymer foils with extreme-ultra-violet (EUV) radiation for applications in biomedical technology'.

Promoted through the Research Information Centre.  
<http://ec.europa.eu/research/infocentre> > search > 19733

## Could severe bacterial diseases become a thing of the past?

*When experts from all over Europe get together to battle a group of diseases, the results can be surprising. A European project may find a viable cure for salmonella poisoning, tuberculosis and others.*

Over the course of human history, pathogens that cause serious diseases have been plaguing mankind. These include, among others, diseases caused by *salmonella* and mycobacteria. The latter are a category of especially resilient bacterial strains such as tuberculosis (TB) and leprosy. Medical science has always wanted to know how such pathogens craftily manipulate macrophages (a specific type of white blood cells) to grow and survive.

Armed with this knowledge, researchers can boost the power of phagocytes

— white blood cells that rid the pathogens by 'eating' them. The research results in this area may help enhance a person's innate immunity and help combat the diseases in question.

The Phagosys <sup>(1)</sup> project, funded for the most part by the EU, has brought together a consortium of European experts that are tackling complementary aspects of this challenge. Working in tandem, these experts and their laboratories are leveraging their expertise far beyond the state of the art.

So far, ongoing research and testing has concentrated on pathogen cell biology related to the maturation of endosomes (highly dynamic membrane systems involved in cell transport). Complex mathematical models and simulations have been developed and improvements have been made to modelling approaches so that they fit better with the challenging aspects of cell biology.

One of these challenges lies in the intricate analysis phagocytosis, the process of engulfing implicated bacteria. Experiments are being conducted on mycobacteria and phagocytic cells in mice. This is then being compared to results in human trials, an exercise which will allow a much more precise understanding of these pathogens.

Upon the completion of this project, better treatment options for diseases like salmonella, TB and leprosy will be expected. This will come as a relief for sufferers of these diseases and associated ones worldwide.

(1) 'Systems biology of phagosome formation and maturation, modulation by intracellular pathogens'.

Funded under the FP7 specific programme Cooperation under the theme Health.  
<http://cordis.europa.eu/marketplace> > search > offers > 5926



## Get ready for smarter food packaging

*Technology is bringing ingenious ways to tell if packaged food is as safe as it should be. Consumers will be able to 'read' freshness right off the package.*

Ever wondered about the safety of packaged food and what risks are involved? The 'Natural antimicrobials for innovative and safe packaging' (Nafispack) project, funded for the most part by

the EU, has embarked on a mission to develop packaging technology to avoid or reduce microorganisms that cause spoilage. This applies especially to perishable products such as fresh fish, fresh

chicken and minimally processed vegetables (MPVs).

Fish and chicken have long been on the health and safety radar, but MPV consumption is a relatively new and growing phenomenon in Europe, which is why Nafispack is aiming to improve packaging in this area. Another important concern is consumers'

increasing awareness about synthetic preservatives and their desire for alternatives. Instead of such preservatives, the project is considering natural antimicrobials, which occur abundantly in the environment and are considered much safer. Nafispack is currently validating the safety of new packaging materials that contain these antimicrobials.

In more specific terms, Nafispack is trying to increase shelf life by two to three days for fresh fish, chicken and MPVs. Through thorough risk assessment, it wants to ensure that the natural antimicrobials are stable, cost-effective, available and comply with the law.

Another angle the project is focusing on is to create 'intelligent packaging'.

This a technology based on monitoring the quality of the food. This involves new visual and measurable indicators built into the packaging, informing the consumer about quality and the degree of spoilage. In a way this represents a much more high-tech method than the current 'best before' and 'use by' philosophy.

When intelligent packaging is combined with antimicrobials, the result is expected to supersede current technology. It will increase safety and quality of fresh food products for significantly longer, raising consumer confidence and strengthening food safety.



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Funded under the FP7 programme Cooperation under the theme 'Knowledge based bio-economy'.

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## Developing new food additives from bacteria

*Carotenoids hold considerable potential to provide health benefits. A research project is investigating how to make them more stable and incorporate them into functional food products.*

Occurring naturally in many plants, fruits, flowers and vegetables, carotenoids could be important sources of antioxidants and vitamin A for people. However, food manufactures have had difficulty incorporating them into their products due to their instability, both on the shelf and in the human digestive system.

The EU-funded Colospore <sup>(1)</sup> project started after the discovery of a type of bacteria of the *Bacillus* genus that forms spores that are rich in carotenoids and

are able to survive passage through the stomach which is an environment of low pH — the downfall of traditional carotenoids from the functional food industry's perspective.

The ongoing project, which began in 2008, is investigating these bacteria further, assessing their safety and seeing how they can be prepared for industrial use. The international team, which includes research institutes and industrial partners, started by characterising

the different related bacteria strains. They identified two which held the most promise for industrial production and determined their genome sequences and all genes involved in their carotenoid biosynthesis.

The researchers evaluated the two strains — HU36 and GB1 — for safety in animal and laboratory tests and found no cause for concern. Other work found the stability and antioxidant activity of the purified carotenoids in the presence of iron to be superior to both *b*-carotene and lycopene.

The final stage of the project, due to end in mid-2011, has begun analysing the potential of the bacteria strains as probiotic food ingredients, incorporating spores of HU36 into baked food products and assessing the effects on taste, odour, colour and stability.

With initial results promising, the project is taking a big step in the development of functional food products which can improve health and drive innovation in the market.

(1) 'New sources of natural, gastric stable, food additives, colourants and novel functional foods'.

Funded under the FP7 programme Cooperation under the theme 'Knowledge based bio-economy'.

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# ENERGY AND TRANSPORT

## Flight of fancy

*A complete rethinking of aircraft design and technology may, in less than ten years, see the creation of quieter, cleaner and more efficient passenger jets.*

Upcoming ultra-modern aircraft types, where the wing and the body fuse into each other for better aerodynamics, are called blended wing body (BWB) aircraft. These and other advanced aircraft require special technology to control and fly them seamlessly.

The 'Active control for flexible 2020 aircraft' (ACFA 2020) project plans to deliver innovative control equipment (or controllers) for ultra-efficient 2020 aircraft configurations, such as BWB aircraft. These new controllers will be a significant improvement over current technology to deliver a more comfortable ride and handling optimising the load of the aircraft as well. BWB planes are supposed to be lighter, quieter, more aerodynamic and more energy efficient. However, they require complicated control technology — known as multi-channel control architecture — to yield the desired manoeuvres, ensure rigidity and counter vibration.

The project aims to apply this advanced technology in these aircraft types, one of which will be a 450-seater commercial aeroplane. The design of such an aircraft with particularly large wings has already been developed in previous initiatives, namely the 'Very efficient large aircraft' (VELA) and 'New aircraft concepts research' (NACRE) projects. The challenge for ACFA 2020 lies in applying the innovative control technology to the new passenger BWB planes which feature an ultra-wide body fuselage. The project team aims to identify the best control technology configuration to achieve the highest possible fuel savings.



There are also plans to redesign the passenger BWB version to make it lighter and more fuel efficient. In addition, the BWB configuration offers even greater potential to further minimize noise by putting the engine over the rear fuselage or in the airframe and working with the higher wing area/weight ratio, which allows for a simplified high-lift system. These design modifications will also fall under the responsibilities of the ACFA 2020 project.

Once these designs and technologies get off the ground, both figuratively and literally, the road to cleaner, quieter and more efficient aircraft will be within reach.

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

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## Aero R&D gets EU-Africa uplift

*As the skies become increasingly busier, and aeronautical technology ever more sophisticated, ensuring that all providers in all nations are on the same page requires cooperation on many fronts. Thus, expanding R&D cooperation with South Africa is the first step in a continent-wide vision.*

The AeroAfrica-EU <sup>(1)</sup> project was the result of an explicit demand to establish a cooperative platform for R&D between the EU, South Africa and other African nations. The first requirements were to map the aeronautical landscape, explore and develop networks and partnerships, and to identify mutually beneficial technical themes for R&D cooperation platforms.

AeroAfrica-EU had to establish an R&D policy dialogue between all involved parties that would support socio-economic development cooperatives. These initiatives would also provide the additional benefit of participants being included in FP7.

The challenges that face the aeronautical industry are globally significant.



Therefore, promoting collaboration between the two regions and thereby promoting African expertise enhances the region's ability to tackle such issues. It also facilitates the



'internationalisation' of the European Research Area (ERA) thus strengthening and broadening its collaborative spectrum.

In order to continue maximising these collaborative efforts between partners, a collative and analytical process has been

developed for their interactions. There are currently seven partners involved, including institutes of education, aeronautics and business.

Future objectives include dissemination of suitable project material via a web-site, the hosting of events to develop

awareness, and the creation of high-level advisory groups, to name but a few.

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

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

<http://cordis.europa.eu/marketplace> > search > offers > 6077

## Aircraft technology for safer skies

*A new system of advanced sensors can help detect cracks and other safety issues in aircraft at very early stages.*

Arguably the most important issue in aviation is the safety of the aircraft and its crew. Aircraft safety and integrity have come a long way since aeroplanes took to the skies, but the search is on to improve safety and pre-empt any problems such as structural damage.



An EU-funded project entitled 'Aircraft integrated structural health assessment II' (AISHA II) is developing advanced monitoring systems to assess the structural state of aircrafts using extended

sensor networks. With the help of aircraft operators and manufacturers the project has already compiled detailed specification sheets with technical and economic requirements for aircraft structural health monitoring systems. The team also investigated fatigue cracks in different parts of passenger airlines, many Airbus models, and helicopters.

Monitoring aircraft structural health is done by automated sensor networks, a feat which requires the development of appropriate sensors. This is an intricate procedure that has its various challenges. To begin with, different types must be incorporated into the system, such as pressure sensors, electromechanical sensors, fibre-optic sensors and others. Because of the number required, they must be manufactured at a reasonable cost to allow for the many sensors to be distributed across the various parts.

An essential challenge is durable integration of transducers (devices that transform sensory input into meaningful data). The sensitivity of these sensors must be just right and they must also interpret signals very accurately. Determining where exactly to put them to obtain the best results is another issue being addressed by the AISHA team. Adhesives that are able to withstand typical temperature and stress variations are also under development. Moreover, many tests have to be conducted on the sensors, such as using fibre-optic sensors to detect, for example, the effect of corrosion from liquids.

The AISHA team now needs to implement the various sensor systems into the main parts of aircrafts and run extended tests. Once validated, technology like this can help to raise safety levels in the aeronautics sector.

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## Beating 'complexity' with integrated systems design

*Product design and safety compliance — especially for critical sectors like aeronautics — is a complex and costly process. But what if the many phases and tasks could be better integrated and optimised? A European consortium is on the job.*

Aerospace systems are becoming increasingly complex, to the point that existing methods for systems development are holding back innovation, which hurts European industrial competitiveness.

To overcome this, industry needs to cut the time to market for new technologies, shave costs to demonstrate 'proof of safety', and meet the greater demand

for skilled resources. It also needs to streamline the design phase to limit the number of costly design iterations. But time- and cost-cutting exercises like this are usually not compatible with tightening safety compliance standards.



The EU-funded project 'More integrated systems safety assessment' (MISSA) is working to fill this gap by providing methods and infrastructure that, in its words, 'accelerate the convergence towards optimal systems architecture which integrate safety constraints.'

To reach this goal, MISSA chose to focus on four main 'enabling contributions' which are linked together in the design process. First, it is developing new tools to optimise the preliminary design phases — when aircraft functions are worked into systems. Second, the researchers must accurately define

and assess a 'systems organic architecture' against the safety requirements resulting from the early design phases. Third, MISSA is providing a way of dealing with detailed system architecture and design, and last, developing software infrastructure to deal with the complex information exchange needed in the first three steps.

With the project end-date in sight, the partners are advancing well. Among the achievements, they have developed a new modelling approach to support safety analysis, drafted methods and prototype tools for optimising installation, and at the systems architectural

level. They also drafted a safety modelling handbook which details new approaches.

Once complete, MISSA's methods and tools will help safety engineers to collect and manage information, to structure their arguments, express their ideas, and perhaps most importantly, find solutions to problems in an efficient, traceable and exhaustive way.

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under the theme Transport.

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## Aerospace: the best of east and west

*China and Europe are coming together in the field of aerospace. Scientific cooperation in fields like multi-physics, aeronautic design and simulation are allowing both to fly high.*

A formidable nation with a robust aerospace industry, China has much to offer to the EU in terms of knowledge exchange and joint ventures.

In more specific scientific terms, multi-physics disciplines considered in Aerochina2 are aerodynamics, structures/materials, fluid dynamics, aero-acoustics, active flow control and aero-elasticity. Joint progress in addressing the challenges of these complex topics and sciences has helped achieve the program's objectives.

To begin with, Aerochina2 mapped out mutual research and development interest. It clarified skills and the experiences and capabilities of the Chinese partners in the relevant technological areas of multi-physics

analysis and design. The initiative then focused on collaboration in those areas between the European and Chinese partners, ensuring a win-win situation for all sides. Also noteworthy was the preparation of specific research and development activities for joint proposals under the EU's Seventh Framework Programme (FP7).

The outcomes and results of the Aerochina2 project have been disseminated via the web-based Aerochina2 communication system and through several

workshops. The multi-physics workshops were held in different locations such as Nanjing in 2007, Marseilles in 2008, Harbin in 2009 and Brussels in 2009.

Several future plans for joint RTD activities between partners from China and Europe related to the analysis and validation of multidisciplinary problems in aeronautics have emerged in recent years. These correspond to project proposals that have been sent to the different FP7 calls. Among these calls are the greener aeronautics international networking (GRAIN) and manipulation of reynolds stress for separation control and drag reduction (MARS). Another important call is titled numerical and experimental investigation of innovative control technologies to reduce aircraft noise production (Nextep).

In conclusion, the Aerochina2 work groups have many ambitious projects mapped out for the future, which will further the aerospace industry like never before. Technological advancements, team expertise, cutting-edge research and quality standards from both regions of the world are converging to create a superior aerospace industry.

(1) 'Prospecting and promoting scientific cooperation between Europe and China in the field of multiphysics modeling, simulation, experimentation and design methods in aeronautics.'

