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Special feature



Robots and us: advances in robotics, from industry to society

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Releasing the robot from its cage...

We are fascinated by machines. Robots, in particular, have captured our imaginations in both book and film. Today and in Europe, we tend to think of robots in a cage — like massive mechanical arms working in unison on a production line. But in Japan or in South Korea, robots have already entered people's homes, both as aides, assistants and even as pets. Europe may be heading down a similar path.

A number of EU-funded projects and researchers are currently working on turning circuitry into a form of intelligence, which can be applied to a range of settings, both industrial and domestic. One EU-funded project has developed a robot arm capable of conducting complex surgical procedures. Another project has created an 'intelligent' robot aimed at helping the elderly remain independent for longer.

*Still, the social and economic impact of industrial machines has made Europe competitive and productive. Customised industrial robots automate applications in our aerospace, automotive, solar panel assembly, and food industries, to name a few. As technology progresses, robots will eventually step out of their cage and into our homes. How far and to what end remains to be seen. To answer that sort of question, we dedicated this issue of *research*eu results magazine* to 'Robots and us: advances in robotics, from industry to society.'*

We look at a cross-section of some of the latest achievements from EU-backed research consortia, including a ground-breaking theory that enables robots to learn from action and experience.

Also in this issue, the biology and medicine section leads with an in-depth study that reveals how to best secure the mental and behavioural development of children through diet.

The energy and transport section leads with an article on reducing the costs of hydrogen fuel cells.

The top story in the environment and society section takes a closer look into the reasons behind the massive decline in bees over the past decade. European researchers are developing a device that will diagnose bees and identify the main suspect for bee death.

In our IT and telecommunications section, scientists are looking at innovative ways to make robots smarter.

The industrial technology section leads with a story on a project that is creating new laser technologies that could be employed in a host of applications requiring minute precision.

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

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

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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

Food... for thought

European scientists are on path to identify the optimum nutrition for the mental and behavioural development of children.

You are what you eat, the proverb says, but did you know that you think and you behave what you eat, too? Indeed, nutrition has an obvious and well-established effect on health, but now studies are starting to show that nutrition has an enormous effect on behavioural and mental development, too.

'Diet is important not only for physical health, but also for the optimal mental development and functioning,' explains Dr Cristina Campoy, paediatric professor at the University of Granada (Spain) and coordinator of the EU project 'The effect of diet on the mental performance of children' (Nutrimenthe). 'Scientific evidence shows this, but clear and reliable information is still not available to many people who are interested in its practical applications.'

Current evidence on the effect of diet on mental performance (MP) is largely based on animal, retrospective studies, and short-term nutritional intervention studies in humans. Nutrimenthe is working towards significantly improving knowledge through research on the role, mechanisms, risks and benefits of specific nutrients.

The research includes quantification of nutrient effects on later cognitive and mental disorders; the effects of food on mental state and mental performance such as mood, activation, attention, motivation, effort, perception, memory and intelligence; it will also look at the effects of food on mental illness.

Nutrimenthe studies the effect of diet on the mental performance of children and is focusing on specific nutrients known to have some role in neurodevelopment. The research includes a close examination of vitamins and minerals thought to improve mental performance, notably iron, zinc and the B vitamins. The project is studying long-chain polyunsaturated fatty acids (LC-PUFAs), typically found in fish oils. These fatty acids appear to be the brain's favourite food.

'There is still a lack of clarity and little consensus on the role of these nutrients in neurodevelopment, mental performance and mental illness,' says Dr Campoy. 'Nutrimenthe aims to address this especially with respect to the LC-PUFAs and folate (folic acid) as their role is much debated in Europe currently.'

The group has also set its sights on the problem from the other end, looking at specific disorders that may have a dietary component, such as attention deficit hyperactivity disorder (ADHD), depression or anxiety and stress.

The consortium includes 20 research centres from eight EU countries doing a highly ambitious work programme which draws from existing studies as well as establishing its own studies.

Generation R

Take Generation R in Rotterdam, the Netherlands, which studies 10 000 children and their parents from foetal life onwards.



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Nutrimenthe plans to use Gen R data to examine the effect of proteins, fatty acids, vitamins, minerals, and antioxidants during pregnancy on behavioural and cognitive development at ages 3 and 5.

ALSPAC — the UK's Avon longitudinal study of parents and children — is among the most important long-term studies ever undertaken. It recruited 14 000 pregnant women in the early 1990s and has followed the health of the children ever since. It is a unique resource used by scientists all over the world and its data has shown that higher dietary fish intake during pregnancy is associated with improved behaviour in children at the age of 6 to 7 years.

Nutrimenthe's research includes analysis of whether this relationship is explained by the effects of possible enhanced concentrations of LC-PUFAs in tissues of the foetus and/or the child.

The project also draws on the work of an earlier EU-funded multicentre study, called Nuheal, which investigated nutrients, cardiovascular health and infant neurodevelopment. Nutrimenthe wants to determine whether there are long-term effects on cognitive development and mental performance as a consequence of taking docosahexaenoic acid (DHA) and folic acid supplements during pregnancy. The children born from this cohort are being followed up during the course of Nutrimenthe.

Another former multicentre study, called CHOP, investigated whether using infant formula can influence the risk of childhood obesity. Nutrimenthe plans to follow up that project to assess the role of different protein intake in early life on mental performance.

Nutrimenthe has launched its own studies, too, such as SIMBA which investigates the influence of iron, zinc, and vitamins B2, B6, B12, folate and LC-PUFAs on cognition and behaviour in school-aged children.

Meanwhile, another study will decide the maximum beneficial dose of LC-PUFAs, the point beyond which no further benefit occurs. It does this by studying children with an inborn metabolism problem, called phenylketonuria (PKU). PKU children



must follow a protein-restricted diet, so they have low concentrations of LC-PUFAs in their blood.

Other studies have shown high-dose supplementation with LC-PUFAs led to improved mental and motor skill performance across a number of measures for PKU children. Nutrimenthe is working to quantify for the first time the optimal dose for PKU children, and this data will establish the optimal dose for other children, too.

The project has already achieved a major goal with the development of a standard neuropsychological test battery (NB) to improve the methodology for assessment of children's cognitive behaviour. Current study methods vary enormously, so they cannot be compared directly.

Food attitude

The project is also studying nutrition and consumer attitudes and the economic impact of nutritional interventions. Its consumer study is looking at how the public perceives the impact of nutrition on mental performance and what effect that perception has on food choice. Economic analysis should establish the social costs and benefits of nutritional intervention both before birth, during early life and its long-term social impact.

The main aim, however, is to use data to establish positive dietary recommendations to improve mental performance and to avoid behavioural problems in children and adolescents, currently the missing link in nutrition research.

The project is just half way through its five-year programme but it is already producing important results. For example, Nutrimenthe researchers at Erasmus MC University Medical Centre in Rotterdam showed that insufficient folate use during pregnancy might be associated with a higher risk of behavioural problems in children at 18 months. Other research demonstrated how genetics impacts absorption of beneficial fatty acids.

That is just the beginning. Over the last 30 months Nutrimenthe has put all the mechanisms in place to access and take advantage of the enormous quantity of data available, and over the next 30 months it will start providing some hugely important insights into neural development. Food for thought, indeed!

The Nutrimenthe project received funding from the Food initiative of the EU's Seventh Framework Programme (FP7) for research.

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The old world and long-term care

The 'old world' is getting older, threatening the prospect of millions of Europeans needing long-term care (LTC). European researchers are now searching the continent for good practices to cope with the coming demand.

It is an urgent search. Right now about 80 % of the long-term care is provided in an informal, ad-hoc and rather disorganised manner. 'Typically it is women, it is a family relative or a migrant worker

who is willing to work for very low wages,' explains Kai Leichsenring, coordinator of the European Interlinks ⁽¹⁾ project and senior researcher with the European Centre for Social Welfare Policy and Research.

The project studies health systems and long-term care for older people in Europe, and aims at modelling the interfaces and links between prevention, rehabilitation, quality of services and informal care.

One early result of the project is that the informal model dependent on relatives or migrant labour will be hardly sustainable in the future. It will be inadequate to meet the expected demand and not as effective as it will need to be.

'We are living longer and if nothing is done now then demand could overwhelm healthcare systems in the future,' Dr Leichsenring warns.

Governments are very aware of the challenge but this is uncharted territory. Reliable, effective policy options are not obvious, or clearly defined.

'We are really doing basic research, because everybody is talking about long-term care systems but nobody has actually got one. No country has an integrated long-term care system in place,' he believes.

He says right now countries deal with people who need long-term care in a wide variety of ways. Some countries deliver LTC, such as it is, through the healthcare system. Others deliver service primarily through the social welfare system, while some are a mixture of both.

'But only a few emerging examples follow an integrated plan to manage longterm care efficiently, throughout the care chain,' Dr Leichsenring emphasises.

Once possible policy options are known, policy-makers can stretch that LTC



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chain to very early preventative measures, deployed well before long-term care is required.

For example, loss of mobility, depression and social isolation are early warning signals that indicate who will need LTC in the future.

‘We all know people who are 90, who need no long-term care, they are still mobile and independent,’ notes Dr Leichsenring. ‘And we know that people who have a lot of social links, friends and family, who are active and take care of their health, these people will need, as a group, much less long-term care, if any,’ he notes.

‘On the other hand, if you’re living alone, in the countryside and you never married, then it is more likely that you will need more help as you get older.’

By encouraging social, active people and targeting early measures at the less active, isolated people, policy-makers can go a long way towards preventing the need for LTC altogether.

But once long-term care is needed there are simple, effective and cheap ways to reduce those problems. Rather than accessing expensive hospital care, activities and services need to be further developed to maintain people in their usual surrounding, and to support family carers in coping with ever increasing strain — by intermediate care facilities, information about alternatives, respite care or professional care counselling.

It is by the simple act of contrasting two outcomes from two different social situations that Interlinks provides highly cost-effective insights.

Qualitative insights

The EU-funded Interlinks project believes by looking at care systems across Europe, it can study all the possible, applicable elements of an effective, efficient LTC system. ‘We are taking an inventory of what is there right now,’ explains Dr Leichsenring.

This type of research, qualitative insight backed up by quantitative sampling, will offer policy-makers new,

evidence-based options for the design of long-term care systems.

Work has progressed at a brisk pace. The project has produced four major reports, looking at prevention and rehabilitation systems across Europe, quality assurance and management (QA/QM), and informal care. It has also produced a case study examining migrant carers in Italy.

‘Prevention and rehabilitation is a huge focus for us because we believe that organisational innovation and equal access of older people to rehabilitation can ensure a decent quality of care,’ stresses Dr Leichsenring.

Prevention can follow the example above, but it can also be as simple as minimising unnecessary hospital visits, for instance. Elderly people tend to be more susceptible to infection and visiting hospital increases the risk of getting one.

Prevention can also focus on integrated care pathways around common procedures. For example, after a hip-replacement the patient will need rehabilitation, physical therapy, and home help in the short term. This ensures the patient gains mobility and independence quickly.

But if a LTC system misses any of those steps in the care pathway, if physical therapy does not follow seamlessly after surgery, then the benefit can be lost. In this situation a fragmented care system is detrimental to individual health and safety, and will produce unnecessary costs in a mid-term perspective.

Dr Leichsenring notes that the research team has seen some fairly impressive schemes for managing LTC at the local level, but improvements can be seen also on the regional and national levels. For instance, the health centre in Skaevinge (Denmark) is getting impressive results by combining home care, outreach and part-time care.

Regulatory systems can also have an enormous influence, too. In Sweden, municipalities are responsible for LTC, but if there is nothing available then the municipality must pay for a hospital stay for citizens who require LTC. This is a strong incentive to develop local services.

In the UK, too, the National Health Service has started to make interesting steps towards integrated funding of LTC by using primary care trusts or PCTs.

Gathering these examples has been hard work. ‘There are different countries involved, and many contributors working within different systems and using different data to quantify their systems,’ remarks Dr Leichsenring, ‘It is like herding cats, so it can be quite challenging.’

Still, Dr Leichsenring believes it is a worthwhile effort. ‘It will lead to a European state-of-the-art model for describing and analysing long-term care provision and offer an analytical toolbox,’ he explains.

‘It will develop a range of reform policy options applicable to any stage of a national LTC system’s development. The project outcome will guide policy analysis and design, permit comparison and will substantially broaden the scientific base that supports Member States’ efforts to organise their health and LTC systems.’

That toolbox will be offered as an interactive, online policy engine, where policy-makers can take certain steps to see how it affects the overall system. The model will also ensure all links in the LTC chain are considered.

‘We will have that model completed by March 2011, when it will be tested internally, and then released to the public in April or May,’ Dr Leichsenring states.

For now, that will mark the end of Interlinks funded work and will contribute to the emergence of integrated LTC systems in Europe.

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

(1) ‘Health systems and long-term care for older people in Europe modelling the interfaces and links between prevention, rehabilitation, quality of services and informal care.’

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Positive signals for treating Alzheimer and cancer

There's so much more to tough diseases than meets the eye, particularly at a molecular level. Identifying minute signals in certain tissue types could help treat these illnesses.

There are numerous ways to study dangerous diseases such as cancer. One of these is to examine body tissue types called epithelia. This type of tissue is regulated by many different factors at the sub-cellular level. Although they play a key role in epithelial integrity, the

molecular mechanisms underlying tissue regulation are poorly understood.

A lot of communication or signalling goes on in epithelial tissue, sometimes leading to overgrowth of tissue or even cancer. Understanding these signalling mechanisms is very important in treating implicated diseases.

Funded entirely by the EU, the NOTCH ⁽¹⁾ and Polarity ⁽²⁾ project was named after two specific types of signalling mechanisms that are implicated in cancer and tissue overgrowth. The project aims to understand how both of these are involved in tissue homeostasis, such as control of epithelial integrity and cell division.

Rigorous laboratory tests have been undertaken on fruit flies or *drosophila*, using advanced digital analysis and images to understand the signalling process in epithelia. Close monitoring and documentation has already started unveiling the secrets of signalling and the role they play in diseases. For one, this is expected to reveal a key set of genes involved in the regulation of signalling mechanisms or 'pathways'.

Some of these pathways have been linked to Alzheimer's disease, different congenital diseases and malignancies such as leukaemia. Once these pathways and mechanisms are understood, the results will help design treatment strategies for these ailments. More concrete results are set to emerge at the conclusion of this project by the end of 2011.

(1) 'Study of the role of notch signalling in controlling cell differentiation and proliferation in the intestinal epithelium.'

(2) 'Role of Crumbs 3 and its partners in vesicular transport and ciliogenesis.'

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

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Safe antibiotics for newborns?

In life-threatening situations, some antibiotics may be better for newborn babies than others. The EU wants to verify that some are indeed as safe as doctors claim.

Antibiotics have miraculous curing properties yet most are not advised for use on very small babies. What happens, however, when a newborn baby suffers from a serious infection or life-threatening condition? Are there any antibiotics that are both safe and effective to administer to babies?

The EU-funded TINN ⁽¹⁾ project is evaluating two types of antibiotics — ciprofloxacin and fluconazole — to see if they are safe to use on newborns. These antibiotics represent two anti-infection drugs included on the priority list of the European Medicines Agency (EMA) for evaluation. The two medicines are already being prescribed to babies off-label, i.e. for medical use other than the

one approved by the EMA. While this is considered common practice, the EU wants to ascertain that these drugs are absolutely safe for use on small babies.

With this in mind, the TINN project is grouping together European leaders in neonatology, paediatric pharmacology, methodology and relevant SMEs for this purpose. It has already established close collaboration between academia, ethical bodies, regulatory authorities and pharmaceutical companies to examine these drugs.

The project will perform *in silico* experiments (i.e. via computer simulations and thorough animal studies) for both drugs to evaluate formulations

adapted to newborns. Testing is being optimised using state-of-the-art methods adapted to newborns in order to develop a solid paediatric investigation plan. The two trials will be performed with neonatologists trained in paediatric pharmacology, coupled with clinical research that adheres to good clinical practices. All the ethical issues related to the two trials will be examined,



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particularly issues such as distress, pain, blood sampling and informed consent. With respect to the latter, parent information sheets and consent forms will be submitted to parents' associations for approval. Finally, TINN will look into short-term safety based on vital signs, blood safety data and function of the major organs. It will also look into the

chance of long term adverse reactions developing later on.

