



# research<sup>eu</sup>

## RESULTS SUPPLEMENT

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**Research in the year  
of creativity and innovation**



*The European Commission has declared 2009 the European Year of Creativity and Innovation. Nothing less is required in the current climate of uncertainty to pull the EU through the crisis. Scientists involved in EU-funded research projects have long applied both concepts thereby becoming world leaders in many areas of research. The European Commission's thematic pick for 2009 should therefore also be seen as an acknowledgement of these scientists' impressive achievements.*

*One of the areas European scientists have always excelled in is medical research. The section on biology and medicine opens up with an article on research aimed at improving the lives of people suffering from chronic airflow limitation, a disability caused by the narrowing of the airways. The CARED project looked at ways to better diagnose patients' needs and come up with appropriate rehabilitation programmes.*

*In the last few years, the EU has become increasingly concerned by the future of its energy supplies. In order for it to be guaranteed, all sorts of parameters are being constantly modified. Research partners in the Trends project have sought to develop a web-based portal and database to help all parties involved in the oil and gas sector keep pace with ever-evolving standards, operation procedures and technologies.*

*The lead article in the environment section highlights how researchers from the Ubenefit project established a peri-urban wastewater treatment system in a sub-Saharan country, Burkina Faso, to convert water that was hitherto lost into a valuable resource to irrigate agricultural land. In so doing, this project aligns itself with EU efforts to encourage technology transfer in an effort to lift developing countries out of poverty.*

*The IT and telecommunications section opening article describes how the 'Preci spray' project developed a GPS-based precision spraying system to better fight pests in apple orchards. In developing this new technique, the researchers managed to achieve more efficient delivery of agrochemicals to orchards.*

*Over the last few decades, DNA has revolutionised mankind's approach to biology. Now it is bound to find applications in other scientific fields as well. The lead article in the industrial technologies section explains how the 'DNA based nanowires project' used DNA-based nanowires to pave the way for a new generation of complex nano-electronic devices. These could eventually be integrated into computing networks.*

*As usual, the events section offers you a non-exhaustive list of forthcoming event announcements in the field of research.*

*We look forward to receiving your feedback on this issue and on the research\*eu publications in general. Questions or suggestions can be sent to: [research-eu-supplements@publications.europa.eu](mailto:research-eu-supplements@publications.europa.eu)*

*The editorial team*

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To read up on the project presented in the offer, click on 'view related results' at the end of the text and then scroll down for links to the project and to the programme which funded it. For more information on ICT Results, access the articles online using the URL provided at the end of the text.

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## Breathing easily using a new therapy

*Chronic airflow limitation (CAL) is a major cause of disability as it prevents the patient from exercising and carrying out routine activities. A team of scientists have devised a non-invasive method of detecting expiratory flow limitations.*



Asthma and obstructive pulmonary disease can cause CAL. As the name suggests, CAL is due to narrowing of the airways and this overall compromises the quality of life for the sufferer.

As a general objective, project partners in the EU-funded project CARED aimed to improve diagnosis of different patients' needs and to devise rehabilitation programmes. They also sought to evaluate and develop pharmacological, surgical and exercise remedies.

Expiratory flow limitation reduces the effectiveness of expiration and can result in dynamic hyperinflation with consequent shortage of breath, especially during exercise. The researchers were therefore looking for a simple non-invasive method for detecting and measuring EFL without disturbing normal breathing.

Specifically, researchers at Politecnico di Milano evaluated a method to gauge the extent of expiratory flow limitation imposed along with forced oscillation technique (FOT). The method involves applying very low amplitude acoustic oscillations (5 Hz) onto spontaneous or in this case, assisted respiratory airflow. The subsequent interaction with the respiratory system modifies the pressure and flow relationship of the forced oscillations. The ratio of pressure to flow can be used to measure, in real time, the absolute value of respiratory input impedance.

The variable measured was delta (rs) — the difference between mean inspiratory and expiratory respiratory reactance and this therefore enables the detection of expiratory flow limitation.

Patients were subjected to nasal continuous positive airway pressure (CPAP) over a range of pressures. Oesophageal pressure was then measured to determine whether the breath was flow-limited, indeterminate or not flow-limited.

The team found that expiratory flow limitation was reduced in one of four cases of confirmed flow limitation by increasing CPAP. This indicates that this method may be used in conjunction with nasal pressure support to alleviate chronic airflow limitation.

Advantages of this therapy are that it is non-invasive and does not increase the lung volume. Avoiding hyperinflation has benefits for the patient in that muscle effectiveness and efficiency are maintained.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: information exchange/training.