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

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The EU-funded Aerochina2 <sup>(1)</sup> project has achieved commendable progress in furthering the cooperation between industry, university and research organisations in the aeronautics sector for both Europe and China. Collaboration focused on the fields of multi-physics modelling, i.e. the study of multiple simultaneous physical phenomena. They also focused on computer simulation and software code validation, as well as experimental testing and design methods for multi-physics challenges within the aeronautics sector.

## Vehicle and vessel design makeover

*Computer-aided design (CAD) software is the tool of choice for designers and engineers who want to create new products or components. But the transition of a computer-generated model to a numerical simulation tool can introduce tiny errors which in transport can prove critical. Research underway aims to iron out this problem.*

These tiny geometric errors could affect simulation results. And incorrect simulation results could develop into potentially real-world problems which in vehicle and vessel manufacturing can prove fatal.

and smooth surfaces except at the vertices, edges and cusps. Examples include ship hulls, propellers, and car frames for the railway and the automotive industry.



To reduce and eliminate the potential for errors, one EU-funded project 'Exact geometry simulation for optimised design of vehicles and vessels' (Exciting), is bridging the gap between CAD and numerical simulation methods by using enhanced isogeometric analysis (IGA). IGA provides a new approach for the design and simulation of free-form objects.

accurately designing the blades of a turbine is extremely challenging. But with Exciting's new IGA application, designers can now produce a CAD model for blades that is suitable for numerical simulation. Designers can also create an entire parametric ship-hull model that respects principal dimensions and other integral parameters. And they can now apply IGA to car components.

The project, which started in 2008 and ends in 2012, is currently working on tackling some of the more theoretical challenges that underpin the development of future applications. So far, they have gained a much greater insight into the isogeometric BEM wave-resistance calculations of an immersed spheroid. They have also found a solution to a persistent 2D test problem often encountered when modelling pipes and deformable walls. And they even managed to develop a proof of concept for isogeometric design optimisation in structural mechanics.

Exciting's results and continued progress will not only help the industry produce better products, but will also save them considerable time and money in their design and testing.

Computer generated free-form objects, in particular, are extremely difficult to simulate with absolute accuracy because their shapes have to be approximated by simple geometric primitives. Free-form objects have well-defined

Exciting, a consortium of academic and industrial institutions from Austria, France, Germany, Greece and Norway, were particularly interested in seeing how IGA could eliminate errors in the design process of vehicles and vessels. According to project researchers,

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

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## Converting glycerine into biogas and fertilizer

*Microorganisms that break down biological material are being developed by the EU-funded Propanergy (1) project to produce renewable energy in the form of biogas.*

The aim of the Propanergy project has been to develop a process for converting glycerine from biodiesel production into biogas and 1,3 propanediol (PDO) and fertilizer. Glycerine is type of colourless, odourless alcohol often used in pharmaceutical formulations.

A bioreactor is used to convert glycerine into PDO and fertiliser, which is then converted into biogas that supplies the necessary energy for product separation. A stream from the biogas reactor is also used to convert residual methanol to biogas and deliver nutrients for

the bioconversion. The result is the complete use of glycerine and methanol residue from biodiesel production for energy production and PDO and fertilizer.

Researchers are working to improve unsterile fermentation techniques by developing a strain of the bacteria *Clostridium butyricum* VPI 1718. An entire production process for PDO was successfully established on the mini-plant scale.

This includes the fermentation step together with a microfiltration unit for separating and recycling biomass, an electrodialysis module for desalination and the concentration of PDO through desalination.



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A pilot plant concept is being developed, which uses a two-step continuous fermentation for PDO production and the degradation of bioproducts to give biogas. High productivity under unsterile conditions and a stable microbial community make this process suitable for the production of PDO and are

significant factors in favour of the construction of a pilot plant.

The work of the Propanergy project will contribute to Europe's development of renewable energy from biological material and help to overcome its reliance on fossil fuels.

(1) 'Integrated bioconversion of glycerine into value-added products and biogas at pilot plant scale'.

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

<http://cordis.europa.eu/marketplace> > search > offers > 5957

## Harnessing wave energy

*Capturing energy from waves is an evolving science. However, in order for it to be commercially viable, the many varying concepts have to be further developed.*

Wave energy converters (WECs) started off as fixed shoreline devices. These have now slowly evolved into floating, deep water and offshore devices. In order for these new devices to be commercially viable, they must be developed into units that are suitable for mass production.

This is what the 'Components for ocean renewable energy systems' (CORES)

project, involving 13 partners from 7 countries, aims to achieve. First generation devices (fixed shoreline devices) normally consist of oscillating water column (OWC) systems. However, the next generations of WECs involve floating devices which pose new challenges that CORES aims to address.

The project concentrates on the development of components for power take-off, control, moorings, risers, data acquisition and instrumentation based on floating OWC systems. It is doing this through simulations and small-scale tank tests in 2D and 3D ocean wave basins. Testing will then move to sea-based platforms for sea trials.

The results from the sea trials will enable the project partners to create a system model which will in turn provide a 'toolbox' for wave-to-wire simulations of WECs. CORES is creating this 'toolbox' to evaluate the effect different components have on the efficiency and performance of the new devices.

The 'toolbox' is made up of a number of models that have been developed in four work packages.

The first work package deals with the design and production of an alternative air turbine system for OWC WECs. The second work package looks at all the electrical components of the devices. The third examines whether the moorings are robust, cost-effective and easily deployable. The final work package brings all of the other packages together to produce a final model toolbox.

Substantial results have already been achieved in the project. The partners have completed laboratory testing of a 5 kw turbine model and designed a turbine generator frequency converter. CORES has also commissioned a near shore facility that can be used for testing in Galway, Ireland.

The project hopes to test a 15 kw model and develop a complete wave-energy toolbox which would be used to improve cost competitiveness.

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## Looking at energy use habits

*Changes are needed to the way we produce and use energy in light of rising concerns over environmental impacts and costs. But what measure will help to change people's energy consumption habits and their attitudes towards alternative energy concepts?*

Climate change and the environmental impacts of our resource use are becoming increasingly important factors in many parts of our lives. One key area which needs attention is our future energy supply and use, especially

when economic realities are taken into account.

We will need to make widespread changes in how we use energy in the future, taking steps to increase

efficiency and reduce the amount of energy we consume. All sectors of society will have to adopt more sustainable and renewable energy sources.

However, the level of changes needed require large shifts in consumer behaviour. 'Barriers for energy changes among end consumers and households' (Barenergy) was a 30-month EU-funded project looking into different approaches to influencing energy consumption behaviour among these groups.



The project looked at two broad areas for behavioural change: the first was energy saving and improving households' energy efficiency; the second was the adoption of new concepts for sustainable and renewable energies. For both areas the team looked at specific areas of consumption, such as car use, domestic heating or household appliance use, and assessed various barriers and strategies to boost efficiency.

The research team identified that the same barriers were relevant for energy

saving, increasing efficiency and in relation to new technologies. They concluded that a mixture of measures focusing on broad institutional changes and targeted at individuals are needed to overcome existing barriers.

For energy saving measures, the researchers found that a lack of knowledge was an

important barrier blocking behaviour change. They also underlined that any steps to reduce consumption must not compromise comfort or personal status.

Clear and reliable product information is needed to improve energy efficiency by encouraging consumers to take steps such as refurbishing household systems and appliances, or buying more fuel-efficient vehicles. Other important factors are awareness of different products and the subsidies that are available for energy saving measures taken at home.

A major barrier is that consumers think green products are more expensive and they do not factor in savings in running costs into their initial buying decisions.

Meanwhile, when looking at the purchases of new 'sustainable energy' technologies, such as photovoltaic panels or hybrid cars, consumers need a high level of knowledge and a solid understanding of the products if they are to invest in new concepts.

The project, which ended in mid-2010, has helped to improve understanding of how the public views energy consumption and how it fits into people's lives. The results provide valuable insights into how to successfully introduce greater sustainability into our societies.

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

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## Nanostructures build solar cells

*The EU-funded 'Self-nanostructuring polymer solar cells' (Solarpat) project is developing a new breed of solar cells using self-assembly and light-scattering technology. Researchers are also interested in the role of nanostructures in the absorption of sunlight.*

Environmental, commercial and scientific interest in organic and polymer solar cells has grown in recent years. This has been due to an increase in the use of low-cost biodegradable materials for producing electricity from sunlight.

The Solarpat project focuses on recent advances that have improved thin-film solar cells through the use of nanostructures. The groundbreaking solar cells contain self-assembled, light-induced nanostructures, resulting in

improved construction techniques and operation.

Project partners have sought to create high-quality fluorescent material by using rhodamine molecules, resulting in a 20-fold increase in fluorescence. Findings reveal that organic solar cells containing a fluorescent active element possess major potential for employing nanostructures as a means to prevent spontaneous emissions.

Work conducted by the Solarpat consortium can help provide a solid foundation for understanding self-assembled crystals in organic thin films. The project's findings can also be used to develop other thin-film solar technologies and help contribute to new nanofabrication processes, enabling Europe to stay at the forefront of solar cell research.

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

<http://cordis.europa.eu/marketplace> > search > offers > 6112





## Laying the foundations for synthetic biology in Europe

*An EU-funded project is looking at new technologies to tackle pollution with microbes designed à la carte.*

Over a two-year period, various European research groups have debated the future of synthetic biology in the EU-funded Tarpol <sup>(1)</sup> project. Synthetic biology is an emerging research field which combines several scientific traditions around the goal of designing and manufacturing new biological systems of industrial interest.

An intense discussion on concepts and terminology has taken place and common databases have been created. The Tarpol partners also launched an advanced training programme on synthetic biology and, after identifying the needs and priorities, developed an action plan for the European Union in this new field of science and technology.

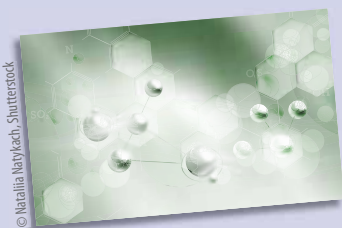
At present, the pace of genome sequencing is exponential and this is providing extremely valuable information which boosts our understanding of living systems and the design and manufacture of artificial forms of life.

### From research to tools

Europe has quickly built up critical mass in research and academic institutions and an industrial base to compete worldwide in areas such as the use of synthetic biology to address environmental contamination issues. For example, microorganisms can be used to break down toxic compounds accidentally released during an oil spill.

European science is also progressing in biofuels, hydrogen technology and biomedicine, where researchers have proved that it is possible to produce more efficient and less costly drugs.

Eighteen research groups from eight European countries coordinated by the Cavanilles Institute of Biodiversity and Evolutionary Biology at the University of Valencia (Spain) have developed over two years the Tarpol project. Funded by the FP7 programme Cooperation under the theme 'Knowledge based bio-economy', this is a comprehensive European project in synthetic biology — from the conceptual framework to applications of the research, while not forgetting the ethical and social aspects and the importance of dissemination.



'Tarpol has been a foundational project that has sought to join forces and unite all European groups involved in one way or another in synthetic biology to create synergies,' says Spanish researcher

Manuel Porcar. A very important part of the work involved developing databases and bioinformatics tools to work with the vast amount of data these experts handle. They have also reached a consensus on a common language, a crucial step in order to advance in any new discipline.

### Method and math

The researchers have also dealt with the difficult transition between the mathematical modelling of a synthetic construction and its actual performance, including how it may evolve over time like any living organism.

The researchers have reflected on the milestones and challenges that currently exist to create synthetic life. Among the obstacles to overcome, there is one that seems simple — to put the appropriate groups to work in common projects. However, this is not so easy because it requires experts in many different fields such as biologists, biotechnologists, mathematicians, physicists, and bioinformatics specialists. Many of these researchers do not even know that they can work together in synthetic biology.

Here, dissemination and training make a valuable contribution 'After the experience with GM foods, the Tarpol partners decided to dedicate efforts in dissemination so as to offer the public a realistic picture and explain that synthetic biology is a useful technology,' says Dr Porcar.

### Getting the word out

The consortium has organised two summer courses for students, one in Switzerland and one in Valencia which brought together experts in synthetic biology from around the world, and they also supported a number of teams participating in the International Genetically Engineered Machine (IGEM) competition. 'Our intention is to support more young people to engage in a discipline that is also very young. In reality none of us working in this field is an expert, so innovative and enthusiastic views are encouraged,' adds Dr Porcar.

Partners have coordinated an extensive analysis on social and ethical issues that will be published shortly. This report approaches the environmental impact, as well as the possible consequences that can result in the development of different technologies. In this regard, they have considered both the negative reactions and the social and economic benefits of synthetic biology.

Although the EU-funded part of Tarpol has ended, several articles are to be published with the project's main findings and the partners will submit a full technical report to the European Commission with advice and predictions on the impact of synthetic biology in Europe. They plan to continue to develop the bioinformatics tools, online applications and databases and more applied projects are likely to be launched.

<sup>(1)</sup> 'Targetting environmental pollution with engineered microbial systems à la carte'.



## EU research protects vulnerable communities from erupting volcanoes

*Nature's awesome power has been clearly shown by Indonesia's Mount Merapi volcano, which roared back into life on 26 October 2010 as searing clouds of gas and ash destroyed crops and villages, tragically killing dozens of local people.*



An eruption of Iceland's mighty Eyjafjallajökull volcano in April 2010 created a cloud of ash that closed many of Europe's airports, forcing more than 100 000 flights to be cancelled. Estimates reveal that across the globe 500 million people are at risk from volcanoes.

In the European Union, anticipating and measuring the threat posed by volcanic activity depends upon the latest scientific knowledge and monitoring techniques. But in international co-operation partner countries (ICPC) risk management depends upon local conditions, which can be unfavourable.

This is due to several factors, including local populations living on volcano slopes or possessing limited resources, such as monitoring equipment. A further challenge is presented by the long periods between eruptions when the volcano lies dormant, which can lull the population into a false sense of security with regard to the real threat.

The Miavita <sup>(1)</sup> project is determined to integrate more cost-effective methods for reducing risks from volcanic activity. Miavita means 'my life' in Italian and is a four-year project that addresses

the multidisciplinary nature of volcanic threat assessment and management in ICPC and European volcanoes.