In short, the project will officially validate common practice, ensuring that these drugs are indeed safe to use on newborn babies. This will help protect very young babies, helping both parents and doctors to make more informed decisions.

(1) 'Evaluation of antibiotics (ciprofloxacin and fluconazole) for the treatment of infections in preterm and term neonates'.

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

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Are 'monster' foods reaching your table?

While genetically modified food has its proper place in the food chain, many look at unauthorised varieties as 'monster' food. The EU is taking steps to inform the public and remedy the situation.

Fruits and vegetables containing genetically modified organisms (GMOs) are becoming a reality in the European food chain. With evidence of non-authorised GMOs in food products, the EU wants to tighten control of genetically modified products.

The 'Multiplex detection of (un) authorized GMOs in food and feed' (GMULTI) project, fully funded and supported by the EU, has developed more efficient detection systems for both authorised and unauthorised GMOs. It has come up with a method called padlock-probe (PLP) which can efficiently detect GMOs. Research laboratories in the Netherlands have tested the novel method on suspect DNA within certain foods to validate its efficacy.

The approach is based on designing PLPs for several DNA targets. These are then mixed together for more blanket testing (i.e. for many types of DNA in many foods). The PLPs react with their targets and alert researchers on

any genetic modifications. The results are then compared with various other dependable yet lengthier methods and in different laboratories to double- and triple-check the efficacy of the new approach.

The implications for European consumers are profound. To begin with, the new method provides an alternative tool for maintaining freedom of choice between GM-free and GM-containing foods. It also supports better labelling of products.

Although, further improvements are necessary for highly specific detection of GMOs and for validation of the method before implementation, the project results are highly promising. They have already been presented at the Fourth International Conference on Coexistence between Genetically Modified (GM) and non-GM based Agricultural Supply. The

results are being published in scientific literature to help reinforce collaboration among EU states regarding GMO detection. In addition, the project will help maintain and increase the competitive scientific level in the EU regarding GMOs, making it more attractive for researchers worldwide.

If all goes as planned, European supermarkets will stop carrying outlawed GMO products and consumers will know exactly what they're buying.

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Irish scientists discover how probiotics impact cell physiology

EU-funded researchers in Ireland have discovered that specially designed probiotics can modulate the physiology of host fat cells. Presented in the journal Microbiology, the study was funded in part by the 'Production of CLA [conjugated linoleic acid]-enriched dairy products by natural means' (BIOCLA) project, which clinched almost EUR 1.7 million under the EU's Fifth Framework Programme (FP5).

The findings offer new insight into how specialised probiotics could keep disorders at bay and lead to new treatments.

The experts from Ireland's Alimentary Pharmabiotic Centre (APC) at University College Cork and Teagasc

Moorepark Food Research Centre engineered a strain of *Lactobacillus* to yield a molecule called CLA. They found a significant change in the composition of fat tissue in tested mice after they ingested this engineered bacterial strain. Thus, ingesting live bacteria can play a critical role in metabolising remote sites in the body, the team concludes.

Various bacteria produce a number of versions of the fatty acid CLA. According to the researchers, one type, called t10, c12 CLA, is linked to decreased



body fat in both humans and animals. This particular type can also slow down the growth of colon cancer cells, which could result in the tumour's death. But only some types of bacteria, such as *Propionibacterium acnes* (*P. acnes*, the bacterium that triggers acne), produce t10, c12 CLA.

For the purposes of their study, the researchers transferred an enzyme-encoding gene from *P. acnes* to the *Lactobacillus* strain, which subsequently produced t10, c12 CLA. The experts said *Lactobacillus* strains are commonly found in normal gut flora and probiotic products, adding that the level of t10, c12 CLA in the mice's fat tissue increased fourfold when they ingested this recombinant probiotic. Their findings showed that gut microbes affects the host metabolism, especially fat composition.

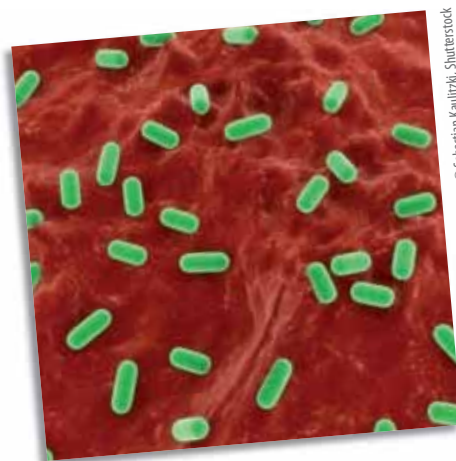
Commenting on the findings, study leader Dr Catherine Stanton from APC

and Teagasc Moorepark Food Research Centre said: 'CLA has already been shown to alleviate non-alcoholic fatty liver disease that often accompanies obesity. Therefore, increasing levels of CLA in the liver by ingestion of a probiotic strain is of therapeutic relevance. Furthermore, fat is not an inert layer around our bodies, it is active and pro-inflammatory and is a risk factor for many diseases, including cancers. The work shows that there is potential to influence this through diet-microbe-host interactions in the gut.'

The team also discovered that microbially produced CLA could lessen the viability of colon cancer cells by 92 %. 'It is possible that a CLA-producing probiotic may also be able to keep colon cancer cells in check,' Dr Stanton said. 'All our findings to date demonstrate that the metabolism of gut bacteria can modulate host cell activity in ways that are beneficial to the host,' she

added. 'We need to further investigate the effects of CLA-producing bacteria on human metabolism, but our work so far certainly opens up new possibilities for the use of probiotics for improvement of human health.'

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Unravelling the stubbornness of stomach ulcers

Stomach ulcers seem to recur because of re-infection introduced through the mouth. Key information on understanding and treating this potentially cancer-causing affliction has now come to light.

Recurrent stomach ulcers have often developed into cancer, and the exact mechanism behind this hasn't always been clear. Medicine has so far discovered the menacing bacteria involved in stomach cancer seem to reappear in the mouth area often and re-infect

the stomach in this way. Key in understanding stomach ulcers is glycosylation, a process where glycans — basically simple or complex sugars — attach themselves to proteins and lipids.

The fully-funded EU project 'Exploring the glycosylation process during infection' (Infection glycomics) is currently investigating these mechanisms in the hope of improving treatment in this area. Research has already shown that intestinal infections in mice and rats compromise glycosylation. The project is currently investigating the exact mechanism that affects the infection cycle. Ultimately, the results will shed light on the design of industrial cell culture facilities where glycosylation

can be reproduced. This will ensure the quality glycoprotein drugs, the type of medication needed to combat stomach ulcers and prevent certain types of stomach cancer. The information is crucial for the pharmaceutical industry, which can then develop more effective drugs to treat stomach ulcers and prevent stomach cancer.

An important finding of the project was the method developed to explore signalling among intestinal immune cells and how certain cells temporarily stop the protein synthesis. This result will have significant implications on understanding the mechanism for asthma and inflammation. With these findings, the project also positioned the European research community as one of the main leaders in glycomic research. Equally important, the main researchers involved in this project are now establishing a centre for glycomic research at the department for medical biochemistry in Gothenburg University, Sweden. They are hosting international workshops to establish the research policy in Europe for glycomics and glycobiology.

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Pinning down a jumping gene

EU-funded research is uncovering the workings of a jumping gene that appears to be highly active in the human genome. The findings of the 'Somatic line-1' (1) project are set to shed new light on the involvement of the jumping gene in human disease.

EU-funded research is uncovering the workings of a jumping gene that appears to be highly active in the human genome. The findings of the 'Somatic line-1' project are set to shed new light on the involvement of the jumping gene in human disease.

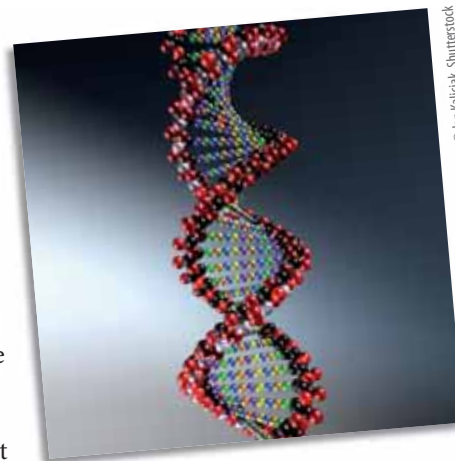
The focus of the project is a mobile stretch of deoxyribonucleic acid (DNA) called 'Long interspersed element 1', or Line-1, or even simply L1. This jumping gene is able to copy and paste itself across the genome, and it is so prolific that it is responsible for a third of the human genome. When L1 lands in the middle of a gene, it can have consequences on our health; diseases such as cancer and haemophilia have been attributed to mutations caused by L1. At the same time, many genes have incorporated L1 elements into their regulatory systems.

Among other things, Somatic line-1's investigations have revealed that L1 is active in neuronal stem cells (NSCs) which have the potential to become different kinds of nerve cell.

The researchers have also found that there are more copies of L1 jumping around in our brain cells than in other tissues taken from the same donor. This suggests that the genome of our brain is not fixed, although further research is needed to determine the biological significance of this finding.

The project partners are now studying whether L1 activity is a characteristic of somatic stem cells in general, or if it is restricted to NSCs.

Looking to the future, the project is expected to contribute to our



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understanding of the workings of L1 and its impacts on human health. Bearing in mind L1's possible involvement in certain diseases, the findings could even lead to the development of drugs to control its activity.

(1) 'Line-1 activity in somatic stem cells: impact and genomic mosaicism'.

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

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Role of GSK-3 in brain degeneration

European scientists are investigating degenerative diseases of the brain and the role played by glycogen synthase kinase 3 (GSK-3).

Alzheimer's disease and others forms of dementia take a terrible toll on sufferers who endure a range of symptoms that include confusion, mood swings and long-term memory loss. Scientists from the NEURO.GSK3 (1) project are investigating ageing and degeneration in mammalian brains by using mice models to study GSK-3.

Research into GSK-3 shows that the protein contributes to complex protein systems that control the structure, function and organisation of neurons in the brain in response to new experiences. Therefore, GSK-3 is now believed to carry out an important role in brain degeneration.

Scientists from the NEURO.GSK3 consortium are developing models for Alzheimer's disease and fronto-temporal dementia (FTD). The models are used to determine the effect of GSK-3 on the degeneration of the brain's synapses and neurones.

New insights into the brain and nervous system and the diseases that affect them can be used to develop compounds that can help regulate the activity of GSK-3 kinases. Furthermore, the work undertaken by the NEURO.GSK3 will help improve the quality of life for those individuals suffering from Alzheimer's disease and FTD.

(1) 'GSK-3 in neuronal plasticity and neurodegeneration: basic mechanisms and pre-clinical assessment'.

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

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Fruit-fly genes help demystify iron imbalance

Genetic research on fruit flies helps understand iron balance in humans. It may also help treat neurological disorders in humans as well.

Drosophila, more commonly known as the fruit fly, is a genus of insects that has been an excellent candidate for unravelling the mysteries of genes and diseases. This is due to their quick reproduction and evolution, and because they can be easily mutated. With this in mind, the Drosophila⁽¹⁾ project was funded wholly by the EU to identify new genes that shed light on iron balance (or iron homeostasis) in insects and mammals.



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After performing genetic screening for *Drosophila* with defects in iron metabolism, the project examined where ferritin — the protein that stores and releases iron — was found in the insect. It revealed that ferritin was mostly localised in the brain, parts of the intestine and around the heart. Ongoing genetic screening has also pinpointed other factors involved in ferritin regulation and important for iron metabolism. Enriching and depleting iron in the diet of these fruit flies also revealed where the ferritin is being accumulated and where it remains unchanged.

Many important discoveries have emerged from this exercise. For example, the blood brain barrier was observed to shield the brain from iron fluctuations. In addition, the project

showed how some cells dubbed ‘iron cells’ stored high levels of iron even with a normal diet.

The next step is to understand the exact relationship between ferritin regulation and iron levels in cells. Genetic tests have also been launched on measurements of iron, copper, zinc and manganese to identify novel genes that affect metal homeostasis. A surprising find was that one gene found to affect homeostasis was the same as a corresponding one in humans.

Expected final results are set to have potential impact on the treatment of neurological disease. There was also evidence that elevated zinc levels were associated with neurodegeneration. Overall, the findings are significant in how metal deficiencies result in illnesses and what cures may be developed.

(1) ‘Identification of novel iron metabolism genes by genetic screening in *Drosophila*’.

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

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Spreading the word on systems biology

The EU-funded ‘Tackling the future challenges in systems biology’ (Futuresysbio) project is spreading the word on the fledgling discipline of systems biology. The project team has already organised a successful international systems biology conference which attracted over 1 000 people from diverse sectors. Further events are planned.

For a long time, biologists tended to study the function of individual genes, proteins and components of the cell in isolation. Recent years have seen scientists start to take a ‘systems’ approach to biology. The relatively young discipline of systems biology seeks to shed light on the complex interactions between networks of genes, proteins and other molecules. This provides a more holistic, integrated understanding of life.

Systems biology is expected to have impacts in diverse areas, including medicine, where it could help doctors tailor treatments to their patients, and in bio-industries. As the Futuresysbio

team explains on its website, ‘Developing the research field and ensuring exploitation of its results is of major social and economic interest for the European Union.’

The Futuresysbio project aims to foster and structure discussions on the development of systems biology and provide guidance on the subject to scientists as well as policy makers, research funding organisations, pharmaceutical companies, biotechnology businesses, higher education institutions, the media and the general public.



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In addition to a series of high-level workshops, the project team organised the International Conference on Systems Biology (ICSB2008) in Gothenburg, Sweden. ICSB2008 was a great success, attracting over 1 000 participants from all of Futuresysbio's key target groups.

A dedicated session on systems biology funding drew representatives of EU and

national funding organisations, while another session addressed the needs of the pharmaceutical sector and bio-industries. Another workshop asked what action is needed to apply systems biology in the clinic.

Further workshops are planned, covering issues such as education and training, systems biology in healthcare, and

more. The Futuresysbio team has also teamed up with another EU-funded project, Erasysbio, to organise a workshop on strategies to organise and fund systems biology activities.

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

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Fat mice help us understand obesity

Lipids affect health in many ways, and comparing their behaviour in mice and humans reveals a wealth of information that helps combat obesity.

Understanding the role of lipids in the body is important in combating disease and promoting health. Lipids are types of molecules that have many subgroups such as fats, waxes, vitamins and other substances. They are involved in storing energy in the body and signalling different processes.

With analysis tools and new imaging techniques, it is now possible to unravel the complex network between lipids, genes and proteins. This approach is dubbed lipidomics, which is what governs the Lipidomicnet ⁽¹⁾ project.

Investigating lipid droplets (which store lipids) and how they affect health, this EU-funded project is analysing obesity and other fat-related illnesses in detail. For example, the abnormal regulation of lipid droplets in the case of obesity has been observed through liver tissue samples from different animals. The data were then compared to human tissue to determine the exact link between metabolic disorders and abnormal lipid storage, revealing interesting results. The ultimate goal is to integrate insights from mouse studies and combine them with novel findings from human studies.

Understanding how these lipids are absorbed, transported and converted into lipid droplets is also key to unravelling the mechanisms behind obesity, a common and troubling condition in today's society. This particular challenge was understood by using fluorophores (fluorescent molecules) to trace the pathways of lipids.

Overall progress within Lipidomicnet involves both generating novel data which will inform issues of human health and providing a platform to increase our understanding of lipid droplets.

Recently, the project focused on organising lipid pathways and defining a significant number of new pathways in the body. Since this information is usually hard to access and integrate, the project provides a valuable resource to researchers. In addition, substantial efforts have been devoted to tackling some of the most common bottlenecks in lipidomics bioinformatics (applying statistics and computer science to molecular biology). More valuable information for researchers and the medical community will undoubtedly emerge as the project runs its course.

(1) 'Lipid droplets as dynamic organelles of fat deposition and release: translational research towards human disease'.

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

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Watch this space!

Coming up in issue 33 of *research*eu results magazine* a special dossier on 'Blue sky' research: a funding lifeline. Why the European Union gets behind research with uncertain outcomes.