The initiative builds upon recommendations from the UN's 'International strategy for disaster reduction' report, which covers such issues as prevention, crisis management and recovery. Although strategies are designed with ICPCs in mind they can also help European stakeholders expand their knowledge of volcanic risk management.

### Three objectives

Miavita has three main objectives. The first is to develop prevention tools based on risk mapping and identification of possible damage scenarios. The second is to improve crisis management capabilities through monitoring, early warning systems and secure communications.

The third objective is to reduce the vulnerability of local communities and ecological systems and develop their ability to recover from a volcanic eruption. To reach these objectives, an integrated information system for organising and sharing data about the latest scientific and technological developments, and training is vital.

The Miavita consortium comprises a multidisciplinary team that includes civil defence agencies, national geological surveys, scientific teams and a private IT company. Local scientists and organisations in Africa (focused on Mount Cameroon, Fogo in Cape Verde) and Asia (on Merapi in Indonesia, and Kanlaon in Philippines) are closely involved in the risk assessment. These groups form an important part of the Miavita project thanks to their expertise in handling volcanic threats and their ability to respond to the entire disaster management cycle.

Current activities include the installation of equipment at Fogo, Kanlaon and Mount Merapi and data acquisition coming from ground monitoring and remote sensing installations. The result has been a better understanding of the target volcanoes and their local areas.

Workshops have been organised in Cape Verde, Indonesia and the Philippines for top officials such as ministers, governors, local authorities and heads of civil protection agencies. The workshops are intended to identify the stakeholders' needs and develop local authorities' awareness of managing risks occurring within the natural environment.

According to Miavita's Coordinator Dr Pierre Thierry at BRGM, the French Geological Survey, the key to the initiative's success is the close cooperation among project partners. 'One example has been a training session on gas monitoring at Mount Merapi managed by Cambridge University for our partners from Indonesia. Its purpose was to teach how to perform ground-based gas measurements using differential optical absorption spectroscopy (DOAS) techniques,' he says.

Collaboration between the two groups has proved particularly useful during the monitoring of the recent eruption of Merapi in October-November 2010. In addition, a partner from the French Civil Defence (DSC) has been to the Philippines to discuss crisis management with local institutions, stakeholders and representatives of the civil protection organisation.



'A similar mission is planned in the near future for Indonesia and will focus on the latest eruption at Merapi,' Dr Thierry reveals.

### Mount Merapi blows its top

The Miavita project makes an important contribution to volcanic risk assessment and management, especially helping local people who have experienced recent events at Merapi. 'The eruption of the volcano during the course of a four-year research project is an extraordinary event. It is tragic considering the number of victims and displaced people, but it also represents an opportunity to make a step forward in our research,' says Dr Thierry.

During the crisis, Dr Jousset (BRGM) and Dr Boichu (Cambridge University) joined the Indonesian team to help analyse data from the ground and satellite monitoring technologies. As soon as the information was received it was passed to the Indonesian partner organisation CVGHM to help assess and mitigate the eruption. Data, together with results from the United States Geological Survey, were used to determine the volcano's level of activity. This is the first time that the international community has responded in such a large way to combine their efforts following a volcanic eruption.

Large deposits of material from the Mount Merapi eruption have covered a

wide area, increasing the potential for major lahars — extremely destructive mudflows formed from a mixture of water and volcanic ash. Professor Lavigne (University Paris La Sorbonne) is also collaborating with Indonesian partners to identify potential danger zones that are at risk of inundation from future lahars, which are a major risk during the monsoon period.

Furthermore, following the main eruptions, new equipment has been set up to help rebuild a high standard broadband seismological monitoring network. Today the alert level of the area surrounding Mount Merapi has decreased to 2 out of a possible 4 and local partners are assessing damage to buildings, soil and agriculture. French and Italian civil protection agencies are expected to visit the region in the near future to share their experience of crisis management with local counterparts.

Project partners are developing guidelines for multi-hazard and risk-mapping on active volcanoes. They have also developed and tested new methods for monitoring volcanoes, through the integrated use of remote sensing and geophysics techniques including gas, seismicity and ground deformation.

Vulnerability of soils and agricultural systems to eruptions is being studied in-depth for the first time in Europe and guidelines for the integration of

socio-economic aspects in risk management should be provided, including community based disaster risk-management plans. Plans for emergency communications systems in isolated areas have been launched and a book on volcanic threat assessment and management, created for decision-makers, scientists and stakeholders, is planned for 2012.

Miavita has worked closely with local partners to enable scientists to gain a better understanding of the threat posed by volcanoes. More importantly, however, has been the achievement of improved safety for those communities living in the shadow of one of nature's greatest threats.

Results of this major collaboration on the Merapi eruption will be presented to the scientific community at the next European Geosciences Union congress (EGU) in April 2011.

The Miavita project is funded by the European Commission's Seventh Framework Programme (FP7) under the Environment research theme.

(1) 'Mitigate and assess risk from volcanic impact on terrain and human activities'.

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<http://cordis.europa.eu/marketplace> > search > offers > 6007

## Preparing Europe for a drier future

*Guidance and recommendations evolving from a recent study on droughts are designed to make sure that Europe is well prepared for a drier future.*

The world is experiencing droughts with greater frequency and intensity. If the climate models are right, even more droughts can be expected in the coming years. This challenge of preparing for the future was taken up in the context of the Xerochore<sup>(1)</sup> project, which received funding from the EU. An extensive network of experts on water issues was assembled from universities, research institutes, government authorities and relevant stakeholders.

The scientific aspects of the problem were thoroughly assessed, including all

aspects of the hydrological cycle. Recommendations followed for several important issues such as addressing the weaknesses and uncertainty associated with computer models. The need for reliable short and long-term drought forecasts was also emphasised.

In order to evaluate the impact of this natural disaster on both society and



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the environment, data was collected for a number of recent droughts. The methodology employed integrated concepts of water demand and supply management.

Finally, the Xerochore team turned its attention to the role of policy in helping to avoid drought or mitigate its impacts when it occurs. The scope of the study extended beyond Europe's borders in

an effort to identify best practices from around the globe.

Looking to share these important findings, several workshops and conferences were organised which were well attended by members of the European Parliament, European Commission and other high-ranking authorities. A guidance document and targeted policy briefs have also been produced. Finally,

many of Xerochore's experts will be continuing their fruitful collaboration through the European drought centre.

(1) 'An exercise to assess research needs and policy choices in areas of drought'.

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

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## Reviewing recommendations and roadmap for climate change

*Climate change and energy-related issues have become a crucial part of our wellbeing and economy. But assessing true progress to address these challenges and proposing better ways has long been on the minds of academia and the public.*

The EU-funded project 'Governance and agents in institutional architecture on climate and energy' (GAIA) set out to draw a clear map on the effectiveness of various ongoing initiatives on climate change and energy issues, both within and outside the UN framework.

The project has examined actors and governance related to business, industry, NGOs, authorities, scientific networks and international organisations. Subjects investigated included greenhouse emissions and environmental effectiveness of institutions in general.

The results are expected to have an impact on the actual design of post-2012 mid- to long-term institutional structures on climate change and energy. They will contribute to scientific development in such disciplines as political science and international relations, and environmental policy studies.

In its investigations, GAIA elaborated a set of scenarios involving a combination of actors required for long-term governance architecture on climate and energy issues. For example, it found that solid agenda setting in this field comes from combinations of scientific institutions, NGOs, media and international organisations. The stronger the influence of 'pusher states', the higher the chances of effective negotiated settlements. In parallel, the stronger the lobbying of 'insider' NGOs the higher the chances of effective negotiated

settlements. Initiatives in this direction can be greatly supported by strong international organisations and academic communities.

Partnerships with NGOs and capacity building by international organisations are also likely to help compliance in developing countries. Collecting data about compliance from independent scientific networks is equally helpful for fostering compliance and governance. GAIA's findings suggested that

multilateral commitments by states and business will be stronger if they were included in climate and energy negotiations. Certificate schemes are also recommended, yet with verification by a third party.

Unsurprisingly, the project also concluded that shaming and blaming by NGOs, amplified by media and scientific reporting can build or reinforce state implementation. All these conclusions and others established through GAIA can make a solid foundation for the next round of climate negotiations and in tackling energy issues.

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

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## Biodiversa — collaborating for conservation

*Species are disappearing at an alarming rate, threatening nature's ability to provide us with essential goods and services like clean air and water, food, fuel, materials, climate regulation and flood prevention, to name just a few.*

Species are disappearing at an alarming rate, threatening nature's ability to provide us with essential goods and services like clean air and water, food, fuel, materials, climate regulation and flood prevention, to name just a few.

Enter the EU-funded ERA-NET project Biodiversa (<sup>1</sup>), which is working to create a single biodiversity research community in Europe. Biodiversa, which is now in its second phase, has received funding from the EU's Sixth and Seventh Framework Programmes (FP7).

Before the Biodiversa project came along, funding for biodiversity research in Europe was fragmented and funding agencies engaged in relatively few joint activities. Yet pan-European cooperation is vital for biodiversity research for a number of reasons. In some cases, the European scale is simply the most logical one. Project coordinator Dr Xavier Le Roux of France's Foundation for Research on Biodiversity gives the example of invasive species. 'By definition they will cross borders and if you need to develop a management plan for an invasive species, maybe it makes sense to develop a European management plan, and not only a national one,' he says.

New and emerging topics, such as the valorisation of biodiversity and ecosystem services (in which scientists attempt to quantify the value of biodiversity and the services provided by nature), are also best tackled at the international level. In these cases, it is unlikely that any one country will have sufficient expertise to run a research programme on its own; European collaboration is essential. In addition, Biodiversa can support pan-European research projects of a size complementary to traditional integrated project (IP) support by the European Commission, and likely more suitable to create actual interdisciplinary work and stakeholder engagement.

Today, Biodiversa links up 21 funding agencies in 15 European countries and

is effectively constructing a European Research Area (ERA) in biodiversity research. Biodiversa's core activity is the funding of biodiversity research through joint calls for proposals. Projects are selected principally on the basis of two criteria: scientific excellence and policy relevance.

The first joint call, launched in 2008, provided over EUR 14 million to 12 projects in the areas of global change and biodiversity dynamics, ecosystem functioning and ecosystem services. Projects funded are studying the impacts of climate change on biodiversity; the use of fire in biodiversity maintenance; the effect of pollution, precipitation and temperature on peatbog biodiversity; the effectiveness of conservation areas and networks; and the impacts of climate change on insects.

A second call, with a total budget of EUR 11 million, was launched in November 2010. Part of the call is devoted to the relationships between biodiversity and the ability of an ecosystem to provide services such as food and water provision, climate regulation, and crop pollination, to name just

a few. Although there is evidence of a link between biodiversity and ecosystem services, these links are complex and poorly understood.

Biodiversa is also eager to fund projects studying new ways of placing a value on biodiversity and ecosystem services. Although a clear economic value can usually be assigned to the provision of goods such as food, fuel, materials and medicinal plants, the same cannot be said for services such as climate regulation or the provision of cultural services such as recreation opportunities.

Finally, the call will fund projects that will address ways of developing policies that will both protect biodiversity and thereby ensure the long-term sustainability of a wide range of essential ecosystem services. Looking to the future, Biodiversa's members recently pledged to launch a joint call for proposals every year. 'It's a very powerful commitment by the partners,' comments Dr Le Roux.

Another recent development in Biodiversa is the establishment of a common rolling research agenda for all agencies involved in the project. As well as setting out the key topics to be addressed by Biodiversa, this document will establish the kinds of activities to be carried out and look at how to communicate research findings to policy-makers and others and how to make best use of research infrastructures, for example.



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The project is also expanding its geographical reach; recent additions to the Biodiversa network include funding agencies in Bulgaria, Lithuania and Turkey.

For Dr Le Roux, the Biodiversa project has a key role to play in raising awareness among policy-makers and other stakeholders of the importance

of tackling biodiversity loss. Ultimately, the projects funded under Biodiversa will ensure that future generations continue to benefit from the many products and services provided by healthy, diverse ecosystems.

‘It’s really of paramount importance to support biodiversity research,’ he states. ‘We hope that the activity of initiatives

such as Biodiversa will help to support people working in the field and also promote awareness of the fact that biodiversity is really one of the grand challenges.’

(1) ‘An ERA-Net in biodiversity research Biodiversa’.

Promoted through the Research Information Centre.

<http://ec.europa.eu/research/infocentre> > search > 19973

## An EU research programme that is made to measure

*Metrology refers to the science and application of measurement, and it impacts on our lives in countless ways. Today, Europe’s metrologists are working together in the European Metrology Research Programme (EMRP), which receives 50 % of its funding through the EU’s Seventh Framework Programme (FP7).*

Through the EMRP, they are helping to address the grand challenges facing the world today in diverse fields such as the environment, energy and health.

According to EMRP chair Dr Jörn Stenger of the Physikalisch-Technische Bundesanstalt (PTB) in Germany, metrology is all about ‘good, reliable and correct measurements’. Furthermore, measurements must be comparable all over the world and at different periods in time.

‘Metrology affects all areas of our lives,’ Dr Stenger insists. For example, if we go to a hospital for a computer tomography (CT) scan, metrology ensures the radiation dosage we receive will be enough to generate the scan while remaining within safe limits. Similarly, if different parts of a car are built in different companies and countries, metrology ensures that the parts fit together in the assembly plant.

National metrology institutes exist throughout Europe, and they have a long history of international cooperation, as the mutual acceptance of standards and measures across borders is essential. For many years, this cooperation was fairly informal. However, that all changed when the institutes recognised what Dr Stenger calls a ‘metrological dilemma’.

In short, advances in technology meant research was becoming increasingly

expensive, yet national metrology institutes’ budgets were at best stable and at worst declining. Since primary measurement standards must be at the forefront of technology to be able to serve all stakeholder needs, metrology is very research intensive. ‘We agreed that only a joint approach in metrology research could help us out of this dilemma,’ says Dr Stenger.

The group obtained funding from the EU for a project called ‘Implementing metrology in the European research area’ (IMERA). This project, financed under the ERA-NET scheme, allowed Europe’s metrology community to formulate a joint, coordinated research programme and determine the procedures and structures needed to implement it.

When the first IMERA project ended, the metrologists carried on working through the EU’s ERA-NET Plus scheme. During this period, the group issued calls for proposals in four key areas: health, the international system of units (SI units), electromagnetism, and dimensional industrial applications.

Projects funded in the SI units field address the challenges of measuring constants of nature to redefine SI units such as the kilogram and the Kelvin. The medical projects focus on, among other things, ensuring that diagnostic tests are precise and reliable enough for

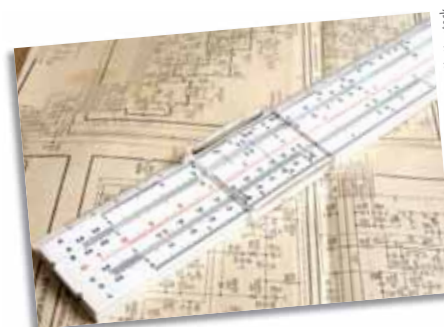
a doctor to decide confidently whether treatment is needed or not.

The topic of dimensional matters covers everything from what constitutes a nanoparticle to measuring the larger distances involved, e.g. in manufacturing an aeroplane, where all components must be precisely fabricated. Finally, the electricity projects address various issues including the safe dose for electromagnetic radiation.

In 2009, the EMRP obtained article 169/185 status, securing the future of the joint research programme between the participating Member States and the European Union for a further seven years. Article 185 initiatives (which were formerly known as article 169 initiatives) intend that countries integrate their national research programmes more deeply into a single European programme.

Meanwhile the EMRP is already having a huge impact on the European Research Area (ERA), as roughly 50 % of metrology research and development carried out in the countries that have signed up to it is carried out through the EMRP. ‘The EMRP is not some nice-to-have, add-on programme, but is really impacting our core mission we have in our institutions,’ emphasises Dr Stenger.

The EMRP is also generating interest beyond Europe’s borders. Countries



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that are particularly interested in the EMRP's work include Australia, Japan, Russia, South Korea, Taiwan and the US. In addition, a number of researchers from outside Europe are involved in EMRP-funded projects.

Looking to the future, the EMRP is keen to address the 'grand challenges' facing the world today. It is asking stakeholders in a number of sectors, including energy, the environment and health, for

feedback on the metrology problems that are specific to their sector.

'Our community is convinced that it is a very successful research programme that we have launched — everything is running smoothly and IMERA+ is already producing papers and outputs,' he adds.

According to Dr Stenger, the keys to the EMRP's success are the fact that the

national institutes already knew and trusted each other and that they share a common mission, which is fundamental to European society. 'This is the basis of everything,' he underlines.

Promoted through the Research Information Centre.  
<http://ec.europa.eu/research/infocentre> > search > 19153

## Ageing at the forefront of European research

*Researchers are helping Europe, and the EU in particular, to meet the challenges imposed on the region by an ageing population and declining birth rates. They are also tackling how fragmentation is affecting the impact and efficiency of international and interdisciplinary research efforts.*

The EU-funded 'European Research Area on Ageing 1 and 2' (ERA-AGE 1 and 2) ERA-NETs have made major headway in tackling these issues by consolidating research resources and know-how, and optimising the impact of research on policy, practice and product development. Thanks to ERA-AGE 1 and 2, Europe is providing answers to issues that weigh heavily on the minds of everyone.

ERA-AGE 1 consolidated skills and knowledge to coordinate ageing research and got a multidisciplinary European Research Area in the field of ageing research off the ground. It helped Europe benefit from investments made in this field. Following on the success of

ERA-AGE 1 was ERA-AGE 2, initiated to ensure the ERA's benefits in the ageing field in the long term.

For ERA-AGE coordinator Alan Walker, a professor of social policy and social gerontology at the University of Sheffield in the UK, ageing holds a very significant place for the public and policy-makers.

'Ageing is defined in various ways. The public and policy-makers tend to think of it in chronological terms, with 60 or 65 as the threshold,' says Prof. Walker. 'It is more helpful I think to see it in functional terms. What people are capable of or, in other words, what damage has been done to people's bodies

and minds over the life course. It is important because the structure of European societies is changing in a fundamental way i.e. fewer younger people and more older people, with life expectancy rising year on year and so more very elderly people.'

Before the project's kick-off, the ERA-AGE team determined that one of the biggest issues facing the ageing research community was the lack of coordination of effort. Despite the involvement of various countries, 'each country was following its own path regardless of how many times it crossed with another country's,' Prof. Walker points out. The headache was the huge duplication of effort. He also notes that there was a significant amount of concern about the lack of capacity among the next generation of researchers in this field.

Enter the ERA-NET scheme, which was the best tool for ERA-AGE as it effectively brings together national research organisations, such as ministries and research councils, in a coordinated effort.

According to Prof. Walker, ERA-AGE 1 and 2 contributed to the creation of the ERA in a number of ways. It brought together partners in a consortium to share knowledge and good practice in mounting ageing research programmes (creating the foundation for the ERA). It also launched the successful 'Future leaders of ageing research in Europe' (FLARE) postdoctoral programme which was designed to address the capacity building issue, engaging all major stakeholders (in biological research, medicine and sociology) in discussion about ageing research priorities. And finally it planned Europe's first research programme in this field.



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As for how the scientific community and the public are affected by the work of ERA-AGE 1 and 2, the benefits are many and huge. 'Impacts include engagement of the wider research community in the ageing research endeavour, a sense of a European research community, focus on multidisciplinary approaches to ageing research, a new cohort of young researchers in this field and an identifiable European focus,' Prof. Walker underlines. 'The impacts on society will follow the research itself but already the FLARE projects are demonstrating impacts across a broad

front — for example, new approaches to the alleviation of hearing loss in later life to understanding the ethical issues involved in the new anti-ageing medicines and techniques.'

While the future of the network is unclear, what we do know is that knowledge exchange and cooperation between multidisciplinary and interdisciplinary researchers are proving fruitful for all Europeans, both young and old. Member States have recognised the importance of the area. The Competitiveness Council has asked

the European Commission to consider launching in 2011 a Joint Programming Initiative on Demographic Change with which ERA-AGE has proposed to collaborate.

With almost EUR 1.7 million in financial support, ERA-AGE 1 and 2 brought together experts from Austria, Bulgaria, Finland, France, Israel, Italy, Latvia, Luxembourg, Romania, Sweden and the UK.

Promoted through the Research Information Centre.

<http://ec.europa.eu/research/infocentre> > search > 19433

## Towards better suicide prevention in the EU

*Effective implementation of suicide prevention programmes requires efficient evidence-based measures. This concept is driving an EU-funded project towards a multifaceted approach to one of society's most serious public health problems.*

Suicide is a dark topic yet one that demands attention if effective intervention is to take place. The 'Optimising suicide prevention programmes and their implementation in Europe' (OSPI-Europe) project aims at evidenced-based suicide prevention combined with concrete intervention evaluation and proper implementation.

With a consortium that spans 10 European countries, the project aims are targeted at health stakeholders and policy-makers. In accordance with the concepts founded by the European Alliance Against Depression (EAAD), a four-level approach has been adopted for a state-of-the-art intervention programme. This included educating guided practitioners through training sessions and videos, public relations activities, training sessions for community facilitators, and support for high risk persons after a suicide attempt.

In addition to developing the suicide prevention intervention programme, OSPI-Europe has developed instruments for assessing and evaluating primary, secondary

and intermediate outcomes. Intermediate outcomes are those that not only involve patients but also their relatives and the general public regarding such areas as attitude towards depression.

Models of intervention implementation have begun in Germany, Ireland, Hungary and Poland. Additionally an

official OSPI website was launched and numerous press releases have been published.

Awareness of the issue is key, and with such major achievement already in place the current and future results of the project are likely to have a positive impact on related fields of research.

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

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## How to combat new threats to old buildings

*Pollution can damage historical buildings in urban environments. Researchers are developing new methods to protect Europe's cultural heritage.*

Industry, transport and other processes produce a range of chemicals that can damage important old buildings which are mainly found in cities.

In addition, the mixing of these pollutants means the chemical composition of the urban atmosphere poses new threats.



The EU-funded TEACH <sup>(1)</sup> project has identified the major critical pollutants and changing degradation processes. The researchers have selected and tested the protection offered by various acrylic, wax and polysiloxane coatings on materials such as marble, sandstone and limestone.

The team assessed existing instruments and developed new equipment to monitor and protect buildings. From this they developed a cost-effective kit for assessing the outdoor environment and forecasting damage. One new device they

have developed measures the blackening and discoloration effects of various pollutants.

In addition, the project partners have developed the necessary electronic and software tools needed to support monitoring efforts. Using these tools and methods, the project has begun tests in six cities across Europe and the Mediterranean. They have also brought together representatives of relevant cultural heritage organisations and increased cooperation in the sector. These activities on the ground are scheduled to run until the end of 2011.

The results will help to shape regulations and strategies on pollution and help to preserve vital cultural treasures across the EU and beyond.

<sup>(1)</sup> 'Technologies and tools to prioritise assessment and diagnosis of air pollution impact on immovable and movable cultural heritage'.

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

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## New tools for old building restorers

*The building industry thrives on careful planning and the latest software tools for streamlining its workflow. This is even truer of complex renovation and old building maintenance jobs.*

But smaller construction companies don't always have access to the tools and information to carry out the works effectively. A European project may have the answer.

New-builds are difficult enough to manage for construction companies, but when you add the need to respect and restore historical, potentially culturally sensitive, features in the building, many firms struggle to find the in-house know-how. This can be costly and too complex for small and medium-sized enterprises (SMEs), which make up the bulk of Europe's building industry, to manage. What is the solution?

An EU-funded project, called H-KNOW <sup>(1)</sup>, is putting the technical, organisational

and functional pieces together for a collaborative website which will give SMEs access to relevant research knowledge. The resulting community of SMEs and research stakeholders will be able to share know-how and collaborate on projects.

The methodologies, software and collaborative services and information management tools being developed by H-KNOW will facilitate training and e-learning within the community, and the exchange of knowledge and innovation which will boost European competitiveness in the old building restoration sector.

The main topics being tackled by the project include restoration tips for



energy-efficient buildings, old building maintenance, and how to restore cultural heritage objects. Halfway into the three-year project, H-KNOW has made the necessary preparations — including benchmarking state-of-the-art collaborative tools and developing user and technical requirements — and proposed early prototypes and approaches to building the community.

Creation of the project website ([www.h-know.eu](http://www.h-know.eu)) has helped in these framing tasks and with communication among the consortium partners. The project has also come up with four business cases to illustrate to the stakeholder community of SME builders and relevant research organisations the benefits of the overall H-KNOW concept.

(1) 'Advanced infrastructure for knowledge based services for buildings restoring.'

Funded under the FP7 specific programme

Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'

<http://cordis.europa.eu/marketplace> > search > offers > 5948

## Ensuring chemical safety

*The EU's REACH regulation requires companies to show that they can manufacture and use chemicals safely. Businesses that need to carry out risk assessments could benefit from guidance on how best to carry these out.*

A 48-month EU-funded project was launched in 2009 with the aim of providing companies with clear REACH risk assessment guidelines. The Cadaster <sup>(1)</sup> project is identifying assessment methods that minimise the need for animal testing, and trim back on costs and time.

The project is examining alternative assessment methods, such as chemical and biological read-across, *in vitro* results, *in vivo* information on analogues, quantitative structure-activity

relationships (QSARs), and exposure-based waiving. The concept of intelligent testing strategies has also been identified as a possible means of facilitating chemical risk assessments. Cadaster also aims to develop and test operational procedures that ensure transparent evaluations.

So far, the project has successfully collected experimental data for chemical hazard assessments. Models for predicting the effect and properties of chemicals have also been identified.

A gap analysis to identify essential, but missing, data and models has also been carried out.

These exercises have already yielded results. For example, the project team has found that the amount of experimental data is quite large — the database already contains 7 027 entries of experimental data within the four classes of chemicals. However, only limited data are available for environmental risk assessment within REACH. Indeed, data on adverse effects for relevant species have been found to be especially lacking. The project team has also found that only a few QSAR models specifically developed for the four chemical classes of compounds have been published to date.

Finally, a prototype of a database for Cadaster participants to upload their models and make them available online to other participants has been developed. The database builds upon the online chemical database and modelling (OCHEM) environment, which is available on the Cadaster website.

It is expected that, by the time the project is completed in 2012, Cadaster will have been able to demonstrate how businesses can meet the challenge of quantifying and reducing uncertainty when it comes to chemicals. The end result will be a practical guide to integrated risk assessment for chemicals belonging to four compound classes.

(1) 'Case studies on the development and application of in-silico techniques for environmental hazard and risk assessment'.

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

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# IT AND TELECOMMUNICATIONS

## Virtual business enters the real world

*Work by EU-funded researchers will help make Europe a world leader in virtual organisations, the new, emerging business reality. It is a reality that will change how work gets done.*

Work by EU-funded researchers will help make Europe a world leader in virtual organisations, the new, emerging business reality. It is a reality that will change how work gets done.

Take Mark Kwan's company in Frankfurt. It designs the logical functionality of video software and needs help from Soo Chen's company in Milan for audiovisual interfaces. They both need Jemish Patel's platform company in London.

They put together software and hardware interfaces so a new type of video camera can work with editing software. They are in a hurry. For this project the three firms become one joint venture, working as a fully integrated virtual organisation (VO). They will collaborate virtually.

But this VO is much more than video-conferencing. Using a 'contract wizard' they are able to rapidly establish the legally binding terms of their cooperation. Their human resources systems link seamlessly, so the right people are assigned to the right job.

The three SMEs work as a single company for the purposes of this one-time project. They can co-opt other SMEs or larger companies on the fly, if they need more expertise. At the end they can dissolve the VO, start on a new project, or another VO.

This is a world where SMEs can self-organise into ad-hoc virtual corporations to tackle projects, take on markets and exploit opportunities that no single SME could do on its own.

It is a big, big vision and it is a lot closer because of the work by the 'European collaborative networked organisations leadership' (Ecolead) initiative, a major European effort to lead the world in networked collaboration.

'In ten years, in response to fast-changing market conditions, most enterprises and especially SMEs, will be part of some sustainable collaborative networks that will act as breeding environments for the formation of dynamic virtual organisations,' says Martin Ollus, coordinator of Ecolead and a researcher at Finland's VTT institute.