ENERGY AND TRANSPORT

The race to cheaper fuel cells

European researchers are working to develop cheaper membranes at the heart of fuel cells, an expensive component of a fast emerging technology.

Lowering costs is crucial. Scientists and economists believe that, in the long term, hydrogen fuel cells are one of the best candidates to replace fossil fuels in cars. But that is unlikely to happen as long as the technology remains expensive.

Currently, the leading technology is the 'Proton exchange membrane fuel cells' (PEMFC). It is one of the least expensive, and even though costs have dropped enormously since fuel cells were first used in earnest for the NASA Gemini programme in the 1960s the technology is still too expensive for mass manufacturing.

The PEM is at the heart of these fuel cells. It is possible to use other fuels, like diesel, but hydrogen is the most often cited. Here is how it works.

Hydrogen is the most plentiful element in the universe. Its atom (H) consists of an electron, a single proton and no neutron. The hydrogen molecule (H₂) enters the fuel cell and encounters the anode, which splits hydrogen's protons (2H⁺) from its electrons (2e⁻).

The membrane conducts positively charged ions, or protons (H⁺), but not electrons, so protons pass through the membrane and on to the cathode, but the electrons must follow an external circuit around the membrane to reach the cathode. As they travel on this circuit the electrons create a current. Once the protons and electrons reach the cathode they react with oxygen to create water.

The EU-funded 'Fuel cell membranes based on functional fluoropolymers' (Flupol) project sought to create cheaper membranes using a fluoropolymers — a fluorocarbon-based polymer with multiple strong carbon-fluorine bonds. It is a very challenging task because PEMs must fulfil a laundry list of performance targets.

Designing new material for this purpose is complex, according to Justyna Walkowiak, lead researcher on the Flupol project, because you can't focus on only one kind of property. 'They need to exhibit high protonic conductivity, no electronic conductivity, low permeability to fuel and oxidant, low water transport through diffusion and electro-osmosis, oxidative and hydrolytic stability, good mechanical properties, low cost, and the capability of fabrication into membrane electrode assemblies,' she explains.

Currently Nafion, the brand name of a membrane by DuPont, is the state-of-the-art. This is a commercially available product that is used in cars and different portable machinery and equipment.

There are other brands, too, with a similar design and all of these membranes are polymers. Polymers are a series of linked monomers, and monomers are atoms or small molecules that can form chemical bonds in long chains with other monomers.

The most common natural monomer is glucose, and it can bind with other monomers to create polymers like cellulose and starch. There are millions of polymers, both natural and synthetic.

All the currently available membranes are based on two or three related monomers, all based on fluorocarbon polymers of one sort or another. Flupol's strategy was to study fluorinated aromatic polymers.

In organic chemistry, aromatic compounds include aromatic rings in their chemical structure. These rings are formed by the way in which atoms bind to each other.

Not cheap

'What we thought is that aromatic compounds are suitable for processing after polymerisation, and this means we would be able to change the polymer properties after synthesis,' Ms Walkowiak reveals.

'We thought that it might be cheaper to change properties after polymerisation. Right now it is not that cheap, but we think there may be scope to lower those costs in the future.'

Ms Walkowiak believes that the two years assigned to the Flupol project was little time to work on such a big topic, but she believes it produced some solid results and offered some clear paths forward.

Firstly, Ms Walkowiak developed a new and cost-effective preparation method for an important class of monomers, called monofluorinated styrenic monomers. This was a good result in a challenging area.

In polymer science chemists typically will see first if a compound can self polymerise. This is called homo-polymerisation. 'If that does not work, you look at using two monomers to induce co-polymerisation,' says Ms Walkowiak.

And if that does not work, you can try termonomer induced copolymerisation (or terpolymerisation) using three monomers. One of the monomers acts as an active couple to link the other two up. You polymerise the active couple with the first monomer and then incorporate the third, to achieve the desired qualities in the final material. Ms Walkowiak's innovation was to find a terpolymerisation method for preparing monofluorinated styrenic monomers.



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Secondly, the project found a way to minimise a common problem between certain monomers and styrene, a very important compound in polymer science. Two monomers, FMST and TFMST can bind with styrene, but FMST slows down the reaction, the rate at which the materials bind. That has two costly consequences. First, it takes longer. Second, the slower reaction results in shorter chain bonds, the links between each monomer. So you get less final material because of the shorter links.

More time and less material can get very expensive, very fast with some of these materials. Ms Walkowiak found a way to blunt the slowing effect of FMST by combining it with TFMST. 'FMST still slows down the reaction, but not as much,' explains Ms Walkowiak.

Finally, the researcher developed a new controlled polymerisation methodology for polymeric materials. 'Conventional free radical polymerisation reactions, like the production of polystyrene, do tend to lack control. One effect of this lack of control is a high degree of branching. Also, as termination occurs randomly, when two chains collide, it is impossible to control the length of individual chains,' explains Ms Walkowiak. 'But using chain transfer agents, or CTAs, you can get a measure of control. The important thing is to use the proper CTAs. And my

work found the specific CTA required to produce copolymers that contain fluorinated styrene and styrene. Those particular copolymers have never been synthesised before. It is something new,' she says.

Those copolymers exhibit really interesting properties, which the researcher is not currently at liberty to discuss. 'The investigations on developing these materials are in progress and the results are promising. They could have really very interesting properties regarding the stability of the material,' she confirms.

But Ms Walkowiak will reveal that the vital step is the introduction of the fluorinated elements into the copolymers. In all, it is an impressive body of results that significantly adds to our understanding of fluorinated aromatic polymers and their potential application to fuel cell technology and there may be other, unexpected benefits as so often happens in this branch of science.

The Flupol project received funding from the Marie Curie programme of the EU's Seventh Framework Programme for research.

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Next generation of biofuel technology

The next step in biofuel technology is being developed by European scientists. The project has identified new enzymes and strains of yeast that can break down plant waste to produce ethanol.

Biofuels are made from renewable biological material known as biomass. A common form of biofuel is bioethanol, which is used around the world in transportation. The fuel is produced by the fermentation of sugars, starch or cellulose derived from plant material. Bioethanol production currently

employs first-generation technology based on sugarcane or maize.

The EU-funded NEMO ⁽¹⁾ project has been established to develop the second-generation technology which can exploit wheat straw, forestry waste or giant cane, also known as arundo. This means that important food crops such as maize are not being used for fuel production. The technology is based on the fermentation of lignocellulose, which is composed of sugars but in a form that cannot be easily utilised by microbes involved in the production of ethanol.

The researchers have used a range of techniques including genome mining, and metagenomic libraries to identify new enzymes capable of breaking down lignocellulose into fermentable sugars. The use of enzymes to break down biomass is known to produce a higher yield of sugars than conventional techniques which rely on strong acids to break down material.

New strains of yeast that can tolerate higher temperatures than strains currently used by industry have also been identified by project partners. The aim is to use the yeast strains to produce ethanol from the biomass sugars in an efficient, cost-effective, large-scale process. The project evaluates the suitability of the developed enzymes and yeast strains for industrial biofuel manufacturing.

The NEMO initiative will help promote second-generation bioethanol production through easily applicable technologies that can be fully exploited by European industry. Exploiting plant waste from agriculture and forestry, rather than agricultural crops such as maize, means important food crops are not being used to create fuel. The new technology will increase the production of biofuels from new forms of biomass and keep Europe at the forefront of the renewable energy revolution.

(1) 'Novel high-performance enzymes and micro-organisms for conversion of lignocellulosic biomass to bioethanol'.

Funded under the FP7 programme Cooperation under the theme 'Knowledge based bio-economy'.
<http://cordis.europa.eu/marketplace> > search > offers > 5940



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Fuel-food crops of the future

Increasing fossil fuel prices, rising energy demands and instability in producing regions have helped establish renewable fuels as a viable alternative. These fuels could also help meet emission reduction targets.

Bio-ethanol from Brazilian sugarcane has already shown great potential in being able to satisfy growing fuel demand while addressing the need to reduce greenhouse gas emissions. However, one limit is the fact that this method cannot be transferred to water-limited or temperate environments.

Researchers have recently been turning their attention to sweet sorghum as a potential alternative. They believe that this crop, which is highly adaptable, could produce fuel feedstock, food and feed, thereby helping to reconcile energy and food security issues.



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A five year EU-funded project entitled 'Sweet sorghum: an alternative energy crop' (Sweetfuel) was launched in 2009 with the goal of breeding improved sorghum cultivars and hybrids for temperate, tropical semi-arid and tropical acid-soil environments. Other expected project outcomes include improved sustainable practices.

The project consortium includes 10 members from Brazil, France, Germany, India, Italy, Mexico and South Africa. Research will also involve structured participation between stakeholders and policy-makers.

One initial challenge was to solve difficulties in exchanging seeds between some of the beneficiaries. Transit through quarantine services for example can often lead to delays. The first field evaluations have however been successfully conducted, and the first crossings for hybrid creation are underway.

Factors such as tolerance to cold, drought, acid soils, high production of stalk sugars and easily digestible grain, have all been taken into account. A few hybrids have already been identified for drought tolerance, and a reliable methodology for determining biomass quality has been defined. A first evaluation of

the response to drought stress in controlled conditions has highlighted the advantages of sorghum over maize.

Early investigations have also shown that an important trait in limiting sugar accumulation in sorghum is stem sink capacity. This will be confirmed through the further study of enzymatic and metabolomic traits. Metabolomics is the systematic study of unique chemical fingerprints that specific cellular processes leave behind.

Efficient communication channels within and outside the consortium have also been established through the website and through presentations of the Sweetfuel project. So far, about 30 demands have been received from parties interested in becoming associate members of the project, while a database of 1 400 contacts is now available.

With some significant work already completed, the partners involved in the Sweetfuel project are confident that bio-ethanol from sweet sorghum can be produced through the creation of materials better adapted to temperate and semi-arid regions. By the end of 2013, the project will also have established an integrated assessment to evaluate the sustainability of bio-ethanol production, taking into account ethical issues.

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

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Solar cells finally come of age

Embraced as a source of alternative energy yet criticised for their lack of efficiency, solar cells are being recreated in much better forms.

Alternative energy solutions are crucial in solving the challenges of global warming and urban pollution. Solar energy is one of these solutions which has been around for a couple of decades. However, it is not an efficient technology and there are continuous efforts in scientific and research communities to improve it.

Solar energy cells, officially known as photovoltaic cells, employ different

kinds of materials that help transform sunlight into energy. The search for the right material with ideal properties is a major challenge in perfecting this technology, and the EU holds solar energy high on its research agenda.

The Ibpower ⁽¹⁾ project plans to overcome this challenge. It is an enterprising project that has been funded mostly by the EU.

Generally, intermediate band solar cells are devised to increase energy efficiency by absorbing more sunlight. To operate, all solar cells require semiconductors — i.e. materials with specific electrical conductivity. A more recent and more powerful type of semiconductor is known as the quantum dot. The latter enhances conductivity and can be used to manufacture much better solar cells than what is currently available.

Ibpower has brought together experts from different European universities as well as from the private sector to perfect quantum-dot conductivity and develop

the ultimate solar cell. By the time the project finishes in early 2012, the team of partners is confident that it would have addressed the challenges and developed an ideal material for highly-efficient photovoltaic cells. Once this happens, exploitation of such a valuable resource, along with the expected savings, will only be a matter of time.

(1) 'Intermediate band materials and solar cells for photovoltaics with high efficiency and reduced cost'.

Funded under the FP7 specific programme
Cooperation under the theme Energy.
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Putting consumers and smart energy grids together

A major European project is looking at how the smart energy grid of the future can incorporate renewable energy and boost efficiency. The aim is to bring economic benefits for consumers and enable greater flexibility, reliability and accessibility.

Electricity distribution grids have traditionally been centrally controlled at a large scale. However, in the future smart grids there will be a growing need for more active participation in the power systems on the part of consumers as well as increasing concern about environmental and energy efficiency issues.

Whilst renewable energy technologies are available to enable individuals and small companies to become providers as well as passive consumers, current regulatory and commercial barriers can make more active participation difficult.

The EU-funded project Address (1) is working to remove these barriers and enable small commercial and domestic consumers to use active demand power systems.

The four-year project, which began in 2008 with 25 partners from 11 European countries, is developing the technical and commercial systems to enable individuals to interact in real time

with the energy grid and optimise their energy consumption.

The project team has developed four scenarios representing realistic situations across Europe on which to base the future system architecture. They then assessed the specifications needed for technical equipment, including aggregators, energy boxes and communications technologies.

Additional work has included evaluations of the benefits such a system will bring for society and participation in events throughout Europe to raise awareness of the project's aims to the public, as well as the research and business communities.

The project runs until mid-2012 and is co-funded through the European Commission's Seventh Framework Programme (FP7) for research.



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(1) 'Active distribution networks with full integration of demand and distributed energy resources'.

Funded under the FP7 specific programme Cooperation
under the theme Energy.
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Seat safety protection for older children, too

European car child safety regulations are some of the most stringent in the world. All children, under the age of three, are by law required to wear appropriately designed seat safety equipment. The same now applies to older children, but is R&D ready for it?

Recent European regulations now require appropriately designed child restraints for older children as well. But to date, designing child restraints has relied on a crash test dummy whose load and size is the equivalent of a small child.

A new crash test dummy — specifically adapted to the size of a 10-12 year-old child — is needed in order to design the best possible restraints and fittings for older children and which conform to European safety regulations.

The EU-funded project 'Enabling protection for older children' (EPOCH) is in the process of designing two such dummies. Ultimately, the three-year project aims to produce a prototype 'Q' series dummy. The researchers also plan to extend the 'New programme for the assessment of child-restraint systems' (NPACS) testing and rating protocols to include assessments of child restraints for older children. Finally, the consortium will draw up pass/fail criteria for the new constraint designs.



EPOCH, which ends in 2012, has already achieved several important milestones. For one, they have successfully identified the key injury mechanisms and the measurement capabilities in dummies representing older children. Secondly, they have established the main priorities for the body areas that need to be protected by restraint systems.

This data were used to help identify the requirements needed to create the crash test dummy. And project researchers have also managed to produce the biomechanical requirements for the dummy. With the necessary elements to design the dummy in place, including

equipment and manufacturing tools, EPOCH is now developing two prototypes.

More work is needed to fully understand the implications of submarining and seat belt design on older children. Submarining is the term given to define the tendency of the body to slide out underneath the seat-belt during a collision.

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

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Planning better road maintenance reduces delays

A properly maintained road system is crucial to the EU's economic success. A European project was set up to improve the efficiency and safety of the European network by collating data that enables the best decisions to be made regarding maintenance.

Safety around road works has been improved for both maintenance staff and drivers thanks to the EU-funded 'Fully optimised road maintenance' (Format) project. The research also addressed the challenge of how to ease the delays associated with road works and the ensuing costs to road users as they attempt to negotiate these areas.

The Format consortium developed an integrated cost-benefit analysis model that addresses key aspects of road maintenance, such as the cost to the

user. Safety strategies were developed for arranging the layout and timing of maintenance operations in order to minimise the danger to road users and workers alike. Project partners also came up with procedures and equipment for monitoring the condition of roads to reduce the number closures required.

Researchers have produced a list of maintenance techniques used in individual Member States. Accelerated

loading tests (ALT) and real load tests (RLT) have been used to trial innovative road treatment techniques for a range of climatic conditions, materials and construction methods. Pilot trials on public roads were conducted to determine how easily these new methods could be implemented.

Road-user costs resulting from delays caused by road works were determined with the aid of mathematical models. Environmental costs, in terms of noise pollution and fuel emissions, were also calculated. Project partners collated accident data from 15 countries to determine the effect of road closures on accident rates. Driving simulators were used to investigate the effect of new traffic management arrangements at work sites on different types of highways. And equipment for measuring the condition of the road itself was assessed on public highways and included the application of ground penetrating radar.

The Format project enabled the planning and repair process for Europe's roads to be optimised through a set of fully integrated maintenance procedures, making the driving experience in Europe a smoother experience.

Funded under the FP5 programme 'Growth'.

(Competitive and sustainable growth).

Collaboration sought: further research or development support.

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Getting to grips with skid resistance

Road safety could be improved if more is known about the interaction between roads and tyres. Comparative research on skidding resistance in EU countries has helped to raise awareness of the need to optimise road surfaces to reduce accidents.

Advances in tyre technology and braking systems have helped to reduce accidents and near-accident in Europe. But awareness of how the interaction between road surfaces and tyres impact on accidents was lacking in the EU. In countries where so-called 'skidding resistance' is taken into consideration in road building and safety policies, such as in the UK, lower accident rates were recorded.

The EU-funded project Tyrosafe ⁽¹⁾ set out to raise awareness of this issue and harmonise efforts to deal with it across the Union.

To get the best understanding of the skidding effect, the project had to investigate different road surfaces and tyre technologies and on the interaction between the road surface and tyres. Noise pollution and CO2 emissions

were also factored into the equation by the team, including partners from Belgium, Germany, France, the Netherlands, Austria, Slovenia and the UK.

The two-year project summarised the current state of scientific understanding and its application towards national and European standards. It proposed a way forward for administrations to optimise three key properties of European roads: skid resistance, rolling resistance and tyre/road noise emission. The project also created a solid scientific background for further research and to help stakeholders develop harmonised policies for essential road surface properties.

Common and compatible road surface assessment in Europe will lead to better road safety, less accidents, and lower CO2 and noise emissions from road traffic, suggest the Tyrosafe team. This stands to benefit the European economy and the general public relying on road transport as an efficient, safe and ecologically sustainable transportation option.

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

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

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Safer surface movement at Europe's airports

Air traffic management can suffer from a limitation on the throughput of traffic due to a lack of sufficient technical support from ground control systems. As a result the EU has funded initiatives for enhancing European airspace and air traffic management.

The Intervuse ⁽¹⁾ project was established to develop a new cost-effective surface movement ground control system (SMGCS) that can fill in the gaps that exist in the SMGC technology developed so far. Millions of euros are required for an SMGCS because of the expensive sensors that they use.

Furthermore, expensive infrastructure restricts the numbers of users who can afford the technology and puts it out of the reach of smaller airports. The result has been incomplete surveillance of surface movement of aircraft due to a lack of passive sensors that can monitor unsupervised blind spots at airports, such as hidden yards and taxiways.

The project has provided smaller airports with a low-cost SMGCS solution, which uses passive video sensors combined with surveillance radar and flight plan data. In addition, the problem of blind spots in large-scale SMGCSs can be reduced or even removed altogether through the use of these sensors.

Tests conducted at Thessaloniki and Mannheim airports have shown that video cameras can make a useful contribution to airport surveillance. Furthermore, the technology developed by the Intervuse consortium can fulfil most of the requirements of surface movement radar (SMR). The system has a number of distinct advantages, which include

the absence of radiation, lower cost and a higher rate of update.

The main benefit derived from the Intervuse project is enhanced airspace and traffic management infrastructure throughout the EU, thereby increasing safety. The work will also help the European aviation sector to become more competitive.

(1) 'Integrated radar, flight plan and digital video data fusion for SMGCS'.

Funded under the FP5 programme IST (User-friendly information society).

Collaboration sought: further research or development support.
<http://cordis.europa.eu/marketplace> > search > offers > 5934



Mysterious case of the collapsing bee colonies

European researchers are creating a cheap and effective test that will help identify one of the major suspects of sudden beehive deaths, which pose a huge threat to European and world agriculture, ecosystems and economies.

Honeybees are extremely important to the economy of European agriculture and are worth billions of euros, as honey producers and crop pollinators. Pollination is also of considerable importance to the environment. In fact, the action of bees on the environment is literally priceless. Bees pollinate about 50 % of all plants so half of our ecology depends on the action of bees for its propagation.

Europe is the world's second largest producer of honey. Small producers dominate the sector but there are 600 000 of them spread across the continent. However, in recent years the survival of the European honeybee has been seriously compromised due to 'depopulation syndrome', which is causing an alarming number of deaths of honeybee colonies all over Europe, and across the world.

From the year 2000 honeybees began strangely disappearing from their hives, and strong colonies suddenly became weak, ultimately dying. Since 2006, the mysterious disappearances have become more and more common.

North American beekeepers noted with alarm that hundreds of bee colonies were succumbing. In Northern Ireland a comprehensive survey revealed that as much as 50 % of the region's hives had collapsed. The phenomenon became so widespread, so frequent and so urgent that it acquired a new name: colony collapse disorder (CCD).

While the exact cause remains unconfirmed, recent studies strongly suggest that a new emergent pathogen from the *Nosema* family is linked to CCD. *Nosema apis* is a well-known parasite common in European honeybees. It is pandemic, but it is not associated with high mortality, though its effects can be costly, because infected workers, drones and queen bees become weak and have a shorter life span. The fast appearance of symptoms results in an equally early intervention and treatment.

In 2008 a study showed that another very similar parasite associated with the Asian honeybees, *Nosema ceranae*, had jumped host to the European honeybee. This pathogen arrived from

Asia to Europe, America and most of the world through the international bee trade.

Nosema ceranae is extremely aggressive to the European honeybee. Moreover, very often there are no symptoms indicating infection before the colony reaches collapse, which means there is no rapid treatment and control of the disease.

'But while the spread of pathogen *Nosema ceranae* seems to be linked to bee depopulation episodes, there are currently no diagnostic tests for this species adapted to the requirements of beekeepers,' explains Irene Gonzalez of the Centre for Research and Investigation of Catalonia (CRIC) in Barcelona, Spain, lead researcher and coordinator of the Cleanhive (1) project.

'Consequently, there is an urgent need to develop methods to help beekeepers detect this virulent pathogen, to control its spread and reduce its dramatic economic impact on the beekeeping sector,' she adds.

Cleanhive is a major effort to combat CCD. The consortium has 13 partners, with three focusing on research and technological development (RTD), including a specialist in colony collapse. The other partners are four beekeeping associations and six SMEs, three of which specialise on the technology side.

Low-cost, fast and accurate

Cleanhive is developing a low-cost, fast and accurate diagnostic kit to inform beekeepers if the pathogen is present using a combination of low-cost, reliable technologies, a lateral flow assay (LFA) and an optical reader. A lateral flow assay is similar to a pregnancy test. The LFA uses capillary action to draw the sample into a dipstick. The sample reacts with chemicals in the dipstick to give a reading.

The optical reader is to provide a portable and accurate interpretation of the assay results. The combination unites the specificity and robustness of lateral flow tests with the sensitivity and data management that optical readers can achieve. In the Cleanhive model, the beekeeper places 25 bees into a plastic bag and processes them using a roller to make the sample. This sample is put in the LFA where two antibodies will react, one for each species of *Nosema* spore.

'The Cleanhive diagnostic assay will not only allow the control of the spread of *Nosema*, but also will ensure the continuity of the beekeeping sector and the benefits of pollination to the European economy,' remarks Ms Gonzalez.

Cleanhive is an enormous boost to European efforts to combat CCD, not least because beekeepers across the world urgently need an effective solution to the scourge. It is an important goal, but one that comes with a number of highly technical challenges. A thorough study of the market showed that there



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were no commercial *Nosema* antibodies available, so Cleanhive researchers launched their own antibody research and developed antibodies that react to the target species, *Nosema apis* and *Nosema ceranae*.

Both pathogens are difficult to differentiate with conventional methods, such as visual inspection or microscope examination, due to their very similar morphology. Other highly sensitive methods like polymerase chain reaction (PCR) or restriction fragment length polymorphism (RFLP), two common lab tests for species identification, are not appropriate for in-field diagnosis.

Cleanhive, which is funded to the tune of EUR 2.5 million (out of a total of EUR 3.29 million) by the European Commission is well into its three-year programme. The group has completed a market survey polling 1 300 stakeholders to identify the market needs for a *Nosema* identification kit. The team has also

developed and characterised a panel of *Nosema* antibodies, a sample treatment protocol adapted to field conditions, and has designed and developed an optical reader, which will be fully validated by spring 2011.

Dissemination is another important component of Cleanhive's work. The project has developed a website, created educational materials to inform people about their work, etc. The beekeeping associations taking part in the consortium are keen to have the resulting technology deployed throughout Europe. They are the initial owners of the project's intellectual property and will ensure the technology is deployed to their members as quickly as possible.

(1) 'Detecting the pathogen that threatens European honey bees'.

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Green homes don't translate to sales success

Results from new EU-funded research show that home buyers are unwilling to buy new, energy-efficient houses. Poor communication between builders and buyers is a big part of the problem, say experts studying the behavioural barriers to better and broader acceptance of renewable energy. The project results are part of the 'Create acceptance' (1) and 'Changing behaviour' (2) projects, which received EUR 3.83 million in total EU funding.

The housing sector currently accounts for 40 % of Europe's energy needs. The lack of energy conservation in this sector is believed to be partly due to energy prices and voluntary regulatory measures.

Both European research initiatives support the need for change in energy use and services across consumer and industrial groups, and are headed by Finnish institutes working in collaboration with a number of researchers from Europe and abroad.

Together, the experts studied the so-called 'sticky information' problem inherent in a project that aimed to promote low-energy technologies used in sustainable housing. Sticky information refers to the way that the knowledge of energy-efficiency experts and that of potential buyers remains 'stuck' in their respective worlds, indicating poor communication flow and exchange.

As part of this project, a competition was organised that invited housing manufacturers to produce energy-efficient homes. Potential buyers were also

involved in stages of the competition and included as members of the competition jury. As a result, 10 competitors received the 'green label' branding that both acknowledged the energy conservation efforts and aimed to inspire greater purchasing power.

Despite some success with raising general awareness of energy conservation and services provided by the technologies, house sales generated by the competition were disappointingly low. Some buyers wanted to make modifications that would render the houses no longer energy-efficient. Other buyers did not trust the information supplied to them or simply remained unconvinced of the urgency to conserve energy.

For the Create acceptance and Changing behaviour researchers, the project fell short of the mark because of poor communication between the housing manufacturers and the buyers themselves. For instance, the team believes the builders did not adequately address the diversity of potential buyers, the buyer's willingness



to participate in the process and be informed, and their desire to tailor the houses to suit their own personal needs.

Looking forward, the researchers recommend greater use of participation methods to improve communication, such as consumer research and focus groups, and by exploring the concept of co-design with buyers. Importantly, these methods would need to be adapted to suit the needs of both manufacturers and buyers and not compromise the overarching goal of low-energy, sustainable housing.

They also point to the option of regulatory instruments on new energy standards, such as building codes, if voluntary strategies fail to work. These would need to be developed in synch with communication strategies to maximise their potential. Beyond regulatory measures as a way to stimulate energy efficient practices, the experts say government bodies could play a greater role by improving the flow of information.



The Create acceptance project brought together experts from Finland, France, Germany, Hungary, Iceland, the Netherlands, Poland, South Africa, Spain and the UK.

The project is complemented by the more recent project Changing behaviour. The Changing behaviour partners are from Germany, Estonia, Greece,

Latvia, Lithuania, Hungary, the Netherlands, Finland and the UK.

(1) 'Cultural influences on renewable energy acceptance and tools for the development of communication strategies to promote acceptance among key actor groups'.

Funded under the FP6 programme Sustdev (Sustainable development, global change and ecosystems).

(2) 'Contextualising behavioural change in energy programmes involving intermediaries and policymaking organizations working towards changing behaviour'.

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

Promoted through the Research Information Centre. <http://ec.europa.eu/research/infocentre> > search > 16353

Beyond the numbers — the why and how of migration

International migration between sub-Saharan Africa and Europe could potentially influence the demographics of society. Numerous reasons have been pronounced to explain the causes of migration and circulation. But surprisingly, there is little empirical evidence in Europe — especially on African migration — to support the theories behind the phenomenon, according to one EU-funded project.



The stories and images of migrants arriving on the coastline of the Canary Islands or those that make dangerous and often perilous journeys across vast expanses of desert are both haunting and lamentable. Every day, people both young and old risk their lives for a better future. Others make their journey legally — either to study or to work. But taken together, migration cannot be solely understood as a one-way movement to Europe. Indeed, many migrants return to their countries of origin — often voluntarily.

But the lack of comprehensive knowledge supported by dedicated research and reliable data means policy-makers in Europe and Africa may be ill-equipped to make decisions that could affect tens of thousands. Why do people migrate? Why do they return to home? And what are the consequences of migration for source and destination countries? The hard evidence to answer these difficult questions is practically non-existent, especially regarding African migration, while this migration appears as a major concern for European policy-makers. Until now that is.

The EU-funded 'Migrations between Africa and Europe' (MAFE) project has collected a unique set of data on the characteristics and behaviour of migrants from the Democratic Republic of Congo, Ghana, and Senegal. The countries

represent three of the four largest sub-Saharan populations in Europe. It is also believed that over a quarter of all African migrants to Europe are sub-Saharan. Therefore, research was also conducted in the Member States where most sub-Saharan African migrants settle — Belgium, Spain, France, Italy, Netherlands, and the UK.

Data challenges common migration perceptions

Official data on migration in Europe does not really explain the causes and consequences of migration according to the researchers. MAFE, a consortium of nine academic institutions led by the Institut National d'Etudes Demographiques (INED), points out that the research conducted by previous studies, while valuable, cannot capture all dimensions of migration because they usually neglect the flow of migrants from Europe to Africa.

'Generally speaking, current migration data on Africa and Europe is not very satisfactory. What makes our data unique is that we look at both the origin and destination country,' says Cris Beauchemin, MAFE project coordinator.

And so far, MAFE results appear to challenge some common perceptions

on migration. Though MAFE is still a work in progress, the researchers have managed to finalise the data collection on Senegalese migration. Official data sets on migrants in Europe only display the number of Senegalese who actually enter Europe, not the number of those who leave Europe. Mr Beauchemin explains that a good percentage of Senegalese migrants who come to Europe eventually return home voluntarily.

'Ten years after their first departure, around one-third of the migrants from Senegal return home,' says Mr Beauchemin. 'It is important to know that African migration is not only an in-flow. Europe needs to expand how it views migration to include out-migration.' Those who return are not just those who are encouraged or forced to leave Europe. Indeed, most return on their own will and do so spontaneously.

The research also has implications for policy making in matter of family reunification. MAFE researchers believe that a common European perception is that families systematically and rapidly follow the pioneer migrants. On the contrary, their initial results suggest that being alone is often long term, furthermore, results also suggest that reunification does not occur only in Europe but also quite often in the country of origin.

Migration revealed

But one set of data is not enough to get the whole picture. MAFE has completed its field work and data collection. The team's objective now is to generate a comparative data set that will help policy makers and researchers find trends. 'A major objective of the MAFE project is to build samples that allow comparable analyses between various countries in order to disentangle national specificities and general processes,' write the researchers.

Understanding the 'whys and hows' of migration takes extensive field research. The team is in the process of uncovering several key elements. They have now identified some of the typical characteristics of migrants, including age, education level, marital status and gender. They will also be able to trace migration routes to Europe and demonstrate how they evolved in parallel to policies currently in place.

The initial results on Senegalese and Congolese migration have shown that two separate migration models exist;

one for Europe and another for Africa. Migration to western countries is highly selective by education unlike migration that occurs inside Africa. Also, they found that return migrants in Dakar are more often self-employed than non-migrants. Another interesting result is that males who are employed and are a close relative to the head of household are more likely to send remittances. 'Altruism appears to be an important motive for remittances,' write the researchers.

Getting the facts for better policy

Collecting the data was an exercise that required cultural sensitivity and ease of approach. MAFE wanted to get data from both documented and undocumented migrants in Europe and in Africa. Migration is a sensitive issue and requires creating a climate of confidence during field research, says Mr Beauchemin. For instance, in Senegal and France, they achieved the mutual trust by working alongside Enda Tiers-Monde, a well-known and well-respected NGO.

But they also trained an extensive team of 130 people to collect data. These individuals spent 11 months in the field and were able to randomly sample over a thousand households and people in each African country. They also selected 420 Congolese, 420 Ghanaians, and 600 Senegalese in Europe. In total, they spoke to about 5 000 individuals, aged between 25 and 75, ensuring a gender balance.

Once the comparative data base is in place, MAFE is hoping policy makers will be better equipped and informed to make decisions. 'We collected structured life histories that help us understand migrants' trajectories,' explains Mr Beauchemin, adding that in the near future MAFE hopes 'to influence the way we define our [migration] policies.'