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'Collaborative networks of organisations provide a basis for competitiveness, world-excellence, and agility in turbulent market conditions,' he adds. 'They can support SMEs to identify and exploit new business potential, boost innovation, and increase their knowledge. Networking of SMEs with large-scale enterprises also contributes to the success of the big companies in the global market.'

### Far-ranging

Ecolead project was far-reaching and consisted of many direct and indirect impacts. It had a large work programme involving 27 partners and a budget of EUR 15.22 million, with EUR 9.75 million provided by the EU. Using these resources the project developed dozens of important tools and many pieces of key infrastructure.

In the process the partners helped to create a whole new market sector for Europe's ICT industry, a sector focused on collaborative networking, VOs and the even more complex community of networked organisations (CNOs).

More importantly, software development for the European SME market is now a viable proposition. Few enterprise solutions target SMEs because it is a fragmented market of relatively small installations. But by creating a focus on the collaborative networking tools SMEs need, Ecolead helped to overcome this barrier.

Ecolead's work had direct application too. Five key strands created the framework for a VO-enabled world. First, there was an important, broad and very influential study of networking and collaboration theory. Second, Ecolead developed appropriate infrastructure and tools.

Next the project developed three strategic processes to enable a sustainable VO ecosystem: VO breeding environments (VBE), dynamic VOs and professional virtual communities.

VBEs are the key element to prepare SMEs, typically consisting of companies that could potentially form VOs. 'There are many groups and associations that have some of the characteristics of a VBE, but they are not particularly acting in this capacity. Industry associations and chambers of commerce offer a potential springboard for the development of VBEs. These potential VBEs have in their DNA the mission to support the overall well-being of their associated SMEs,' explains Mr Ollus.

Here, software is the key enabler and Ecolead developed a series of tools and services that can be used together or separately. The assistance tool, for example, supports rapid creation of a virtual organisation which accommodates issues of trust, competency, and other factors to set it up.

For performance, the project developed a measurement tool to record the efforts of each member. Over time this data becomes invaluable for matching SMEs in a VO. A contract negotiation wizard allows member to quickly establish the terms of cooperation.

Meanwhile an application service provider (ASP) model offers management tools to run the VO, without clogging up the IT infrastructure of member companies with ad-hoc software. There is collaborative problem solving support for trouble-shooting when something goes wrong, and there is an advanced collaboration tool that can match individual competencies across the VO to specific tasks.

Ecolead developed all this essential software infrastructure after an extensive theoretical study of the requirements. The work has become so influential that Springer has published two books about it.

*'The global market is pushing SMEs into cooperation with other SMEs and also with big companies in the collaborative network paradigm.'*

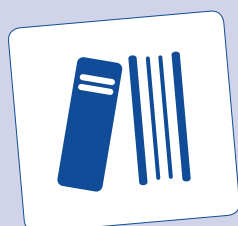
These results are real enabling factors for the adoption of ICT solutions in SMEs; VBEs and ICT-vendor companies will be able to provide Ecolead-compatible solutions. But collaboration frequently requires a preparedness that usually is missing in actual SMEs,' stresses Mr Ollus.

But however many tools, services and supports Ecolead develops, SMEs will always require help at some point. For this reason Ecolead developed models of professional virtual communities. These consist of consultancy companies relevant to VBEs and VOs. These consultants provide the key services that are not available within SMEs. It was an enormous work programme, and Ecolead achieved its overall aim to create strong foundations and mechanisms needed to establish the most advanced collaborative and network-based industrial society in Europe.

The project's work continues, moreover; the 'Collaboration and interoperability' (COIN) project carries on this work, further underlining Europe's commitment to be number one in this field. In the future business will be networked, it will be collaborative, it will be agile. Thanks to the work of the Ecolead project, that future is a lot closer than we thought, and Europe is leading the way.

The Ecolead project received funding from the 'Networked business and governments' initiative of the EU's Sixth Framework Programme for research.

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## Interview

### Curiosity-driven research

*Europe is a leader in blue sky research. And the quest to unravel secrets on the atomic scale through the laws of quantum mechanics is one of its most exciting undertakings, says Dr Tommaso Calarco, professor at the University of Ulm and coordinator of AQUTE. Dr Calarco answers this month's research\*eu results magazine's questions.*

'Good luck came a-knocking at my door. Skies were gray but they're not gray anymore.' This is how Irving Berlin described his blue skies in the 1927 song of the same name. For many scientists working on far-out, curiosity driven research, a good dose of good luck goes a long way. Curiosity, alongside the drive to seek out fundamental knowledge, is a basis for blue sky research.

The advent of computers arose from the genius of mathematicians and physicists long before anyone put together the first CPU. Today, scientists continue this pursuit of knowledge without necessarily searching for a solution to a specific problem.

It is within this mindset that some of Europe's brightest are working towards new discoveries. But it takes more than just luck. It also takes determination, drive and imagination. We found these exceptional qualities in Dr Calarco, who coordinates the EU-funded 'Atomic quantum technologies' (AQUTE) project.

*'To me, it is mind-boggling that paradoxical quantum phenomena, once regarded as almost philosophical speculations, can now be observed and manipulated almost on a routine basis.'*

At just 38, he became full professor of quantum information processing at the University of Ulm with full tenure two years later. This on the back of a two-year post-doc stint at Harvard University. Today, he also chairs the ERA-Net CHIST-ERA scientific advisory board. He's won numerous prizes

and fellowships for his research, including the Marie-Curie Outgoing International Fellowship of the European Commission and the 'E. Wallnöfer' Prize of the Tyrolean Industry Association.

He's published almost 70 articles in peer-reviewed journals and is often invited to give lectures and presentations at international conferences.

**• In your view, what are some of the more engaging blue sky research undertaken in the EU? And how do you see this developing in Europe in the near future?**

Looking at physics and interdisciplinary related fields, I think the biggest and most exciting developments are taking place at the smallest scale. From the technological side, this is a consequence of miniaturisation that has been going on at a steady pace in electronic devices for decades.

Even Gordon Moore, who created in 1965 the law that bears his name, noting that the number of components in integrated circuits had doubled every year from the invention of the integrated circuit, could hardly have imagined how far into the future this trend would extend. As a matter of fact, he envisioned it to continue 'for at least ten years', while it has basically lasted until now.

And here is where the exciting part takes place — hitting the atomic scale is a roadblock in terms of conventional semiconductor technology. But it opens up entirely new horizons in terms of blue sky research because the behaviour of systems at that scale is entirely dominated by the laws of quantum mechanics. It gives us the unprecedented possibility to observe directly the completely counterintuitive phenomena that take place in the quantum world. This does not involve just quantum information



Dr Tommaso Calarco

processing, but photonic and atomic-scale technologies in general.

Europe is extremely well positioned to take advantage of these developments, as European groups are at the moment among the world leaders in these fields. Until now, European and national funding has been supporting this process with a very effective synergy. The big open question is to which extent this will continue in the future, in particular throughout the Eighth Framework Programme.

**• Quantum computing is often cited as the next big step towards infinitely faster processors. Yet, for the moment, experiments in the field have only been able to demonstrate that the idea of quantum computing is valid. Why, after all these decades, are we still in this preliminary stage?**

Because maintaining physical systems under the conditions that allow for truly quantum behaviour is an extremely delicate business — to use a classical metaphor, it's like preserving a snowball in the middle of hell! In more technical terms, quantum coherence — the feature that is essential for obtaining quantum computing speed-up — is rapidly degraded via interaction with the environment surrounding a physical system, and this effect becomes more and more dramatic as the size of the system itself increases. This is why, while we can perform very simple calculations like dividing 15 by 3 on a



quantum computer, going bigger is a huge challenge.

In fact, the scalability of quantum computing systems is the major challenge faced in the field today.

On the other hand, if we think of time scales, it helps to remember that the quantum computing adventure kicked off only 15 years ago, and that we shouldn't measure progress with the standards of the present-day microelectronics era. Rather, we should compare it to the times when a transistor was several millimetres in size. It took several years to conceive and develop the integrated circuits that are so pervasive today — remember back in 1943, T. J. Watson, then president of IBM, allegedly stated 'I think there is a world market for maybe five computers'.

To take another very descriptive example, it took about 50 years since the discovery of quantum theory to conceive and realise the laser, and 50 more to bring it to such widespread use today. The first application scientists could envision for a laser was to pop a balloon enclosed within a bigger inflated balloon without damaging the outer one! We may laugh at such statements as they appear completely naive, but obviously this is the case only *a posteriori*, with today's knowledge that took decades to develop.

As a matter of fact, the progress that has been achieved over the last 15 years in the field of quantum physics is simply astonishing. I can still remember the first conference I attended as an undergraduate student on what was then called 'foundations of quantum mechanics', where a colleague presented the first theoretical concept of quantum teleportation. Even among specialists, this was regarded as something very speculative. Barely three years later, three research groups in Austria, Italy and the US independently made it happen in the lab, and now it is possible to achieve it over distances of several tens of kilometres. And the next step is to make it work via a satellite link to enable global-scale quantum communications — this is already being planned.

Of course, quantum computing technologies are still much less advanced than that. But first prototypes of special-purpose quantum computers, namely quantum simulators able to calculate properties of materials well beyond the capabilities of existing classical computers, are well underway and we are expecting them to be operational in a relatively short timescale.

• **Your project, AQUTE, is currently pursuing entanglement-enabled technologies. Can you explain some of the main objectives behind this research? And what do you hope to see transpire?**

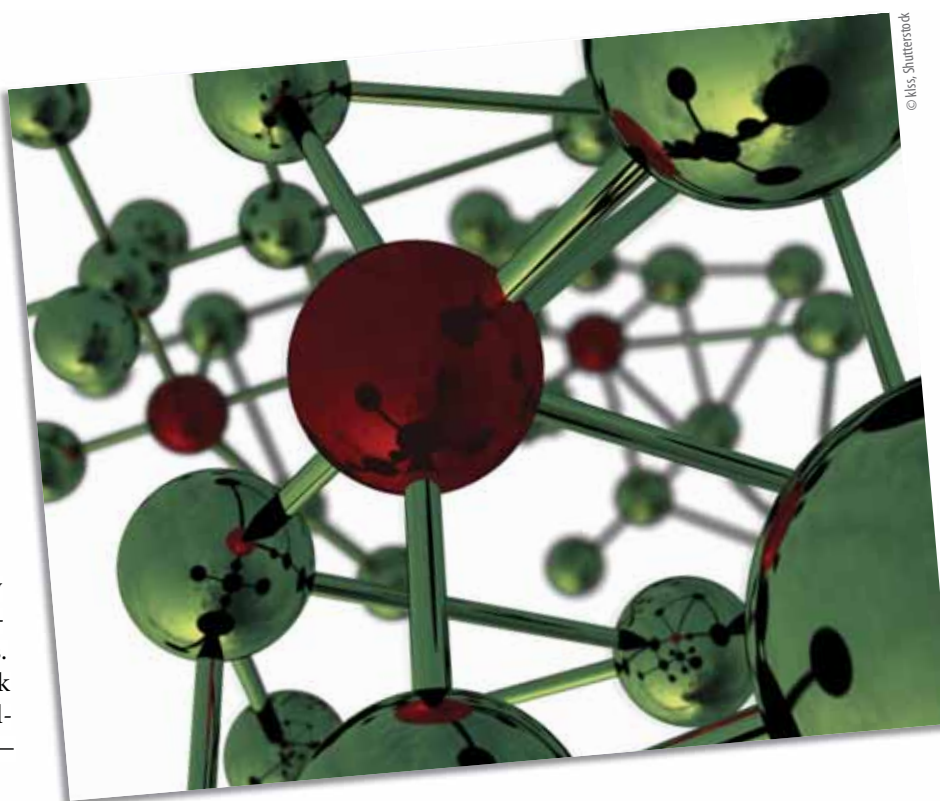
The main objective in the field of quantum technologies is to exploit quantum coherence and quantum entanglement, the very same physical phenomena that lie at the core of quantum information processing and communication and represent its most basic resource, as resources for other applications in further fields of research. One big example is quantum sensing. The essential aspect here is the following: we know that quantum entangled states are easily disturbed by the interaction with their environment. This phenomenon, as discussed above, is really an annoying bug for a quantum computer, because it impairs fundamentally its operation if not properly taken care of.

But there is an alternative point of view that allows us to turn this bug into a positive feature. Quantum systems are extremely sensitive to external conditions, so why not try and use them as high-precision measurement devices and sensors?

For instance, one can turn the ability to manipulate single electron spins in diamond nano-crystals into the ability to use them for detecting extremely small magnetic field variations. This may sound quite technical, but it is something that has enormous applications in medical imaging and diagnostics. Another example is the possibility of using entangled atoms for ultra-precise frequency measurements — and again, this may sound like stuff just for specialists, but it is at the core of technological applications like positioning (i.e. GPS), where quantum technologies can allow for a big leap forward in terms of accuracy and precision.

• **How has European research funding/policy helped in your field? What challenges has it tackled? What improvements could be made?**

European funding has been instrumental in bringing together the different scientific and national communities working in this highly interdisciplinary field. Physicists alone could not make



it without the help of mathematicians and computer scientists to understand the foundations and the full potential of quantum-based information processing paradigms, as well as contribution from chemists and material scientists towards the necessary technological basis. Nor could a single country alone make it, because the broad spectrum of competencies needed for this undertaking is necessarily delocalised across the continent.

In this context, the European Commission — and pre-eminently its unit on Future and Emerging Technologies — has played a pivotal role in enabling the necessary competencies to coalesce around a common goal and vision, which is laid down in the European QIPC Roadmap that I have the privilege to coordinate. The main improvement that is needed, given the scale of the ambition at stake, is to secure sufficient stability to the time horizon for the funding of these activities, as well as an even stronger synergy with national

funding agencies and research agendas.

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

I had absolutely no idea about this. When I was in high school, I was actually taught that atoms could not be seen with optical means. Ten years later, in my first month as a postdoc in Innsbruck I visited the ion trap lab and looking through an optical microscope — merely a series of crystal lenses — I could observe a single ion trapped inside a vacuum chamber. It was very faintly glowing with a greenish light and looked a little bit lonesome, plus absolute obscurity was necessary to be able to make it out, but you could do it with your eye! I still remember this as one of the most impressive sights in my entire life...