(1)'Integration and enhancement of key existing European deep-ocean observatories'.

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Thinking globally, acting locally

Rising raw material and energy costs together with environmental concerns have focused attention on how the global food industry operates. EU-funded researchers have taken a global look at the issues.

The global food chain is under scrutiny. And local producers are gaining favour in many local markets, because they result in less 'food miles' and CO₂ emissions from transporting produce around the world.

A recently completed EU-funded project pulled together a number of interested parties to identify future research topics on alternative agro-food networks (AAFNs). The 'Facilitating alternative agro-food networks' (FAAN) project, launched in 2008, drew together five academic institutions and five civil society partners from five EU Member States that deal with alternative agriculture and rural development.

The project set out to examine a number of issues relating to AAFNs, and most specifically to local food systems. Topics covered included how current policies facilitate or impede the development of AAFNs, how alternatives may be

complementary or oppositional to conventional agro-food networks and how AAFNs contribute to regional development.

Another goal of the project was to see if policies needed to be changed in order to strengthen local food systems in the future, and to test how the cooperative research approach used in the project actually worked in practice.

Each of the five national teams participating in the project — England, France, Hungary, Austria and Poland — comprised an academic institution and a civil society organisation. Each national team carried out two case studies on the development of local food systems. The results were then brought together, and their implications for policy and practice at EU, national and regional levels assessed.



The FAAN project succeeded on a number of points. It provided evidence to support recommendations on how policies could strengthen local food systems in the future. Such changes include support for setting up cooperative networks and infrastructure; knowledge exchange; more local sourcing in public procurement; more appropriate funding; and more flexible adaptation of over-burdensome legal regulations.

FAAN also helped to shed light on how a European-level cooperative research approach works in practice. The entire project was carried out through the



close cooperation of academics and civil society organisations, and also with participatory research through the involvement of other relevant stakeholders at certain stages of the project.

Participants concluded that for the cooperative research process to succeed, mutual understanding was vital.

They also concluded that cooperative research was a useful approach for designing research more relevant to practitioners and policy issues. Civil society partners, for example, are able to promote the uptake of research findings through their stakeholder networks and so better reach policy circles.

Environmental networking gets an important boost

Attracting projects with high environmental potential is important for both the European economy and for climate change. The necessary network to achieve this is now in place.

Ever since the EU was born, research and technology partnerships among its nations have been a major feature. Since its launch, the EU's successive Framework Programmes have played a key role in funding multidisciplinary research and cooperation on the continent and beyond. The current Seventh Framework Programme (FP7), like its predecessors, is an important source of funding for innovative projects in many fields from nanotechnology and environment to culture and ICT.

Coordinating all these activities — including partnerships with countries

beyond Europe's borders — are organisations known as National Contact Points (NCPs). These organisations provide technical support and information to potential participants in these programmes.

All over Europe and in many parts of the world, there are different NCPs related to different fields. The ENV-NCP-TOGETHER ⁽¹⁾ project, an EU-funded endeavour, groups together Environment NCPs from EU Member States and Associated States. Its main goal is to improve the services offered to potential proposers of

The project results are available in a booklet which targets people who are already involved in local food systems, policy-makers, public institutions and others who wish to learn more.

Funded under the FP7 specific programme Cooperation
under the theme 'Science in society.'

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environment-based calls and to support the integration of environment NCPs from the countries involved.

The project is strengthening cooperation between NCPs from EU Member States by promoting transnational cooperation. It is also reinforcing international cooperation with NCPs from other countries, particularly those that match projects or calls under FP7. Ultimately, this is set to increase the number and improve the quality of project proposals submitted to FP7 calls.

The network project has made commendable progress in reaching its goals. To illustrate, the project has increased knowledge and expertise that NCPs offer through different kinds of trainings. ENV-NCP-TOGETHER has also created a better set of tools to assess project proposals and has encouraged entry into project consortia through fairs or 'brokerage events'. Relations with countries beyond the EU have intensified thanks to the project's initiatives, such as a database of Indian research partners related to the environment.

ENV-NCP-TOGETHER is strengthening cooperation between NCPs across Europe through new, more effective communication tools. It is extending its services to attract more project proposals under FP7, focusing as well on non-EU NCPs. The improved network of NCPs will undoubtedly strengthen the EU in its research endeavours globally and encourage its stewardship for a better world. This holds particularly true since the upgraded NCP network has its focus on environmental initiatives that will benefit all the nations involved.

(1) 'Environment NCPs cooperating to improve their effectiveness'.

Funded under the FP7 specific programme
under the theme Environment.

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Safer food surfaces

Stringent regulation and growing consumer concern mean that the prevention and eradication of microbial contamination across the food supply chain is now of the highest priority.

It is vital that all surfaces which come in contact with food and foodstuffs are free of potentially hazardous micro-organisms. Researchers have found that compared to conventional anti-microbial agents, polymeric biocide materials applied to surfaces have the advantages of being non-volatile, chemically stable and do not release degradation products into the environment.



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An EU-funded project Biosurf ⁽¹⁾ is underway to develop amino-functionalised norbornene polymers that can be used to develop biocide anti-microbial surfaces for different food industry applications. The project is also developing a means of monitoring the efficiency of these surfaces.

The consortium initially focused on assessing and specifying the microbial characteristics typical in food processing plants. A comprehensive research analysis was carried out, and a questionnaire distributed to end-users. Samples were also analysed in order to determine on-site conditions. This all helped to identify exactly which bacteria to target.

Different amino-functionalised polymers were then synthesised, and their anti-microbial effectiveness tested. Some polymers were spin-coated onto glass substrates, or blended into a polyethylene matrix. Stainless steel plates were also coated with a mixture of Ni-P-PTFE.

The best performing polymers are undergoing further assessment. A combined approach could lead to even more improved anti-microbial

activity, and preparations to produce such hybrid materials are ongoing.

The development and testing of monitoring tools for end-users has also been addressed. Basic parameters have been discussed, and software is being programmed. Additionally, four target bacteria have formed the basis for the development of the tailor-made polymerase chain reaction (PCR) system, which will be used for detecting and identifying bacterial species during further laboratory tests in the pilot plant.

It is expected that effective anti-microbial and anti-deposit surfaces and coatings will improve hygiene and food safety in food plants. This will minimise potential downtimes and provide cost benefits.

Also, by minimising cleaning and disinfection processes, the possibility of consuming partially hazardous chemicals will be decreased. The benefits of this project, due for completion in 2011 are therefore not only for end-users but also consumers.

A project website has been established to raise awareness and interest in the project's results.

(1) 'Development and implementation of a contact biocide polymer for its application as antimicrobial and anti-deposit surfaces in the food industry'.

Funded under the FP7 programme Capacities under the theme 'Research for the benefit of SMEs'.
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Keeping a close eye on ocean circulation

Forecasting how important ocean circulations will evolve in the future requires knowledge of how they have behaved in the past. A new model named for the god of thunder in Norse mythology could provide the answer.

Thermohaline circulation (THC) is often referred to as the ocean conveyor belt since large volumes of water are transferred between different regions. In fact, the THC helps moderate Europe's climate since it brings relatively warm water to its shores from the equator.

There is concern that climate change may impact the THC, possibly even shutting it down. The consequences for Europe could be dire. For this reason,

significant EU funding has been set aside for the 'Thermohaline overturning — at risk?' (THOR) project, which aims to closely monitor the status of the THC.

Sensors have been put in place at various sites in the Atlantic Ocean to monitor salinity, temperature and several other parameters. Historical data concerning the strength of the THC is being reconstructed from clues in sediment cores extracted from the ocean

floor. The THOR team is not starting from scratch as data from relevant earlier European-funded projects has been incorporated.

Computer models are also playing a central role in THOR's approach to the THC. The models not only address the oceans themselves, but also the atmosphere and cryosphere since winds and melting ice directly affect the THC. In fact, a new combined model also called THOR has been developed during the project.

The models have been run 1 000 years into the past in order to better understand the natural variability of the THC. It was determined that model



performance was more dependent on oceanic than on atmospheric data. Sensitivity tests have indicated relatively good agreement between the models and observations.

This bodes well since the models are to be applied to future settings to predict the potential impact of global warming on this important circulation. The

possibility of establishing a watchdog to continuously monitor the status of the THC is also being investigated.

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Can Europe produce rubber like Brazil?

Vast amounts of rubber come from Brazil, but with increasing manmade and natural threats to production it is important to come up with alternatives. The answer might be right here in Europe.

Derived mostly from the *Hevea brasiliensis* rubber tree, natural rubber is essential to industry, medicine, transportation and defence. Increased worldwide demand for natural rubber and latex, however, is prompting the EU to look at other natural sources. Essential risks to natural rubber production in Southeast Asia such as plant disease, socioeconomic challenges and climate change are also prompting the drive for alternatives.

To address this challenge, the EU-pearls (¹) network was established, bringing together stakeholders involved in developing alternatives. The project is focusing on two other crops that supply rubber and latex: *Parthenium argentatum* (guayule) and *Taraxacum koksaghyz* (Russian dandelion). It is developing and collecting seeds, as well as studying the biochemistry, genetics, breeding and processing of the crops.



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Through conventional breeding, genes involved in rubber biosynthesis are being mapped to generate plants with commercially viable rubber yields. Efficient growth and rubber production of these plants will then be tested in the field under different climatic conditions in Europe. Specific prototypes — e.g. rubber gloves and tyres — will then be produced to evaluate the viability of the new crops. In short, the project aims at setting up a production chain for natural latex and rubber in temperate crops in Europe. An elaborate database of rubber biosynthesis in the new plants has already been developed.

Headway has been made in genetic breeding to improve the properties of the plants. Ideal areas in Europe for growing guayule have also been mapped out, taking into consideration soil suitability and climatic conditions. Furthermore, successful field trials were achieved in Spain and France. Methods for extracting and measuring rubber and resin content in guayule is also under development.

Russian dandelion has also seen success in a European context. Molecular analysis has shown that rubber concentrations in the varieties derived were comparable to rubber produced by *Hevea brasiliensis*. The first greenhouse, field and fertilisation trials are already under way. In addition, over 2 500 experimental crosses were made between *Taraxacum koksaghyz* and other *Taraxacum* species.

Aside from crop growth, EU-pearls has also investigated extraction of rubber, application testing and development of products. Work has focused on latex and rubber extraction techniques, as well as the design of extraction facilities. Also,

the use of by-products from both crops is being seen as a way to increase production feasibility. For example, some of the by-products can be used in cattle feed, while remaining resins can be exploited for the production of biofuels and chemicals.

Lastly, the project website (www.eu-pearls.eu) was set up to disseminate information and studies on several aspects of these crops such as bio-refining and socio-economic considerations. Thanks to European innovation, the continent is on track to becoming an important rubber producer.

(1) 'EU-based production and exploitation of alternative rubber and latex sources'.

Funded under the FP7 programme Cooperation under the theme 'Knowledge based bio-economy'.
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Magnets and ultrasound to sort plastics from waste

Separating and recycling plastics from construction debris, electronic equipment, household waste and automotive shredder residue could help reduce Europe's dependency on some raw material resources.

Every year, the European consumption of plastics increases. At the same time, polymer resources found in complex wastes are largely unused and are either buried or burned. Complex wastes include the aforementioned examples.

The techniques and technology used to separate and melt the plastics from demolition sites, for example, have yet to be honed into a viable solution. Producing high-purity polyolefin — a polymer used in a wide range of products — from such sites at acceptable costs remains elusive.

But one-EU funded project, W2plastics⁽¹⁾, has found a novel technique using innovative technology to separate the debris from the plastics. The 48-month project, set to end in 2012, has already produced some promising results. W2plastics is developing a cost-effective and clean technology based on magnetic density separation (MDS) and ultrasound process control to recover high-purity polyolefins from complex wastes. According to the project researchers, Europe currently only recycles 1 million out of 14 million tonnes of polyolefin sold annually throughout the EU.

Some waste sources for polyolefins are better than others. It was previously thought that electric and electronic equipment was the most valuable source for polyolefin. But the W2plastics researchers discovered that construction and demolition sites could

potentially obtain a much higher polyolefin yield.

Researchers also discovered that the compatibility of secondary polyolefins extracted from waste not only depends on quality but also on their melt flow index (MFI). Finding a constant MFI is vital and 'was listed as one of the most important criteria by plastic industry companies in the market analysis on the use of secondary plastics carried out within the project,' write the researchers.

The process is as intriguing as it is innovative. Complex waste is poured into a liquid that is magnetised. Researchers developed a tool that both detects and controls the magnetised liquid. Certain debris then floats to the top.

This is known as a sink-float separation. Researchers discovered that a 'good wettability of polymers' is essential for high-accuracy sink-float separation because the grade and recovery are influenced by even a small percentage of air bubbles. Ultrasound is then used to correctly identify polyolefin before it is extracted.

Since the project began, W2plastics has organised a seminar, published 22 articles in journals and conference proceedings, and produced tangible results. Reusing waste, no matter how difficult to extract, is a challenge that will help Europe meet its 2020 objective to become more sustainable. And W2plastics is helping Europe make it happen.

(1) 'Magnetic sorting and ultrasound sensor technologies for production of high purity secondary polyolefins from waste'.

Funded under the FP7 specific programme Cooperation under the theme Environment.
<http://cordis.europa.eu/marketplace> > search > offers > 5916





EU scientists prove robots can learn to 'think'

EU-funded scientists have tested a groundbreaking theory that sees robots learning to 'think' about the actions they can perform on an object. The upshot is that robots can teach themselves by learning from their observations and experiences.

This latest development is an outcome of the 'Perception, action and cognition through learning of object-action complexes' (Paco-plus) project, funded under the 'Information society technologies' (IST) thematic area of the EU's Sixth Framework Programme (FP6) to the tune of EUR 6.9 million.

The Paco-plus project partners sought to test the so-called 'object-action complexes' (OACs) theory. OACs are units of 'thinking-by-doing' and this approach designs software and hardware that allows a robot to think about objects in terms of the actions that can be performed. For example, if a robot sees an object with a handle, the robot could grasp it. If it has an opening, the robot can potentially fit something into the opening or fill it with liquid. If it has a lid or a door, the robot can potentially open it. Objects therefore gain their significance by the range of possible actions a robot can execute upon them.

This opens up a much more interesting way for robots to think autonomously, because it fosters the possibility of emergent behaviour, complex behaviours which arise spontaneously because of quite simple rules, according to the partners. The team's approach in many ways imitated the learning processes of young infants. As they encounter a new object, infants will try to grasp it, eat it, or bang it against something else, and as they slowly learn from trial and error that, for

example, a round peg will fit into a round hole, their range of actions expands. A child's understanding also improves from watching other people.

Paco-plus conducted most of its work with humanoid robots — robots shaped like people. 'Humanoid robots are artificial embodiments with complex and rich perceptual and motor capabilities, which make them... the most suitable experimental platform to study cognition and cognitive information-processing,' explained Dr Tamim Asfour from the Humanoids Research Group at the Institute for Anthropomatics at Karlsruhe Institute of Technology (KIT) in Germany, and co-coordinator of the Paco-plus project.

He said the group's work followed on the work carried out by Rodney Brooks, a leading robotics professor now based at the Massachusetts Institute of Technology (MIT) in the US. Dr Asfour explained that Professor Brooks 'was the first to explicitly state that cognition is a function of our perceptions and our ability to interact with our environment. In other words, cognition arises from our embodied and situated presence in the environment.'

Prof. Brooks believed that moving and interacting with the environment were the difficult problems in biological evolution, and that once a species achieved that, it was relatively easy to evolve the high-level symbolic reasoning of abstract thought, according to Dr Asfour. The reverse approach is taken by artificial intelligence, which believes if you develop enough intelligence, machine thought will be able to perceive and solve problems, he added.

The jury is still out on who is right, and the researchers admitted that while progress has been made, there is still no genuine intelligent robot candidates on the scene. 'That Hollywood interpretation is still a ways off, but the applications and demonstrators built by Paco-plus show that we are now, perhaps, on the right track,' the team said.

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Robot gives a helping hand in surgery

A robot assistant has been developed that can conduct a range of surgical procedures.