Even during my university years I was drawn to the field of quantum theory because I was attracted by its completely crazy and paradoxical aspects, which

defied any intuition. Only later on — actually, around the end of my undergraduate studies — it started becoming clear that these apparently philosophical issues had in fact very concrete applications, going much beyond what any of us would have imagined only a few years before.

I still remember the day that I saw for the first time one of the papers that laid the foundation of the field, Ignacio Cirac's and Peter Zoller's proposal for an ion-trap quantum computer. I remember that I was thinking to myself 'boy, this is the thing I've got to do for a living'. My thesis advisor didn't take me seriously at all, and probably I wasn't doing that either...

Having had the chance, just a few years later, to work together with those very people and to contribute — to a much more modest level — to the development of this very vision, has been for me a dream come true, and to a large extent it still is.

## Super knowledge systems to benefit smaller enterprises

*Small and medium-sized companies (SMEs) are set to benefit from a novel knowledge management approach. The technology integrates new web tools yet considers human networks as well.*

Small companies often work differently than large ones in managing knowledge. Generally, knowledge management programs of larger organisations are expensive, relatively inflexible and unsuitable

for knowledge-intensive SMEs in Europe.

Traditional knowledge management focuses on top-down, detailed and tightly controlled knowledge repositories. On the other hand, small knowledge-intensive European companies practice ad hoc, people-centred work processes, relying heavily on the social structures of the company (i.e. the individual knowledge and complex team formations). This has led to a need for a next-generation knowledge management system that manages and promotes social structures.

The EU-funded Organik (<sup>1</sup>) project is developing an innovative knowledge management approach,

consisting of theoretical knowledge management foundation and technology of business social software applications. The approach deploys a new breed of digital environments, such as Web 2.0, for generating, sharing and refining organisational knowledge. As a result, the participating SMEs can manage content and knowledge while allowing for informal, people-centred and ad hoc everyday procedures to be employed, upon which they heavily rely. Organik's results with the development of innovative know-how, products and services, as well as improve competitiveness.

Organik is already applying the resulting knowledge management capabilities among the nine participating SMEs and research partners from Germany, Greece, Italy and UK. The project team has successfully devised the system and has launched a prototype version. It has customised, deployed, and integrated Organik solutions in the SMEs partners.

In its essence, the Organik technical architecture is facilitating research of data, retrieval, publication, and collaboration. This is achieved through



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advanced information retrieval, visualisation, and navigation tools. The system encourages the publication of data by supporting the authoring, structuring, contextualisation and release of knowledge. It enhances collaboration by enabling the joint creation, sharing and application of information by knowledge providers and seekers. The

latter is achieved through communication, coordination, and community management services of Web 2.0 technologies such as Wikis.

Overall, the Organik consortium has generated significant results to support the ongoing advancement of European knowledge-intensive SMEs. This will

facilitate knowledge collaboration and the efficiency of European SMEs.

(1) 'An organic knowledge management approach for small European knowledge-intensive companies'.

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

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## The search for super-fast communications

*As files get bigger, software gets heavier and long-distance calling lasts longer, better communications technology is a must. A new, much faster standard for data transmission may be in the making.*

Fast, reliable data communication has become a pillar of technological advancement and information exchange. As more complex data — such as audiovisual, educational or corporate — are being shared,

accurate and rapid transmission of large amounts of information is vital.

Both radio waves and copper wires have played an important part in the data transfer, from the days of AM radio and telegraphs to the digital and fibre-optic formats of today. While advances have been made as transmission became digital and could carry more information, there is room for much newer technology. One of the most up-to-date communications technologies is known as synchronous quadrature phase shift keying (QPSK) transmission. It is much faster than current technology, both wired and wireless. When QPSK is combined with a multiplexing approach (transmitting different streams of information through one medium), the results could mean spectacularly fast communication.

One EU-funded project, entitled 'Components for synchronous optical quadrature phase shift keying transmission' (SYNQPSK), has taken fibre-optics using QPSK and multiplexing to new heights. The project succeeded in virtually perfecting the technology and has spurred commercial ventures that will see it enter into operation. The transmitted signals generated by the project were faster than anything else available on the market, cost less than existing technologies, and offered very high quality in many ways.

The new standard put forward by the consortium of researchers is ideal for metropolitan areas and long-haul fibre-optic communications. In addition to crisper sound, increased data and better video, the internet is expected to benefit from this technology in years to come.

Funded under the FP6 programme IST (Information society technologies).

Collaboration sought: further research or development support.  
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## Next-generation broadband for anyone, anywhere

*Getting access to affordable, reliable broadband and good mobile reception remains an issue. Difficult terrain, in particular, is a barrier towards efficient telecommunications that most enjoy in urban settings.*

Telecom operators often do not see a viable business incentive to install conventional networks in areas where few people live and on terrain that elevates infrastructure and maintenance costs. Those who visit or live in areas like deserts or remote mountains simply cannot take full advantage of all the benefits affordable and reliable

telecommunications has to offer.

A new concept and method to deliver broadband based on flexible relays in wireless orthogonal frequency division





multiplexing (OFDM) networks is therefore required. One EU-funded project, 'Flexible relay wireless OFDM-based networks' (Fireworks), stepped up to the challenge. Fireworks set out to design and validate a next-generation broadband access (BWA) prototype.

By using novel concepts like mesh network architecture and flexible relay-based deployment and cooperative communications, the researchers were able to enhance OFDM based WMAN/WLAN technologies. To achieve their goal, they had to address two major issues.

First, they needed to design advanced cooperative transmit and multiple receive (MTMR) techniques. Combined with hybrids of multiple-input and multiple-output (MIMO)

and beam-forming techniques, the advanced MTMR would be able to adapt itself to any number of radio and network variations while simultaneously maintaining spectrum efficiency and systems performance.

Secondly, researchers needed to make the medium access control (MAC) flexible enough to handle both ad-hoc and mesh networks. MACs enable several terminals or network nodes to communicate within a multi-point network. An ad-hoc network is a decentralised wireless network that does not rely on pre-existing infrastructure.

Fireworks managed to complete both of these challenges. During their research, they also developed a mechanism that reduces interference, created new algorithms for the OFDM relay system, and

came up with a new way to optimally place fixed relays.

The potential impact of their results could not only reduce investment risks of telecom operators but also lower all associated infrastructure costs. And the ad-hoc nature of the mesh network reduces the probability of network failure. In the end, however, Firework's innovative research will stand to benefit the people most of all — regardless of where they work, visit or live.

Funded under the FP6 programme IST  
(Information society technologies).

Collaboration sought: further research or development support.  
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## Tiny devices may help reinvent wireless technology

*The advent of nanotechnology and minute circuitry is allowing European researchers to develop ultra-fast wireless technology.*

Mobile and wireless technology has come a long way in recent years. Consumers are accessing huge amounts of information, communicating with each other and sharing media like never before. As their needs grow, so does the need for faster, more efficient wireless technology. In the meantime, devices are getting smaller while demand on their performance and power output is increasing.

Enter nanotechnology, which could help change mobile communication to the better. The 'Microwave amplification by spin transfer emission radiation' (Master) project, funded by the EU, is currently exploring the potential of spin-transfer nano-oscillators (STNO) to help upgrade wireless telecommunication technology. These

are minute structures driven by an electric current that emit microwave radiation.

Master is investigating how to increase their efficiency and power output. At the heart of this initiative lie the challenges of magnetisation and storing of magnetic data, which the project has overcome after intense effort. In light of this, a patent has been filed to safeguard the technology and ensure proper exploitation channels.

In parallel, the project has been bringing together highly trained scientists and engineers. Synergy between participants has helped put the European teams involved at the forefront of international research. The quality of work performed has already been acknowledged through several publications, and if all goes to plan the technology will help take mobile communications to a much higher level.

Lastly, the innovative microscopy techniques developed under Master will have a broader, long-term impact for nanotechnology on the whole.

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'  
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## A virtual culture built on trust

*Today's business climate is demanding and fast-paced. Companies rely on technology for a competitive edge. The Trustcom <sup>(1)</sup> researchers looked into the adoption of entirely new business models as yet another solution to improve their position in the market.*

We are clearly heading towards the era of e-business. E-transactions have already laid the ground for electronic commerce and their scope in terms of applications is constantly growing. And as new opportunities arise, the way of conducting business is changing too.

Faced with the rapidly changing customer demands and the challenges a competitive market presents, small and medium-sized enterprises (SMEs) choose to share expertise and resources to survive the battle. Thanks to information technology such alliances are not solely formed between companies in their own neighbourhood.

Unlike traditional 'bricks and mortar' companies, virtual organisations (VOs) which span national borders are being built. During the life-time

of these dynamic alliances, old partners may leave while new partners are joining — all according to the business needs at the moment.

Over the past years numerous projects and studies have been carried out with the aim of establishing the technology and best practices to support these on-demand businesses. This effort is visible in Europe through funded programmes supporting various projects in this area.

A case in point was Trustcom funded under the Sixth Framework Programme. This project looked into a number of barriers hindering the migration of SMEs to empowered alliances, but focused on a gap in the management of risks.

The established way of minimising risks and building trust is through

service-level agreements (SLAs) between partners. Besides the obligations and the quality of service (QOS) promised to a client, an important element of these contracts is the penalties implicated in case of non-compliance.

For negotiating SLAs in a semi-automated way, Trustcom developed a generic framework of web services. This service-oriented architecture (SOA) can run on a virtual, shared infrastructure, using physical resources spread all over the world to monitor their fulfilment in real time.

It was designed to make business information such as internal business processes transparent and within reach. It has security and privacy implications as well — trust is essential for any VO to work.

That is why the Trustcom framework offers partners the choice to share only the data they need, not more. Furthermore, grounded in the experience and expertise of lawyers, business and software developers, criteria were established to help identify partners that fail to fulfil their obligations.

However, much more needs to be done before the technology is mature enough to be deployed on a wide scale. Legal issues also have to be ironed out, if companies are to take full advantage of the benefits promised — especially as most legislation today covers paper contracts, not digital ones.

(1) 'Trust and contract management framework enabling secure collaborative business processing in on-demand created, self-managed, scalable, and highly dynamic virtual organisations'.

Funded under the FP7 specific programme  
Cooperation under the theme  
'Nanoscience, nanotechnologies, materials and  
new production technologies.'  
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## Learning to collaborate...virtually

*We know we need to collaborate to achieve common business goals. We have the tools to do it, but how can we get the full potential of collaboration among members of globally dispersed teams? A European project worked to provide the best corporate learning solutions to help develop the necessary skills and attitudes.*

Creative people are typically thought to be individuals working in solitude. Yet in today's fast-changing business environment, teamwork is needed to

achieve larger goals. Without adequate support, however, partners which are often geographically dispersed struggle to complete their joint task. A range of



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e-business solutions and virtual platforms exist on the market, but they are of variable quality and many rely on technology alone to support collaborative working.

The EU-funded 'Learning to collaborate' (L2C) project was launched to address the wider need for corporate learning solutions that help people develop the skills needed to collaborate more effectively. A working prototype of a next-generation computer-supported learning system was implemented to provide an intensive and game-like learning experience.

This series of software tools for the development of collaborative competencies is L2C's most tangible result. In creating its open platform, which is suitable for a broad range of simulated exercises, the L2C team drew on lessons offered by top business schools to manage change and innovation.

Funded under the FP6 programme IST  
(Information society technologies).

Collaboration sought: information exchange/training.  
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## Coping when disaster strikes

*One of the most crucial factors in dealing with emergency situations is time. Effective coordination between rescuers and communication with victims can save time, and thus save lives.*

Satellite systems can help in the rapid deployment of telecommunications infrastructure where ground-based alternatives are no longer available, such as after a natural or industrial hazard. However, satellite phones and other heavy cumbersome devices are not always suitable for these situations.

As a result, an EU-funded proposal was launched in 2006 to study, develop and validate rapidly deployable lightweight communications infrastructures specifically designed for emergency conditions. The goal of the 'Wireless infrastructure over satellite for emergency communications' (Wisecom) project was to define the reference architecture of an emergency telecommunication solution, to be called Wisecom system.

The project was split in two main phases. The first phase involved analysing and designing the reference architecture of the Wisecom system. The second phase focused on the development and testing of this system, and validating the key features.

During the first phase, the team looked at issues ranging from classical management of disaster situations to licensing and regulatory issues for emergency telecommunications. These investigations reinforced the necessity of a lightweight, robust and easily deployable telecommunication

system to quickly restore local coverage with the most common wireless communication standards. Such a system would enable highly stressed victims and members of rescue teams to use their own well-known, personal telecommunication devices to access the provided telecommunication services.

The investigation phase identified the wisecom access terminal (WAT) as the



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critical device for emergency telecommunication. As this device would be carried to the place of the disaster, it had to be light and as small as a suitcase. In addition, it needed to be resistant to shock, water, humidity, dust and heat.

The integration of satellites with terrestrial technologies also needed to be taken into account. The Wisecom project came up with a solution that could be easily upgraded to fit with upcoming technologies, and accommodate the complex interactions between rescue

teams and different service providers. Testing and validation was then carried out.

The project succeeded in integrating several terrestrial mobile radio networks over lightweight and rapidly deployable satellite systems, designed specifically for public safety communication. The targeted infrastructure, covering bi-directional communication needs for voice and data, is scalable and works for limited user group up to a larger group. What is more, the

equipment can easily be carried by one person.

By facilitating effective communication to and from citizens and enabling rapidly deployable emergency telecommunications systems, the Wisecom project could help save lives.

Funded under the FP6 programme IST  
(Information society technologies).

Collaboration sought: further research or development support.  
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## Emerging technologies — do they pose a security risk?

*While most technologies are developed with good intentions, if they fall into the wrong hands there can be serious consequences. European researchers are investigating the security threats posed by emerging technologies.*

Developments in science and technology can also be used for harmful purposes; computer hackers can cause widespread disruption, while bioterrorists could release a deadly virus into the population. The aim of the EU-funded project Festos <sup>(1)</sup>, which began in 2009, is to identify and assess the security threats posed by the abuse of emerging technologies and propose ways of addressing these threats.

The project team has carried out horizon-scanning activities to pick up emerging trends and new drivers of change in the next two decades.

The team focused in particular on 80 technologies from the fields of robotics, information and communication technologies (ICTs), new materials, nanotechnologies and biotechnologies.

This analysis was complemented by a global expert survey which uncovered insights regarding the risk and severity of abuse of given technologies. Festos identified three broad categories of potential threat: malicious disruption (i.e. communication jamming); easier access

to technologies once reserved for the likes of the military or authorities (i.e. signal interceptors); and misuse of technologies designed for good purposes (i.e. toy robots).

Elsewhere, the Festos project embarked on discussions with stakeholders about how to prevent knowledge falling into the wrong hands.

This controversial issue involves a trade-off between security, human rights and the freedom to create knowledge.

Meanwhile the Festos team is continuing to work on threat scenarios and related early warning procedures.

(1) 'Foresight of evolving security threats posed by emerging technologies'.

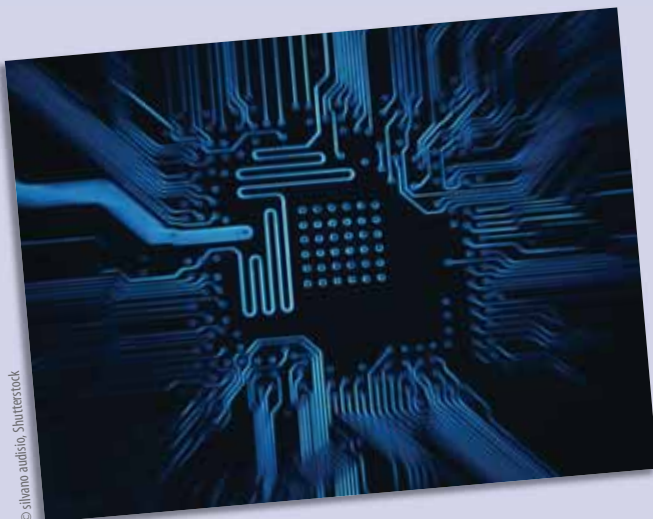
Funded under the FP7 specific programme Cooperation  
under the theme Security.  
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## Big steps in the nano-world revolutionise new products

*Not so long ago a mobile phone had the dimensions of a brick, laptops were not yet invented and tiny electronic devices in our pockets and embedded in our lives were still a figment of a scientist's imagination. Nanoscience — the science of the very small — has transformed the electronics industry. And European research has been at the heart of this transformation.*



Electronic devices are getting smaller but their power, speed and functionality is getting bigger. And with progress in nano-electronics come substantial new opportunities to develop more powerful microchips at smaller and smaller scales — a nanometre, or nm, is a billionth of a metre — and at a price that remains attractive for industry and for the end-user.

Aware of this challenge, the European Commission gathered key players in the field — scientists from industry, research institutes and universities — to work together on advanced processes with the aim of developing ever-smaller microchip technology, 32 nm and below.

But the laws of physics have not made this task an easy one. Moore's law — named after Intel's co-founder Gordon Moore — states that the number of transistors in a microchip doubles every two years. Computer scientists are reaching beyond that limit by packing more functions onto a single chip. And European researchers are at the cutting-edge of the complementary metal-oxide-semiconductor (CMOS) technologies underscoring this progress.

### Beyond physical limits

In 2004, the EU kicked off its campaign to take a lead in CMOS by funding an integrated project, called Nanocmos<sup>(1)</sup>, which acted as a platform for knowledge and expertise development. By working together, the participants created a vibrant, united research community in Europe necessary to develop the 45 nm, 32 nm and smaller CMOS technologies.

The encouraging results of Nanocmos prompted the EU to pursue its efforts and fund the 'Pulling the limits of nanoc-

mos electronics' (Pullnano) project. Uniting those involved in Nanocmos with around 15 new academic partners, Pullnano continued to advance knowledge in this challenging field.

As a result of the project, 45 nm and 32 nm CMOS technologies were rolled out, allowing European integrated circuit manufacturers to consolidate their position in the global microelectronics market. Both the 45 nm and 32 nm CMOS technologies have been taken up by the Eureka nano-electronics clusters. They developed a project, entitled Foremost<sup>(2)</sup>, which successfully finalised work on an industrial version of the 45 nm technology in mid-2009. This technology is now used in production by the leading European chip manufacturer STMicroelectronics.

The results accomplished by Pullnano are today underpinning important innovation which is taking place in Europe's R&D sector, leading to products and services in a range of applications, from communications and consumer products to embedded electronics in industrial applications. For example, the applications being developed are used in new generations of i-phones, televisions, videos and audio systems, and a raft of mobile devices and portable computers.

The Nanocmos and Pullnano projects have helped European chip manufacturers to maintain their strong contribution to the worldwide microelectronics industry and paved the way for new challenging system-on-chip designs and their successful introduction to the market. The technologies developed by these successive projects are also now being used in a series of more application-oriented projects focusing on such challenges as energy efficiency, CO<sub>2</sub>-reduction and electric cars.

Thanks to some far-sighted research funding policy, the Commission has helped European industry gain a valuable lead in a fast-moving and vital enabling technology. The results of which can be seen in the small but powerful electronic devices that help us in our daily lives, at work, on the road and in our homes.

(1) 'CMOS backbone for 2010 e-Europe "nanocmos" from the 45 nm node down to the limits'.

(2) 'Fullerene-based opportunities for robust engineering: making optimised surfaces for tribology'.



## New production techniques for single enantiomers

*The 'Integrated synthesis and purification of single enantiomers' (Intenant) project has combined two different approaches to speed up the production of single enantiomers.*

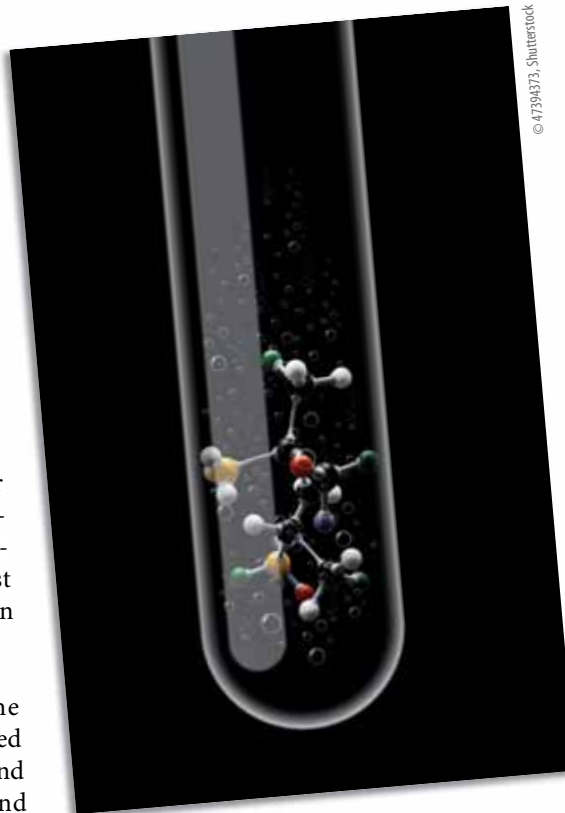
Enantiomers are pairs of molecules that, like a pair of human hands, are non-superimposable mirror images of one another. Therefore, they are identical in composition but not in form. Currently the pharmaceutical, fine chemical, food and agrochemical industries are showing great interest in enantiomers and in methods for their production.

The initiative's aim has been to create a combined approach for producing a number of target compounds and develop tools that are capable of evaluating innovative processes. Following suggestions by industrial partners, the researchers have selected 18 compounds to be carefully studied.

One of the first and most important tasks has been to deliver sufficient quantities of the pure compounds to

the different participating laboratories, in order to provide a basis for the study. At the same time the consortium has been developing theoretical models and appropriate tools for investigating ways of producing the different target components. The most promising process routes can then be validated.

The approach used by the Intenant project has combined two competing techniques and simplified the synthesis and purification of single enantiomers. These compounds are of great value to industry and their rapid, reliable and cost-effective production will help Europe to compete more effectively on the global stage.



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Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'  
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## Driving the auto industry in Romania

*Romania's western region may soon emerge as a strong hub for the automotive industry, thanks to the efforts of an enterprising EU project.*

Romania, particularly its western region, has exhibited strong potential in the auto industry over the last few decades. By creating the right conditions and expertise, this potential has been transformed into establishing a formidable auto-industry cluster in the region.

The EU-funded Westeer <sup>(1)</sup> project has promoted co-operation among regional development promoters, universities, research centres, enterprises and other stakeholders in the automotive sector, laying the foundations for promoting sustainable development based on stronger collaboration between research and regional policies.

To achieve this, the project team established a cluster management unit (CMU) to promote research-industry co-operation in the automotive industry. It set up databases on research and development and supported the transfer of research results

towards local small and medium-sized enterprises (SMEs). Mentoring of the newly established cluster by experienced European partners has also taken place, and involved the exchange of information and transfer of good practices in cluster development. In addition, Westeer implemented a complex set of activities in support of a research-industry pilot project on fostering co-operation between research entities and SMEs.

Project deliverables included a comprehensive report on the sector, relevant databases, a roadmap on future stakeholder cooperation, and marketing initiatives including a newsletter. Communication and cooperation among regional and international stakeholders was further enhanced via a virtual communication platform and through other communication tools.

All this has resulted in improved understanding and greater capacity for policy actions concerning the dynamics of the automotive sector at regional level.



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It also led to region-wide consensus in support of the cluster development initiative. The resulting multi-annual action and business plan for the cluster is evidence of the project's success, as is the significantly increased capacity at regional level to enhance science and technology-based development, with a special focus on the automotive sector.

Westeer has had a substantial impact on the policy and socio-economic environment in Romania's western region which is bound to have a long-term effect on the pattern of economic development, the region's overall economic performance and its integration into relevant European structures and networks.

(1) 'Support actions for the emergence of a research driven automotive cluster in west Romania'.

Funded under the FP7 programme Capacities under the theme 'Regions of knowledge'.

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## Building smaller biosensors with lasers

*European scientists are developing highly sensitive biosensors that can conduct rapid analysis of very small samples of biological material.*

Biosensor technology has made significant advances over the past 20 years. The sector still holds enormous potential for the future, however, particularly in the fields of environmental monitoring, industrial and food processing and health care.

The EU-funded Biolift <sup>(1)</sup> project has employed a new technique for developing biosensors that do not require the use of biological labelling. Project partners have successfully used the 'Laser-induced forward transfer' (LIFT) technique to deposit biomolecules on the surface of the sensor. Use of the LIFT technique has enabled sample sizes to be greatly reduced while employing capacitive transducers that allow high sensitivity and low-power operation.

Researchers began by first identifying an appropriate laser system and then optimising the laser pulse

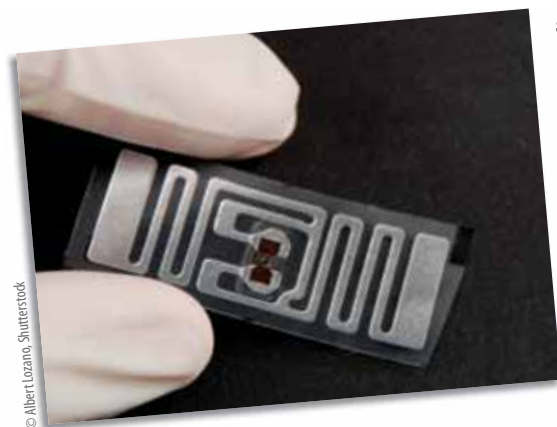
intensity. Scientists then selected the most suitable carrier for the material to be deposited and optimised the distance between the carrier and the substrate. The aim is for the sensor to be used to analyse thousands of types of samples including proteins, different ribonucleic acid (RNA) strands and pathogens.

The Biolift consortium has successfully designed a sensor that is both highly efficient and robust and can rapidly conduct analyses. Results from the project will enable European research to remain at the forefront of biosensor technology.

(1) 'Fabrication of capacitive biosensors using the laser induced forward transfer process.'

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

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## Optical lasers light up the electronics world

*Optical lasers with an organic edge represent the latest in the field of optoelectronics. These lasers developed by a European consortium are redefining electronics and technology.*

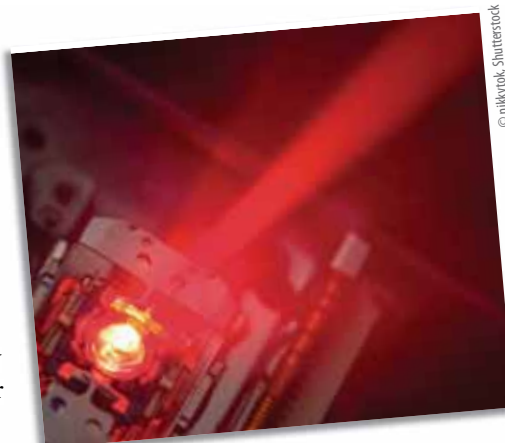
Optoelectronics refers to electronic devices that produce, detect and control light and certain forms of radiation. It is a technology used in transistors, circuits, imaging devices, lasers and fibre-optic communications, among others. Perhaps the best known example of this technology is light emitting diodes (LEDs), today used to illuminate anything from appliances to vehicle instrumentation.

One area of this technology is called organic based optoelectronics, which uses organic compounds

such as carbon. This makes the technology inexpensive, lightweight, flexible and eco-friendly. Thus, organic optoelectronics offer many advantages over traditional or inorganic counterparts.

A consortium of research partners, backed by EU funding, embarked on a project to create what is known as an 'Organic electrically pumped laser' (OEPL). The project team used cutting-edge organic circuits and semiconductors to overcome the main difficulties

of the new laser. Such lasers have a profound impact on science, technology and communications. They can be used in a variety of applications and are more effective than their predecessors and can interact with more types of materials such as glass, polymers and silicon.



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While both Japan and the US have been experimenting with this technology, the team managed to make important headway. Three patents were filed which leave the door open for possible exploitation of the results in the future,

with a general consensus that the project results were highly successful. Disciplines from physics to optoelectronics stand to benefit significantly, and the EU is already showing its leadership in this area.

Funded under the FP6 programme IST  
(Information society technologies).