The 'Accurate robot assistant' (Accurobas) initiative has developed a lightweight robotic system that supports different levels of autonomy for accurately conducting surgical procedures with human interaction.

The European project has focused on adaptive control through a series of

sensors that communicate with one another to increase the systems' accuracy. Project partners have developed a robot arm that possesses a complex sensor system and its control system which is capable of conducting a range of complex surgical procedures.

The device is based on open modular system architecture. The configuration ranges from one arm for open surgery to at least three arms for conducting minimally invasive robotic surgery (MIRS). Because the robot is light it can be mounted or removed by the operator with minimum effort during an operation. Researchers have designed a device known as an 'end effector', which is fitted to the end of the robot arm. Tools such as the laser scalpel can then be attached to the device.

Marker spheres were attached to the end effector of the robot to measure its actual position with the optical

tracking system. The end effector comprised a colour camera, a scan-head, a flange for the mirror arm and a laser sensor for determining distance. An algorithm was developed to enable the optical tracking system to track the prototype laser by enabling the robot to move to different positions and then remember the location.

To demonstrate the effectiveness of the Accurobas system, two scenarios were selected: laser osteotomy and palpation. Osteotomy involves the shortening, lengthening or changing the alignment of bone and uses a pulsed CO2 laser. Palpation involves a physical examination of the patient where an object is felt to determine its size, shape, firmness and position.

A cost-effective and reliable surgical robot developed under Accurobas will help perform faster and better operations and can be controlled by human operators in the same room or a different hospital altogether. The overall result promises better health care for Europe's citizens.

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

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Home help robot will give the elderly independence

A new EU-funded project will build an intelligent robot that operates in a 'smart home' to help elderly people secure a better quality of life and allow them to live independently for as long as possible.

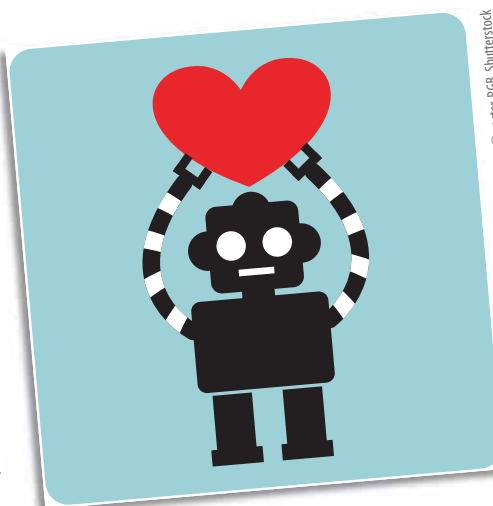
The 'Knowledge service robots for ageing' (KSERA) project has a total budget of EUR 4 million, EUR 2.9 million of which comes from the 'Information and communications technologies' (ICT) theme of the EU's Seventh Framework Programme (FP7).

KSERA got underway in February 2010 and will run for three years. The project is coordinated by the Department of Engineering and Innovation Sciences at the Eindhoven University of Technology (TU/e) in the Netherlands and brings together seven partners from five EU countries.

The team says that the robot will be a 'sensible family friend' that will help elderly patients make the right decisions. KSERA will initially focus on people with chronic obstructive pulmonary disease (COPD), a disorder that mostly affects the elderly. World Health Organization (WHO) figures estimate that by 2030, COPD will be the third main cause of death worldwide.

Over the next three years, the KSERA project partners will build

three demonstration houses that will demonstrate what is possible in a smart home. The houses will be equipped with a robot that will help COPD patients in their daily lives. The robot will follow the patient through the house, make helpful suggestions, offer advice, learn their habits, monitor the patient closely



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and inform a doctor if the patient is unwell. 'We want to show what is possible in this area,' said project coordinator Dr Lydia Meesters from TU/e.

Dr Meesters emphasises that the smart homes will be comfortable places to live, not cold, robot-controlled environments. 'It should be as homely as possible,' she explained. 'In an ideal situation the only technology you will see will be the robot. It will be the contact for all the domestic systems, but otherwise the place will just look very homely.'

To achieve this objective Dr Raymond Cuijpers from TU/e will study robot/human communication to make it as

easy as possible for a human being to understand a robot and vice versa. For the robot to be useful it must understand the patient's wishes, be intelligent and able to anticipate what the patient needs.

For this aspect of the research the team will work alongside another TU/e project called Roboearth which is building a global central memory for robots to enable them to communicate with each other and with human beings.

Special attention will be paid to ethical issues such as what the robot should do if a patient lights a cigarette or how much information should be passed on by the robot to the central operating

system. 'We need to define clear limits, for the robot will continuously measure and see very private data,' Dr Meesters pointed out.

Other partners working on KSERA alongside TU/e are the Central European Institute of Technology (Austria), Vienna University of Technology (Austria), Hamburg University (Germany), Institute Superiore Mario Boella (Italy), ICT company Consoft (Italy), and Maccabi Healthcare Services (Israel). The demonstration homes will be located at CEIT and Maccabi Healthcare Services.

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Estonians put Roboswarm technology to the test

Invent Baltics, an Estonian research and development (R&D) consultancy group, has successfully tested the swarm coordination technology demonstrator that was designed and developed by the EU-funded 'Knowledge environment for interacting robot swarms' (Roboswarm) project. Roboswarm received almost EUR 1.7 million under the 'Information society technologies' thematic area of the Sixth Framework Programme (FP6).

Launched in 2006 and finalised in 2009, Roboswarm targeted the development of a technology for self-configurable, inexpensive and robust robot swarms that people could use in various applications on a daily basis including, among others, cleaning, patrolling and escorting. A robot swarm is similar to a colony of ants: with a higher collective intelligence, the swarm may be used to accomplish tasks that lie beyond the capabilities of a single robot.

Bringing together 9 research and industry partners from 7 countries, Roboswarm fulfilled its goal of developing a demonstrator that is composed of 10 to 15 devices and that allows a swarm of simple robots to perform a number of cleaning tasks.

The project partners used fixed radio frequency identification (RFID) tags to help the swarms with positioning and

navigation. The tags are used by the robots for coordination and task sharing, and are marked with various surfaces and objects.

Thanks to the Roboswarm technology, simple robots will be able to communicate extensively so as to split individual tasks in order to heighten the functionality of the swarm (i.e. scalability), to learn from the experience of individual swarm members through the local or international knowledge base (i.e. self-learning), and to operate with as few sensing capabilities as possible (i.e. cost efficiency).

Experts say there is a growing interest in the multi-robot system (MRS) where several robots interact to achieve common goals; the potential to perform coordinated tasks compared to a single robot system effectively save time, money and effort.

Microsoft Research in the US has already expressed an interest in the Roboswarm technology.

Roboswarm is coordinated by the Department of Computer Science at Tallinn University of Technology in Estonia, and brings together teams from Estonia, Spain, France, Italy, Portugal, Finland and Sweden.

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Better technology for Europe's silver surfers

They say that necessity is the mother of invention and so it goes for European researchers who have developed an easy-to-use platform for older Europeans to lead productive and healthy lives before and after retirement.

Europe's population is ageing. Meeting the needs of the elderly presents European authorities with many challenges — socio-economic and health-related — but also some unexpected opportunities for innovative solutions and new technologies to emerge.

Take Germany, the most populous country in the EU with around 82 million people. But with a fertility rate of just 1.38 children per mother the population is expected to shrink to between 65 and 70 million by 2060. That means less working-age Germans to support retirees. This is where technology can help.

The EU-funded project 'Vital assistance for the elderly' (VITAL) has developed an integrated set of technologies and a unifying platform to provide internet-based services and applications to elderly users.

The researchers put in extra time and effort to make the technology accessible to older users who may or may not be experienced in basic computing or technology interfaces like keyboards. As technology goes, it was clear that older generations are more at ease with the television, how it works and what it can do for them as a source of information and entertainment. So VITAL used the humble TV as a benchmark for how simple their tools should be.

'If you can use a television, you can use VITAL's platform,' stresses Dr Oliver Keller of the German Research Centre for Artificial Intelligence (DFKI) which coordinated the multidisciplinary European research project.

Remote control for the remote

To succeed, the VITAL team knew they would need to push the state of the art in three key fields: advanced user interfaces designed for the elderly (i.e. TV and mobiles), intelligent systems offering interactive and personalised information and services, and speech recognition and natural language technologies.

The three-year project, which was extended eleven months to complete the extensive testing and validation work, has delivered on its promise. The VITAL platform comprises applications and services, a user-terminal and an operator-terminal, as well as software to run user applications and the bits and bobs needed to test and operate the applications.

The services they have developed include audio books, education and entertainment (edutainment) like multimedia cooking programmes, peer-to-peer games which encourage social contact, a personal newspaper geared to users' interests, and videoconferencing. All of which are mediated through the television.

'Loneliness and the feeling of isolation are common conditions for many retirees, especially if they suffer from illnesses which restrict their mobility,' explains Dr Keller. 'So, the "social" applications are important for more than just fun and games; they can be a vital link to friends, family and carers.'

The advantages for people living in remote parts of Europe are also significant, the project coordinator notes, especially for medical consultations via, for example, videoconference. And with the easy-to-use system, older people can stay independent for longer in their homes, which has potential cost-savings for health administrations.

Typical scenario

In a typical scenario, an elderly person sitting in front of the TV can interact (using speech commands or a remote control) to choose from the services arranged as icons on the screen. The application software then guides the user through the necessary steps.

'VITAL is actually an easy-to-use and modular system, designed to hide the complexity of the transactions taking place in the system,' notes Dr Keller. The results from the various user trials have been very promising. The feedback from the elderly people who

used the system interactively over an extended period has helped VITAL to adjust the system in line with the real needs of this special user group.

The VITAL system has significant commercial potential as well, especially as western populations continue to age. In 2025, the over-65s in Europe is predicted to reach more than 30 %, which is equivalent to 211 million citizens. By 2050, this group could reach more than 42 %, corresponding to almost 265 million people.

VITAL is not the only research group looking to provide better, smarter services for the growing greying market, but the extra effort that they have invested in making the platform easy to use and to put the 'fun' in functional should pay off in the long run.

Two aspects were of very special concern while designing and developing the system. First, the project applied a very modular approach — the VITAL system can be extended to include new services very quickly and efficiently, with existing service platforms easily integrated. Second, VITAL is based on accepted world standards (ISO/IEC) which dramatically improve the accessibility and usability of its services.

The VITAL consortium has a sound plan for exploiting its results, including the service component and capitalising on the social network market. Metcube, an SME with a dedicated business strategy for the health care and ambient assisted living (AAL) markets, will lead the market rollout of this plan.

VITAL project received funding from the 'Information society technologies' (IST) initiative of the Sixth Framework Programme for research. The project has just delivered its final report which is available at their website www.ist-vital.org.

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Intelligent homes not far away

Electronic devices are increasingly 'networked', but they are intelligent? Not really. But one EU-funded project set out to get the fridge and TV talking to our mobile phones and PCs.

Researchers in the European project 'Amigo ambient intelligence for the networked home environment' (AMIGO) enrolled the services of 13 partners, including leading telecommunications companies such as France Telecom, Microsoft and Phillips, to realise the full potential of an intelligent networked home.

To do this the partners first had to resolve key issues like the lack of interoperability between individual devices. AMIGO created a software platform that gets individual devices in the home to talk to each other and provided context-aware artificial intelligence to control them. More importantly, its basic components and all user services are available as open source software for everyone to use.

By steering away from creating a monolithic system and making the software accessible to all, the project partners believed that they could bring intelligent homes one step closer to reality. Acceptance by the end-users was also of vital importance, so the team invested in developing attractive user services. Indeed, to make the technology not only work from a technical point of view, but also motivate people to use it was one of the main challenges.

AMIGO homes adapt to the habits of their occupants, automatically adjusting the ambient lighting to watch a movie, locking the doors when someone leaves or contacting relatives when someone is ill or has an accident. Dedicated prototypes were prepared during the course of the project to make the benefits immediately clear.

Despite AMIGO's technical advances, it may be a while before intelligent networked homes become commonplace, say the project partners. But the 'smart home' dream is edging ever-closer to reality.

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

Collaboration sought: further research or development support.
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Finding survivors trapped under collapsed buildings

The brave and dedicated men and women from the rescue services need access to the best equipment to successfully locate and extract survivors of large-scale structural collapses. The EU-funded 'Second generation locator for urban search and rescue operations' (SGL for USAR) project will provide the state-of-the-art technology they require.

Imagine being buried alive under a collapsed building, not knowing if anyone will ever find you. Time is not on your side, as trapped individuals who are injured rarely survive longer than 24-hours. Even those who are entombed but unhurt rapidly deteriorate after three days, unless they have

access to drinking water. Therefore, any system that can help rescuers to quickly and safely locate survivors is of the utmost importance.

Project partners have developed a prototype standalone device that uses sensors, images, sound and chemical analysis to locate entrapped survivors and corpses. The device continuously checks the air conditions in the spaces under damaged and partially collapsed structures. Smart sensors can also monitor casualties and report back on their medical status. The SGL for USAR consortium is also developing

an ICT platform that can integrate all the data and manage the flow of information from the field to the centre of operations.

Dissemination tools and materials have been created, including the project web page, the team space collaborative tool and a technology forum. Distribution of the project's results together with information from field experiments facilitates the exchange of know-how between project partners and stakeholders. It is intended that the technology forum will continue once the project has been formally completed. This will take the form of meetings, workshops and conferences and on-line discussions, news and an interactive web page.

The work of the SGL for USAR project will make a valuable contribution to emergency services and rescue teams around the world and enable Europe to be a leader in rescue technology.

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

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Boosting public debate on scientific issues

Getting scientists and citizens together in the same room will help advance the public debate on a number of critical issues and the 'Facilitators' units network for debates' (FUND) project is making it happen.

Climate change is one of many scientific subjects which spark vigorous public debate in recent years. The way in which this debate is carried out often leaves out a significant part of the population. It does not have to be that way.

The FUND project is looking at new ways to open up dialogue between the scientific community and general public, namely city inhabitants. It builds on concepts developed and tested during previous EU-funded research projects.

One of the first actions during FUND was the organisation of a seminar to bring together experts in science as well as communications. The discussion focused on developing concepts for events to foster knowledge transfer and open dialogue on different scientific themes.



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To put these ideas into action, small grants called 'microfunds' have been made available. Furthermore, a set of online tools has been uploaded to the FUND website (www.playdecide.eu) to help potential participants organise and advertise their networking events.

A number of different, innovative projects have already been funded. Information about the specific initiatives as well as a general review of all actions can be found on the website. FUND has also registered with a popular social networking site in an effort to encourage interaction with the general public.

Both scientists and citizens alike stand to benefit from this fresh approach to connecting people and ideas.

Funded under the FP7 specific programme Cooperation under the theme 'Science in society.'

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Transforming a little noise into a lot of energy

A revolutionary way of thinking about electronics has led to success turning the 'noise' that circuitry emits into useful energy. Many scientific fields from neuroscience to nanoelectronics stand to benefit significantly.

As electronic devices become smaller, the useless noise that their circuitry emits becomes relatively stronger. Normally, such noise degrades the performance of electronics, but new research is coming up with ways to actually boost signals using this noise. This translates into better, faster electronics, thanks to a discipline known as stochastic resonance.

The field of stochastic resonance has been hotly debated for over 30 years but little progress had been made before the EU-funded 'Sub KT low energy transistors and sensors' (Subtle) project was launched.

Traditionally, in the field of electronics, achieving high signal-to-noise ratios (i.e. lots of signal for very little noise) has been considered the ultimate objective. Now, the principles of stochastic resonance will actually exploit this noise to improve signals in electronic devices, where output may be greater than the input or where the sum is greater than the parts.

Research under the Subtle project has unveiled some exciting advances in this respect. The team has developed technology (scientifically known as submicron arrays of resonant tunnelling diodes) that mimics signals between neurons. The technology has

also helped develop sensors for signals usually hidden under the noise. The implications offer spectacular potential, as these new sensors operate at less than millivolts, considerably less than the current state of the art. All this, for example, may be used to create neural networks for future quantum computing. Fields such as nanoelectronics, neuroscience, electronic engineering and biomedical prosthetics stand to benefit significantly as well.



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Such developments and several other discoveries emerging from the project have raised the eyebrows of many corporations. Serious discussions with businesses have already been initiated,

with important names in several industries such as Hitachi High Technology HHT, A&D and Novelx. This once again demonstrates Europe's primacy in intricate technology.

Funded under the FP6 programme IST

(Information society technologies).

Collaboration sought: information exchange/training.

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ICT comes of age in the Western Balkans

As young Western Balkan states solidify their identity and industry, their foray into the 21st century can benefit from EU expertise. The EU is giving the region a strong boost in ICT.

Harmony and innovation within the EU depends on its relationship with the rest of the world, particularly with its neighbours. An important component of this premise is the close academic ties with non-EU countries in the Western Balkans. With this in mind, the EU set up a support initiative called SCORE ⁽¹⁾ that addresses the need for well-defined future research and development priorities with the concerned nations.

The countries included in the project are Albania, Bosnia-Herzegovina, the Former Yugoslav Republic of Macedonia and Serbia. The project enhances scientific and research cooperation between the Western Balkan region and the EU in information and communications technologies (ICT). It was financed almost in its entirety by the EU for this very purpose.

Essentially, SCORE aimed to contribute to the development of a consultation culture in priority setting and policy-making within the region. The consultation process involved several stakeholders — including the public — from the Balkan states in question and the EU itself.

Four ICT workshops in different countries were organised in 2008 to help realise key objectives of the project. The workshops helped transfer EU research results to the Western Balkan ICT R&D communities and helped develop EU-Balkan R&D networks. In effect, these workshops have provided the participants with knowhow on current EU research developments and state-of-the-art

technologies in ICT. They also encouraged partnerships between the participants and EU research experts, rendering EU researchers more aware of the research potential in the Western Balkans. Moreover, the workshops helped stimulate public debate and obtain feedback from stakeholders on how Western Balkan countries can enhance their research collaboration with the EU.

One of the most important successes of SCORE was the development of a document, called 'Shaping EU-Western Balkan cooperation in the field of ICT research & development in the period 2008-13: priorities and recommendations.' The paper outlines the main

findings of the consultation process in the region and addresses decision-makers both within the Western Balkan countries and the EU. This has a direct effect on Western Balkan policy-makers, governmental officials related to the field of ICT, academia and the private sector.

Both the paper and the workshops have set the stage for enhancing ICT capabilities in the Balkans and strengthening ties with the EU on many levels. The positive repercussions of this project will go on for many years.

(1) 'Strengthening the strategic cooperation between the EU and Western Balkan region in the field of ICT research'.

Funded under the FP6 programme IST

(Information society technologies).

Collaboration sought: further research or development support.

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Making sense of signals

We live in a world of mixed signals — from sound to light — that often don't make any sense. Through advanced mathematics, we can now analyse and exploit them to the benefit of advancing technology.

The world is bombarding us with different intermittent signals from everywhere. These can be audio signals, radio signals, light signals, image signals, seismic signals or even signals defined by space or time. Quantifying these signals and studying them helps us understand the world we live in and has many applications. But doing so requires sophisticated mathematical calculations and algorithms.

Although the average person may not know much about this discipline, behind the scenes there are scientists and mathematicians trying to make sense of the 'signal-filled' world we live in. The EU has fully funded the SFSASDA ⁽¹⁾ project to help understand these signals, creating more accurate models and giving more meaning to signals.

SFSASDA used a complex way to study these signals — a method called scattered data approximation. The method has

been used in the past for reconstructing uneven surfaces, modelling terrain, defining fluid interaction and estimating parameters, among other applications. The project's challenge is to make it work for signal processing, a discipline in itself that falls somewhere between mechanical engineering and mathematics.

Scattered data approximation has been ideal for computing undefined phenomena in biology, engineering geology and mathematics to name a few. In theory it should work well in defining and approximating the intermittent data that signals emit. After intense testing of different mathematical models, the project successfully developed ways to apply signal analysis in the fields of geophysics,

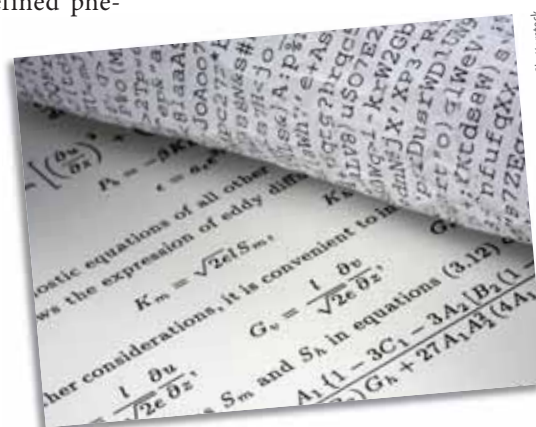
wireless communication and medical imaging. The new results also help in filtering out noise and improving acoustics.

In the near future, when better maps, medical equipment, hearing aids, or sound systems are created, some of this 'behind-the-scenes' computation and technology may well have much to do with it.

(1) 'Spline-like function spaces with applications to scattered data approximations'.

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

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Sharing information the grid way

Beyond the internet, academic and professional information sharing can be difficult and costly. Grid4all ⁽¹⁾ may give people an opportunity to share expert information across the globe.

Imagine a communication system where schools, household users, small businesses and non-profit organisations can

access each others' resources and share them when needed. Grid4all is a project funded by the EU that has worked on achieving this very dream.

In such a context, e-learning could also take on a much more robust role.

By pooling large amounts of inexpensive resources, demand can be satisfied more easily. It can support geographically isolated groups, as well as peer-to-peer applications. The ultimate aim is to organise large numbers of small-scale resources into large-scale grids, based on openness and low cost for end-users.



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The project envisions a future where such access is democratised and cooperative. Home users, for example, may be able to access an image editing application while school projects can access volcanic eruption simulations. Cooperation over Grid4all could include joint homework between pupils or even international collaboration among various teams.

To achieve its goals, the project has developed prototype applications. It has achieved an architecture-based approach using architectural models to deploy, monitor and reconfigure activities. There are plans to implement the Grid4all architecture in all its scenarios in a real-world case study. Eventually, the benefits to schools, small businesses and even homes could be enormous.

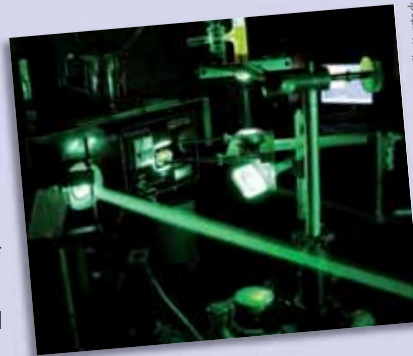
(1) 'Self-grid: dynamic virtual organizations for schools, families, and all'.

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

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Bright future for European laser technology

Compact, mass-producible lasers which can work in traditionally inaccessible parts of the light spectrum — the so-called 'green gap' — are now much closer to reality, thanks to groundbreaking work by European photonics experts.



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Laser diodes are semiconductor devices used in common devices like barcode readers and laser pointers. They currently have a restricted range of visible wavelengths which is holding back development of the sort of 'high-brightness' lasers needed in science and industry today

The European project 'Nano-photonics materials and technologies for multicolour high-power sources' (NATAL) took up the challenge to develop new laser technologies that plug the 'green gap' and which could serve a host of other applications requiring brighter, specially tuned miniature lasers, from overhead beamers to factory production.

NATAL's breakthrough tracks developments in novel semiconductor gain materials and the demonstration of advanced micro-optical elements needed for new lasers. Key to the success has been their work on optically pumped 'Vertical external-cavity surface emitting lasers' (Vecsel) — a kind of semiconductor diode laser (SDL) that produces a high-quality, high-power light beam.

Partners in the project achieved several scientific firsts, including a record-breaking high-power visible light, and the first-ever use of blue laser diodes for direct optical pumping of red SDL material. One partner has developed an advanced 3D simulation tool that takes into account electro-optical and

thermal properties of the gain chip but also the effect of external optical elements.

Potential scientific and industrial uses for compact, mass-produced Vecsel-inspired lasers are many, including in medicine, display technologies, life sciences, and UV lithography.

NATAL partner OSRAM Opto Semiconductors has reportedly been developing low-power, red-green-blue (RGB) projection technology. Another partner Epicrystals has commercialised its proprietary Decibel technology, while the firm Toptica is working on scientific applications of semiconductor Vecsel technology in the near infrared.

The collective work of the NATAL consortium and its various follow-up projects and activities, such as the EU-funded Fast-dot integrated project, pave the way to a bright future in European laser research and technological development.

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

Collaboration sought: further research or development support.
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Europe's quest for better QIST research

Increasing cooperation and exchange between scientists and industry helps spur research throughout Europe. This is no truer than for quantum information science and technology. But thanks to European initiatives this is one field that has a true champion.

The gap between what industry needs and the research produced by academia is sometimes wide. But by creating

a forum of exchange, the gap can be closed. And certain fields of research need this level of cooperation more than others.

Quantum information science and technology (QIST) is one of them because it covers such a diverse range of subjects. And because it is based on the physical laws of quantum mechanics instead of classical physics, QIST is an important fixture of research for future applications in information and communication technologies (ICT).

But the problem facing QIST scientists is that they were not always aware

of similar research being conducted in other Member States. This means business opportunities for their application and benefits to society may be held up.

The momentum of Europe's early and leading role in QIST needs to be maintained. To maximise and harness the potential benefits of QIST, the EU-funded project 'European research into quantum information science and technology' (ERA-Pilot QIST) identified key areas of European research and how best to foster collaboration among all the various scientists, policy-makers, and industries.

The project aimed at not only establishing a forum of exchange among these players, but also identified best research practices, and created a set of measures that could be incorporated into plans for future funding policies by individual



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Member States and the European Commission. ERA-Pilot QIST also suggested ways to best cluster regional and thematic centres of excellence.

Navigating through all these initiatives and finding the optimal solution for everyone involved is a task that requires long-term commitment. But first, the project needed to elaborate a classification scheme for QIST that would raise awareness and inform the scientific community of developments within the field.

Once completed, the scheme was quickly adopted and implemented by the scientific community. Indeed, it was the first

time any organisation or project had developed such an extensive and user-friendly classification system. With the classification in place and in use, the European QIST community can now analyse differing research groups in almost all European countries simply by accessing an online database.

Next, the project researchers put together a European QIST guideline. The guideline helps initiate dialogue among scientists, policy-makers, and industry representatives. Finally, the project looked at and compared European QIST research with other structures outside Europe. This enabled researchers to spot best practices that

could be adopted into the European research framework.

The result is that the ERA-Pilot QIST has helped foster European QIST research. The online database, guideline, and comparative study with non-European research structures, enables research groups here to better cooperate with their peers and the industry. It also gives pertinent knowledge and recommendations to funding institutions at the national and European level so that Europe can maintain its momentum in QIST research and application.

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

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Plastic optical fibres light the way

Ground-breaking research by a team of European scientists paves the way for optical computing, ultra-high-speed networks, new sensing devices and more. All using cheaper, safer plastic optical fibres.

Many of today's photonic applications, from ICT to bio-medical, require low-cost, flexible, lightweight and robust solutions. Organic materials are ideal candidates with excellent photonic properties, which means they are able to carry light and transfer data better than ever before.

Flexible plastic fibres, with a core diameter of just 1 mm and made from polymethyl methacrylate (PMMA), are cheap to produce, easy to install and transmit light in the visible range as opposed to

infrared, making maintenance easier and safer. But those properties typically come at the expense of lower bandwidth and high attenuation, restricting their use to sending data over short distances at relatively low speeds.

As a result, POF networks have mostly been used as an alternative to copper wires for short-distance — or so-called last-mile — data transmission. In offices and homes, POF has become a popular alternative for setting up

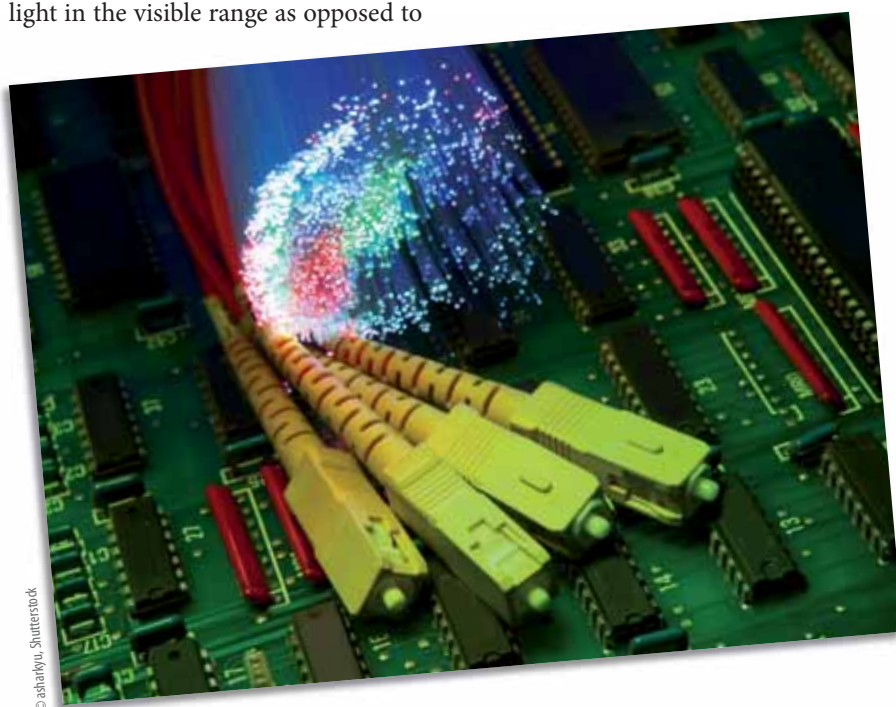
local area networks (LANs), while in cars plastic fibres have replaced copper for sending video signals to onboard entertainment systems or obtaining data from sensors. Polymers can also be used as active layers in a variety of plastic laser devices, in amplifiers and also for all-optical switching, to name a few applications.

The EU project 'Plastic optical fibres with embedded active polymers for data communications' (Polycom) delivered several breakthroughs in this field. It improved material quality, established a better understanding of the photophysics and improved the base technology, including ultra-fast switching in polymer amplifiers, conjugated-polymer doped POFs, and in so-called distributed feedback lasers used in optical communication. The consortium, including leading academic institutions, also came up with new devices such as optofluidic chips designed to use optical interfaces only.

The project's breakthroughs look set to strengthen European competitiveness in the field of organic optoelectronics, nano-fabrication, nano-photonics and nano-electronics. Its work matches the needs of many of today's photonic applications, from ICT to bio-medical, which require low-cost, flexible, lightweight and robust devices.

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

Collaboration sought: further research or development support.
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Promoting optics and photonics research

Optics and photonics are poised to become one of the most important technologies of the 21st century. An EU-funded initiative has helped to coordinate European efforts in this rapidly expanding area of research.

The European project 'Optics and photonics in the European Research Area' (OPERA2015) has helped place Europe among the world's leaders in the field of optics and photonics, by providing a framework for investigating the properties and applications of light. The framework has been used to implement a joint strategy for research that will shape the future of this vital industry.

One of the consortium's main achievements has been the OPERA2015 final summit where key strategic issues regarding photonics in Europe were discussed. An inventory has also been conducted of European photonics companies, which has shown that the range of businesses has increased with the addition of new EU Member States. The inventory is in the form of a detailed database that has boosted networking within the industry.

The OPERA2015 website operates as an information exchange platform for

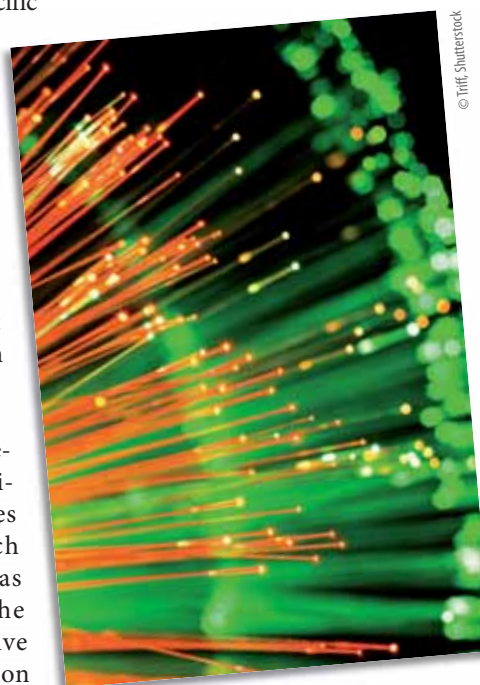
those involved in optics and photonics throughout the EU, providing information to researchers, students and job-seekers. The training section lists specific issues and events aimed at improving the skills of participants. Published roadmaps of photonic activities and funding have been collated according to project. The database also indicates national and international sources of information, highlighting published data that can aid European researchers and policy-makers in their work. As a result more than 50 data sources have been identified.