Collaboration sought: further research or development support.  
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## Lightweight plastics with impact properties

*European scientists are developing lighter, stronger and more energy-efficient reinforced plastics for a wider range of applications. Industry and the environment are likely benefactors.*



Not all plastics are equal. Some are stronger and more rigid, others softer and pliable. Some are easier and cheaper to make and some are more easily recycled than others.

The EU-funded 'Resource-efficient self-reinforced plastic materials and processing' (Esprit) project is developing lighter plastic components by shaving the amount of plastic that goes into them by up to 30 %. But the trick is keeping the plastic strength and form while reducing weight. So Esprit set out to develop the next generation of lightweight, self-reinforced plastics (SRPs) together with the energy-efficient manufacturing processes needed to produce components from this family of materials.

In SRPs, a polymer matrix is reinforced with high-tenacity fibres or tapes of the same polymer family creating a material with typically three to five times the strength and stiffness of

un-reinforced polymers. This means getting more strength from less weight and no need for 'foreign' reinforcements like glass or carbon which affect the plastic's recyclability.

But there is a catch. Current forms of SRP, especially in commodity and low-cost polymers, are only available in sheet or fabric form. This restricts the range and types of components that can be manufactured. Esprit is working to remedy this by developing what it calls a 'flowing versions of SRPs from commodity polymers — polyolefin's, polyamides and polyesters.' Key to this is the development of techniques allowing the selective melting of the polymer matrix without causing adverse effects on the polymer reinforcement fibre. Typically, it is expected that the materials savings will be in the region of 30 % for general plastic mouldings, but higher for components that have performance criteria dominated by material strength and stiffness.

About halfway into the 42-month Esprit project, initial work has centred on materials investigations and the characterisation and testing of possible polymer and additive combinations. There are some particular characteristics required from the basic polymer materials which are different from most other moulding applications — melt temperature in particular.

Esprit faces some several pressing challenges in meeting the demand for high-quality SRPs that meet diverse market considerations, applications, recycling options and processing equipment. Nevertheless, progress is being made and the first round of materials have been selected — polypropylene (PP), nylons (PA, including semi-aromatic PAs) and polyesters (PET).

Whilst these materials were being purchased, modified and combined by the researchers, initial moulding trials were carried out using a 'model system' of PET reinforcement and PP matrix designed as a framework for testing and refining the problems. There is still a lot of work to do but the effort will pay off.

Self-reinforced plastics are more resource efficient, much stronger and fit-for-purpose as a component part than conventional polymers. They use less material to reach a particular specification, but they require innovative new heating processes to form them into components, which include alternative energy sources. And this is where Esprit comes in.

Funded under the FP7 specific programme Cooperation under the theme 'Nanoscience, nanotechnologies, materials and new production technologies.'  
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## The sound of plastic

*Moulding miniature plastic parts is costly yet important for intricate processes, technology and industry. Ultrasound technology is a new way of overcoming the challenge and simplifying these processes.*

Most people are familiar with the ultrasound technology (sound waves beyond those of human hearing) used to map images of foetuses in hospitals. The same technology has many other applications, such as welding and moulding plastics, because of the heat that ultrasound technology can generate.

Sonoplast <sup>(1)</sup> is an EU-funded project that is working on a completely revolutionary concept of plastification and

moulding for very small plastic parts. It is based on the use of ultrasound technology to respond flexibly, reliably and cost effectively to the needs of suppliers for the production of complex parts. In more specific terms, the project is developing the first ultrasound-based moulding machine for the production of plastic parts at the micro- and mini-scale size. Development of this machine requires a new concept of mould and plastic feeding system that fits its ultrasound and mechanical features. Thus, Sonoplast is working on the machine's product design, mould making and injection moulding, among other features.

Previous trials have already confirmed that it is possible to fill tiny cavities in a mould with plastic melted by using ultrasound technology. The equipment provides heat for melting the polymer while producing the required filling pressure. Taking only a few tenths of a second, the energy provided by the ultrasounds also allows for filling the mould while applying significantly less pressure compared to the solutions currently in use.

The new technology also eliminates the plastification unit, common in traditional plastics manufacturing. All these advantages help reduce cost and increase efficiency during production.

The project had to overcome many challenges. It studied how ultrasounds affect the melting properties, and determined how to achieve the best results in this respect. It also worked out all the details in developing a mechanical concept and novel moulding techniques for the ultrasound moulding machine. Sonoplast also developed a new feeding system, followed by process-control strategies and systems, including implementation of a sensor system to ensure process reliability. Automation was also studied and incorporated, rendering the equipment as efficient as possible.

In a nutshell, Sonoplast's original aim — the development of the first ultrasound moulding machine for the production of micro and mini plastic parts — has been successfully achieved. The new technology positions Europe as a leader in manufacturing minute plastics, and will have a positive impact on a myriad of applications.

(1) 'New process and machinery for microparts moulding based on ultrasound excitation'.

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

<http://cordis.europa.eu/marketplace> > search > offers > 6069



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## Knock on wood

*In the future, novel wood-based composite materials that can be recycled and come from renewable sources may help to make polluting plastics obsolete.*

Many of the complex materials used in industry — such as composites and polymers — are derived from non-renewable sources like fossil fuel. This problem is exacerbated by an ever-growing demand for plastics and similar materials. The EU-funded Woody <sup>(1)</sup> project aims to change this by developing new materials based on types of wood that can regenerate

easily, with the focus on maximum eco-sustainability.

Several breakthroughs have already been achieved by this project, such as the development of novel fibres, foam types and resins to create new materials. Nanotechnology has also played a role in rendering these materials attractive to many industrial processes.

Studies and tests have been conducted on separate parts of the composites, such as fibres and resins. Novel approaches to chemical and mechanical treatment of cellulose — the structural component of wood — have been undertaken to produce fibrils (very small fibres). This process has the potential to yield newer, stronger and more flexible materials and even textiles.

Another research focus is on the 'pro-  
teic treatment' of cellulose, a method which holds much promise in reducing the costs of both the raw materials





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and the processing. Overall, the project aims to create materials that derive from different sources, are resistant, conform to different surfaces and possess the ideal chemical properties.

The interconnectedness of fibres in these new materials — or matrix — is also being addressed. There are efforts to render the resins involved fire resistant. The ultimate goal is to reduce flammability and increase overall resistance.

One of the main considerations in creating new wood-like composites is the core of the material, i.e. what lies between the 'skins'. The project is examining efforts to

create cores made from natural polymers. It is exploiting different materials, mixtures of polymers and shapes for foamed material to be used in filling the core. While this is set to reinforce

the composite, tests must be taken to ensure the compatibility with skins.

The implications of such new, eco-friendly material will help the sustainability of industry, conserve energy and lower our carbon footprint. Since these new composites are more natural, their recyclability will be enhanced while pollution is set to decrease. Meanwhile, the composites' novel properties and the lower costs will make production viable and keep both industry and consumers happy.

1) 'Innovative advanced wood-based composite materials and components.'

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

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## EU researchers to develop low-cost hydro turbines

*European researchers are developing a methodology for low-cost hydro turbines of up to 5 megawatts, which are more efficient than currently available models.*

The productivity and costs of tailor-made, small hydro turbines should be improved by 3-5 % through the

application of a numerical optimisation methodology currently being designed by EU-funded scientists.

Thirdly, the team adopted hierarchical, distributed and meta-model assisted evolutionary algorithms to accelerate the optimisation of turbine design.

The team noted that preliminary performance was satisfactory, and has continued with the construction and adaptation of three test rigs for the prototype turbine models, namely the action type turbines pelton and turgo, as well as the reaction type matrix turbine.

The researchers believe that within 30 years most small action turbines installed in Europe could take advantage of the project results, thereby enhancing the competitiveness of European companies and the EU in general.



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Having received positive feedback from small EU hydro companies about the need for such a project, the research team selected different parameterisation methods for each turbine type, with best features concerning both the design flexibility and the cost-effective applicability for optimisation.

The team behind the Hydroaction <sup>(1)</sup> project then selected flow simulation tools, which involved adopting and applying the 'Lagrangian smoothed particle hydrodynamics' model.

(1) 'Development and laboratory testing of improved action and Matrix hydro turbines designed by advanced analysis and optimization tools.'

Funded under the FP7 specific programme Cooperation under the theme Energy.  
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The following upcoming events were selected from the event diary of the Directorate-General for Research and from the CORDIS event calendar.

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

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

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

### Workshop on document retrieval

*A workshop entitled 'Diversity in document retrieval' will take place on 18 April 2011 in Dublin, Ireland.*

When an ambiguous query is made by a user, a sensible approach is for the information retrieval system to send back a diverse range of results. This is done in the hope that at least one of the interpretations of the query intent will satisfy the user.

As diversity is, in general, an emerging topic, there is no overall consensus which has been set on the various aspects of the field. The primary aim of this workshop will be to foster an interactive, in-depth environment, with discussions centering on four themes:

- modeling ('What are the key components of diversification models?');
- evaluation ('How can a better evaluation experiment for diversification be structured?');
- applications ('What are the key applications for diversity in commercial search?');
- presentation ('How should diverse results be presented?').

The event will take place at the same time as the 33rd European Conference on Information Retrieval.

*For further information, please visit:*  
<http://www.dcs.gla.ac.uk/workshops/ddr2011>

### Workshop on computational colour imaging

*A workshop on computational colour imaging will take place from 20 to 21 April 2011 in Milan, Italy.*

The workshop will present research that advances colour image processing, colour image quality assessment, colour vision modeling and colour image reproduction. The scientific programme of the conference is planned to include both invited talks by speakers and contributions by participants.

The event is intended for researchers and practitioners in the digital imaging, multimedia, visual communications, computer vision, and consumer electronic industry, who are interested in the fundamentals of colour image processing and its emerging applications.

*For further information, please visit:*  
<http://www.ivl.disco.unimib.it/cciw11>

### Science and technology of graphene conference

*A conference on the 'Fundamental science of graphene and applications of graphene-based devices' will be held from 24 to 29 April 2011 in Obergurgl, Austria.*

The event will be devoted to the science and technology of graphene, advances in its growth and chemical processing, manufacturing graphene-based devices and studies of electronic transport, investigation of physical properties using various methods and emerging applications of this new material.

Graphene is a one-atom-thick planar sheet of bonded carbon atoms that are densely packed in a honeycomb crystal lattice. It has a variety of uses in gas detection, transistors, integrated circuits, solar cells, capacitors and bio-devices.

The conference will also address studies of optical properties of graphene and their applications in optoelectronics, graphene manufacturing by mechanical and chemical exfoliation, synthesis and growth on metals and semiconductors.

*For further information, please visit:*  
<http://bit.ly/ajdKBq>

### Second symposium on business informatics in central and eastern Europe

*The second symposium on business informatics in central and eastern Europe will be held from 28 to 30 April 2011 in Cluj-Napoca, Romania.*

The event will seek to integrate the scientific business informatics research mainly from central and eastern European countries and to provide opportunities for collaboration of researchers and professionals. The symposium will also seek to create new bridges — and build on the existing ones — for scientific debates amongst researchers in business informatics from this region.

Topics are set to include:

- digital economy;
- business intelligence;
- cloud computing;
- new enabling technologies;
- virtualisation;
- curriculum content design and development;
- e-learning;
- virtual environments for education;
- evaluation and assessment;
- research and teaching methodologies;
- frameworks and models for region-specific business informatics projects;
- intellectual property rights and research innovation exploitation.

*For further information, please visit:*  
<http://www.econ.ubbcluj.ro/sbicee2011>

## Scientix European conference

*The 'Scientix European conference' will be held from 6 to 8 May 2011 in Brussels, Belgium.*

The event will be an opportunity to learn more about different science education projects in Europe, get to know the people behind the projects, and share expertise, knowledge and best practices. The conference is intended to give a thorough view of the potential and possibilities of the scientix.eu portal and community.

Scientix collects teaching materials and research reports from European science education projects financed by the European Union under the Sixth and Seventh Framework Programmes for research and technological development, the 'Lifelong learning programme' and various national initiatives.

The conference is not only intended for science, math and technology teachers, but other stakeholders, such as researchers, policy-makers and science communicators.

*For further information, please visit:*  
<http://www.scientix.eu/web/guest/conference>

## Workshop on pervasive wireless healthcare

*A workshop on pervasive wireless healthcare will take place from 16 to 21 May 2011 in Paris, France.*

The average age of the population is increasing, while the number of people requiring care intensive medical monitoring is not diminishing. This increases overall cost of medical care. Therefore, partially replacing the assistance of nursing staff by small health surveillance and communication equipment like sensors, networks and monitoring software could be cost effective and increase the quality of life for patients.

Recent advances in technology have led to the development of small, intelligent, wearable sensors. These are capable of remotely performing critical health monitoring tasks and then transmitting patient data back to healthcare centres over wireless medium. Such wireless health monitoring platforms aim to continuously monitor mobile patients needing permanent surveillance.

The workshop will aim to be a forum for discussing what aspects have to be considered to provide effective and pervasive wireless healthcare systems. The event will include presentations of theoretical and experimental achievements, innovative wireless systems, prototyping efforts, case studies and advances in technology related to wireless healthcare networking and systems.

*For further information, please visit:*  
<http://www-l2ti.univ-paris13.fr/~boudjit/MobiHealth>

## Fourth international workshop on game theory in communication networks

*The fourth international workshop on game theory in communication networks will take place on 16 May 2011 in Cachan, France.*

Advances in information and communication technologies are leading to increasing demand for networks that are self-organising, self-optimising, and autonomous.

This need is generating new technical challenges that next-generation communication and wireless networks must meet. Due to this, game theory has recently emerged as a key tool in the design and analysis of next-generation communication networks.

Game theory is a branch of applied mathematics that is used in a variety of areas, including: biology, engineering, political science, international relations, computer science and elsewhere. The games studied in game theory are well-defined mathematical objects which consist of a set of players, moves, or strategies and a specification of payoffs for each combination of strategies.

The field of game theory can be used in a variety of applications such as resource allocation, network formation, routing, interference management, dynamic network operation, spectrum allocation, cooperative transmission, cognitive radio, security, ad-hoc networks and the deployment of wireless agents.

*For further information, please visit:*  
<http://www.game-comm.org/2011>



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