In view of the general need for creating stronger links between institutions and national programmes and for developing a research framework, the OPERA2015 has proved extremely valuable. The work carried out by the initiative has also enhanced Europe's position

as a producer of optical and photonic technology and boosted its emerging knowledge economy.

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

Collaboration sought: information exchange/training.
<http://cordis.europa.eu/marketplace> > search > offers > 5879



Nanotechnology pushes the forefront of electromechanics

Miniature electromechanical devices and their components are set to reshape the way circuitry and electronics are developed. This will lead to improved chemical sensors, scanning devices and much more.

An EU-funded project has focused on how to integrate 'Carbon-based nano-electromechanical devices' (CANEL) with silicon technology, with emphasis

on applications in information technology such as switches and memory. The researchers succeeded in modelling, measuring and establishing the viability to fabricate this novel technology.

Technology can benefit significantly from ever-smaller electromechanical systems. These systems use less energy, can be more sensitive and apply to a range of fields. The ultimate reduction in such systems is described as nano-electromechanical systems (NEMS), representing miniaturised electrical and mechanical functionality at the nano-scale. Such technology integrates mechanical actuators (e.g. pumps or motors) with transistor-like nanoelectronics. It can be used for applications

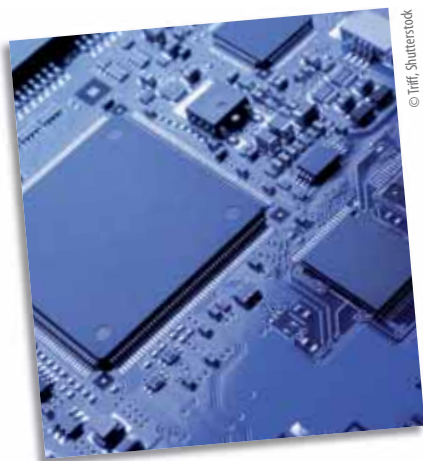
such as sensors to detect stresses, forces and vibrations at the atomic level, as well as chemical signals. Better scanning devices ranging from the medical field to safety also stand to benefit from this miniaturisation.

Much of NEMS technology is based on carbon nanotubes — tiny structural forms made from cylindrical carbon molecules. These have properties which are extremely useful in electronics, optics, nanotechnology and science in general. These nanotube structures, also known as carbon allotropes, combine extraordinary strength with low mass, extending the range of NEMS far beyond the present limits.

These pioneering results lay the groundwork for a whole new 'minute' level of upcoming technology.

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

Collaboration sought: further research or development support.
<http://cordis.europa.eu/marketplace> > search > offers > 5944



Super polymers may take industry to new heights

Stronger, more flexible materials using nanotechnology are giving an edge to industrial applications in many fields.

Polymers can be defined as organic materials such as rubber and cellulose, or synthetic materials such as many plastics. Some important polymers are mixed organic-inorganic compounds such as silicone. Adding tiny inorganic filler particles to reinforce polymeric materials has been done for many years to create strong composite materials.

Yet with the advent of even smaller particles, i.e. on the nanoscale, it would be possible in theory to create nanocomposites. Some success has already been established in creating nanocomposites, but many are not 'behaving' as expected, necessitating intensive efforts in modelling and testing the new materials.

Backed by EU funding, the Nanomodel (1) project plans to achieve this goal, investigating the properties of these nanocomposites and how they behave in practice. The project is bringing

together a critical mass of scientists to try different modelling approaches and eventually create high quality nano-filled materials. In scientific terms, these experts are developing, implementing and validating methods to compute the mechanical, thermochemical and physical behaviour of nano-filled polymeric materials.

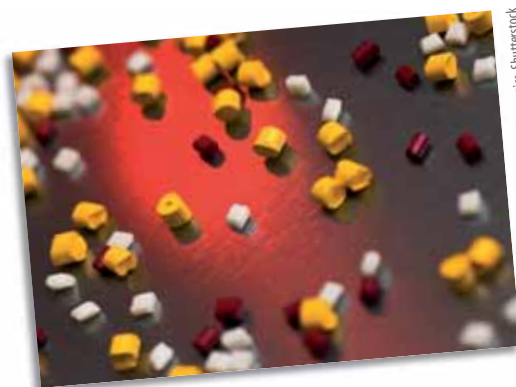
To illustrate, project partners have already examined the positive effects of spherical nanoparticles decrease viscosity and reduce thermal degradation. A decrease in viscosity, for example, would work well in injection-moulding applications. German industrial giant Bosch has undertaken much of the blending and mechanical testing for polystyrene, including plans to run many more sophisticated tests in the near future.

Much progress has emerged from the testing and modelling, with publication of results well underway. Hands-on training and workshops in the emerging results and technology have been conducted by Dutch company Culgi, which specialises in computational chemistry and industrial modelling. Dissemination of results are ongoing, and the promise of new, ultra-reliable nanocomposites is almost a certainty.

(1) 'Multi-scale modeling of nano-structured polymeric materials: from chemistry to materials performance.'

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

<http://cordis.europa.eu/marketplace> > search > offers > 5877



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Vehicles that beat the elements

An international team of researchers are developing coatings to enable vehicle surfaces to resist corrosion and 'self-heal' damage from the elements.

All vehicles — whether on road, land or sea — are highly exposed to the elements and no matter how strong the materials used in their construction are, they are vulnerable to corrosion and damage. However, a team of researchers believe that it is possible for these

materials to self-repair through the use of nanotechnology coatings.

Working together under the EU-funded 'Multi-level protection of materials for vehicles by smart nanocontainers' (MUST) project, they have been combining several damage prevention and reparation mechanisms to improve the long-term performance of metallic substrates and structures used in vehicles. The idea is to develop coatings containing these technologies which gradually respond to impacts from the environment, such as water, salt or exposure to different chemicals, to initiate the appropriate protection mechanisms.

The first step under the four-year project, which began in 2008, was the development of various nanocontainers

and analysis of their properties. The project partners then formulated coating systems including these nanocontainers and tested their self-healing properties in various scenarios for road, aerospace or maritime applications.

So far tests of the new coatings have shown improved corrosion protection, but the results need to be stepped up further in the remaining work. A key issue is to ensure the compatibility of the developed nanocontainers with commercial coating and adhesive systems.

The project involves partners from research institutes, academia and industry in several EU countries. It received over EUR 7 million in funding from the EU's Seventh Framework Programme for research (FP7).

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

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Technology follows nature's example

European researchers have studied examples taken from nature in their search for exciting new technologies.

Nature has often been an inspiration for artists, while providing scientists with some of their best ideas. The application of biological methods and systems found in the natural world to the development of engineering systems and modern technology is known as biomimetics. Examples include radar and sonar, which imitate the echolocation used by bats to find their prey.

The 'Nature-inspired smart information systems' (NISIS) project coordinated multidisciplinary studies and research activities into the development of advanced information systems. The initiative supported more than 60 research institutes based in industry and academia across Europe that have studied biomimetics in order to develop innovative technologies.

Three focus groups investigated the theoretical and technological aspects of nature-inspired systems in the fields of data technology, networks, and systems modelling optimisation and control. Overall integration of the initiative's work has been overseen by the Integrated Technology Board (ITB), the result of which has been the NISIS roadmap and links with other existing networks.

Annual symposia have been organised by the project to showcase the latest developments in nature-inspired systems with intelligent technologies. The focus has been on the integration of life and applied sciences (and engineering) to smart information systems that can be used to solve problems in the real world. Researchers also investigated nature-inspired systems that coordinate perception, reasoning and action to pursue multiple goals while acting autonomously in a fast-changing environment.

Scientific competitions have been an effective means of motivating scientists to develop new ideas for centuries and the NISIS project has been no exception to this tradition. NISIS competitions have been organised by the committee responsible for technology transfer, which normally concentrates on technological concepts and algorithms.

Studying biological organisms and systems in order to address scientific and engineering challenges has helped researchers to develop ground-breaking technologies that help Europe to compete in the global marketplace.

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

Collaboration sought: further research or development support.

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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>

European space components conference

The European space components conference will be held from 15 to 17 March 2011 in Noordwijk, the Netherlands.

Over the past decade, European space component manufacturers, users, national agencies and the European Space Agency have worked on coordination efforts in order to make more components available for European space systems. These activities have been collectively implemented through various programmes such as the European Component Initiative (ECI), agency technology programmes and annual qualification activities.

The event is designed as an open and inclusive forum where current and future collaboration on European space components can be presented and discussed. It will provide an overview on the current situation and address the actions necessary to secure the availability of adequate components for European space systems. The conference will also cover the resources needed to ensure successful development, evaluation, qualification and procurement activities.

For further information, please visit:
<http://www.congrex.nl/11m06/>

Iron-related diseases: a look to the future

An event entitled 'Iron-related diseases: a look to the future' will take place on 18 March 2011 in Cambridge, UK.

Iron is central to the health of humans. It is an essential co-factor in oxidative metabolism and related processes. Accumulation of excess iron is now increasingly recognised as occurring in many diseases — and is often age-related.

Innovative science now offers new strategies for the diagnosis and treatment of disorders of iron metabolism; it may

also allow the course of several neurodegenerative diseases to be modified specifically by interventions that affect the cellular disposition of iron in the brain.

In fact, the past decade has seen the identification of numerous proteins implicated in iron transport, its storage and control of its metabolism. The event will focus discussion on these intriguing molecules and examine unique the perspective they offer into cellular iron homeostasis and pathophysiology.

For further information, please visit:
<http://bit.ly/fcDqX3>

Sentinel potential science products assessment and consolidation workshop

A workshop entitled 'Sentinel potential science products assessment and consolidation workshop' will be held from 22 to 24 March 2011 in Frascati, Italy.

The primary purpose of sentinel satellites is to support European operational and policy needs of the Global Monitoring for Environmental Security (GMES) programme. Their ability to operate various sensors with global coverage and rapid revisit times, covering different remote sensing technologies and spatial resolutions, makes the sentinel missions also highly useful in advancing our understanding of earth system processes and interactions, and thus in addressing the scientific challenges of the Living Planet Programme.

For example the continuity of data, already widely used within the science communities, with a long-term operational commitment, is essential for the parameterisation of long-term forecasting models. The sentinels also offer an increased spectral coverage, which supports data harmonisation, a prerequisite in establishing a fundamental climate data record, and additional science products with many potential applications

fostering knowledge transfer into the GMES service domain.

The objective of the workshop is to facilitate discussions on the scientific challenges and the potential of sentinel 1, 2, and 3 measurements and products, beyond those provided by operational GMES services which could significantly advance the scientific progress in land surface, solid earth, ocean and cryosphere system research.

For further information, please visit:
<http://www.sen4sci.org>

International working conference on enterprise interoperability

The international working conference on enterprise interoperability will take place from 23 to 24 March 2011 in Stockholm, Sweden.

Enterprises increasingly need to compete and collaborate in a global marketplace. Using the internet and other technical means can overcome the traditional geographic barriers. The area of enterprise interoperability examines the ability of a system or a product to work with other systems or products.

The internet has a key role for enterprise interoperability, with future development empowering enterprises to innovate and create new business value. This would mean that the current internet would evolve into a universal business support system in which enterprises enjoy interoperability services that can be requested according to their individual needs.

At the same time, stakeholders have said that these developments should happen in a sustainable and socially responsible fashion, making efficient use of physical resources with a minimal environmental footprint.

The conference will aim to identify and discuss challenges and solutions with respect to enterprise interoperability, both at the business and the technical level, with a special focus on the future internet.

For further information, please visit:
<http://www.ics.kth.se/iwei/IWEI/Home.html>

Second international workshop on business intelligence and the web

The second international workshop on business intelligence will take place on 25 March 2011 in Uppsala, Sweden.

Over the last decade, society has experienced increasing use of business intelligence (BI) solutions. These which allow companies and individuals to query, understand, and analyse business data in order to make informed decisions.

A new trend emerging, though, where BI applications no longer limit their analysis to the data inside one company. Increasingly, they also source their data from the outside, i.e., from the internet, and complement company-internal data with value-adding information in order to provide richer insights into the dynamics of today's business. At the same time, business intelligence applications are also moving from company-internal information systems to service-based platforms on the internet.

The event will be a forum for exchanging ideas on how to leverage the huge amount of data that is available on the internet in BI applications, how to apply web engineering methods and techniques to the design of BI applications, and on using BI knowledge in the design of internet applications.

For further information, please visit:
<http://gplsi.dlsi.ua.es/congresos/beweb11>

Eleventh workshop on language descriptions, tools and applications

The eleventh workshop on language descriptions, tools and applications will take place from 26 to 27 March 2011 in Saarbrücken, Germany.

The workshop will be an application and tool-oriented event focused on grammarware (software-based on grammars in some form). Grammarware applications are typically language processing applications and traditional examples include parsers, programme analysers, optimisers and translators. A primary focus of the event will be grammarware that is generated from high-level grammar-centric specifications.

The event is also a forum in which theory is put to the test, in many cases on real-world software engineering challenges. The application of grammarware to areas will be on the agenda, with such topics as:

- programme analysis, transformation, generation, and verification;
- implementation of domain specific languages;
- reverse engineering and re-engineering;
- refactoring and other source-to-source transformations;
- language definition and language prototyping;
- debugging, profiling and IDE support.

For further information, please visit:
<http://ldta.info>

Psimex workshop: interactions and pathways

A conference entitled 'Psimex workshop: interactions and pathways' will take place from 28 March to 1 April 2011 in Cambridge, UK.

Sponsored by the EU-funded 'Proteomics standards initiative and international molecular exchange — systematic capture of published molecular interaction data' (Psimex) project, the workshop will provide an introduction and hands-on training to enable you to study protein-protein interactions and pathways using publicly available resources and tools. The workshop will also have an extended segment on teaching others how to use the resources and tools covered during the event.

Psimex supports the activities of the international molecular exchange collaboration, which is working on single set of curation rules for capturing data and making it publicly available.

For further information, please visit:
<http://bit.ly/ffiu4>

Event on regional innovation agencies

An event on regional innovation agencies will be held from 29 to 30 March 2011 in Reims, France.

A regional innovation agency is an organisation in close cooperation and connection with the regional authority or government which:

- supports the growth of enterprises through innovative projects;
- develops an innovation-friendly environment, notably with operational partnerships with universities, research laboratories or technical centres;
- improves the region's knowledge base, encourage knowledge dissemination;
- develops, improves and strengthens a region's innovation services and network.

The event will address regional innovation policy and its implementation. Case studies for regional authorities and regional innovation agencies will be presented as well as the first results of the identification of practices conducted in Partnership on European Regional Innovation Agencies. The debate will be placed in the context of the Europe 2020 strategy and the future orientation of the European Cohesion Policy.

For further information, please visit:
<http://www.innovact.com/en/rubrique1.html>

Innovation in healthcare: from research to market

A conference entitled 'Innovation in healthcare: from research to market' will be held from 30 to 31 March 2011 in Brussels, Belgium.

This conference will bring together the key stakeholders of the healthcare sector to highlight and discuss the policy developments needed for research and innovation in healthcare at European and national level, in the frame of the Innovation Union and beyond.

The event programme will consist of a number of plenary and parallel sessions and provide large space for debate among panellists, involving also the audience. There will also be a fair for associations and support structures with plans for discussions and networking.

The conference is being jointly organised by the services of the European Commission (DG Research and Innovation, DG Enterprise and Industry and DG Health and Consumers), in consultation with major stakeholders.

For further information, please visit:
http://ec.europa.eu/research/health/events-04_en.html

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