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## New vaccine gives a rough ride for brucellosis

*Brucellosis melitensis (B. melitensis) is one of the species of bacteria that causes brucellosis in small ruminants as well as humans. Researchers from the BRU-VAC project have developed a new vaccine that overcomes the limitations presented by the Rev 1 vaccine.*

*B. melitensis* causes reproductive problems in ruminants like sheep and goats. As it is zoonotic, it can be transmitted to humans, mainly through the consumption of undercooked meat. In southern Europe in particular, it causes economic losses and human suffering.

Vaccination is one approach for sustainable control of the disease. Previous to the BRU-VAC project, the vaccines in use were beset with problems. For example, the smooth strain Rev 1 vaccine induces a strong antibody response to the lipopolysaccharide

S-LPS. Since S-LPS is the main antigen used in serological testing, this posed problems. Furthermore, the strain used for the Rev 1 vaccine is resistant to the antibiotics used to treat human brucellosis, a major disadvantage. Also, the Rev 1 vaccine does not confer complete resistance.

The project team at the University of Navarra in Spain worked on a rough (R) vaccine based on a mutation of a gene selected from laboratory models and sheep. It possesses markers for easy typing and has

a typing protocol for the polymerase chain reaction (PCR). From the point of view of human safety, it is safer than Rev 1 and is not sensitive to the antibiotics used for human brucellosis.

Further research on these lines is required as the vaccine does not afford the level of protection conferred by the Rev 1 vaccine. However, it may be useful as a prophylactic in certain circumstances or form the basis for further developments for effective and sustainable control of the disease.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; licence agreement; manufacturing agreement.

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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

## Chest wall mechanics and changes in pressure support ventilation

*Researchers investigated the effects of different pressure support ventilation (PSV) settings on the mechanics of the chest wall of patients with acute lung injury.*

Chronic obstructive pulmonary disease and chronic asthma can result in airway limitation, a leading cause of disability around the world. The condition prevents the sufferer from exercising and carrying out normal daily tasks, thereby reducing their quality of life. In some cases treatment can take the form of low-flow oxygen, non-invasive ventilation.

Pressure support ventilation assists spontaneous breathing in patients. The patient can control all aspects of breathing, including frequency and length of inspiration, except for the pressure limit. The synchronisation of respiratory muscle action with the resulting movement of the chest wall gives an indication of how well the patient is adapting to the ventilator.

The CARED project investigated the criteria for selecting the optimal settings of mech-

anical ventilators. Researchers analysed the effects of different PSV settings on a number of factors, including muscle pressure and the breathing of patients with acute lung injury. In nine patients, four different levels of PSV were randomly applied, while the same consistent level was used for expiration.

Scientists measured flow airway opening, and oesophageal and gastric pressure. Optoelectronic plethysmography was used to record changes in volume for the entire chest wall, the ribcage and abdominal compartments. The pressure and work generated by the diaphragm, rib cage and abdominal muscles were determined using dynamic pressure-volume loops. This was applied to the various phases of each respiratory cycle.

The results were compared with the patient's effort to match inhalation and expiration with

the action of the ventilator. The whole breathing pattern was measured and correlated with the movement of the chest wall. The researchers discovered that during PSV the ventilatory pattern changed according to the level of pressure support. Patients with acute lung injury support greater than 10 cm H<sub>2</sub>O allowed respiratory muscles to act together, with a simultaneous expansion of the chest.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support.

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## Simple, rapid access to radionuclides experiments

*Experts working on developing standards or guidelines relating to exposure to radioactive materials can benefit from the development of an enhanced database which consolidates data from over 1 900 experiments on the subject.*

Radionuclides play an important role in technologies such as food preservation, agriculture and medicine and as such, the processes which provide us with food, water and good health. However, radionuclides also have the potential to induce very harmful effects.

A concerted research effort entitled EULEP, aimed at improving the reliability of assessments made which evaluate the dangers related to the intake of radionuclides. These assessments deliver an evaluation of the result of doses delivered either to workers, the en-

vironment (in the case of accidental releases) and to the general public. Because of the scope of the assessment, it is integral that the information provided is highly accurate.

The research teams went about their work by conducting a review of all the current available literature on the subject of biokinetics of radioactive compounds. The experiments concerned different ways of intake, inhalation, injection, ingestion and wounds. Since the aim of the research was to elucidate available information, one of the tasks conducted by the team was to collate

all updated research findings into a single database. This database contains about 1 900 experiments from some 700 references. Information is held on 62 elements.

The format of the database updated and enhanced by the researchers facilitates extension, distribution and retrieval of information. There are drop-down lists for frequently used terms and specific fields for data entry, and there are also links to spreadsheets and hyperlinks. Furthermore, the database can be searched using a web browser via the internet. All this facilitates the ease with which information can be retrieved and shared between researchers.

Funded under the FP5 programme EAECTP C (Euratom research and training programme in the field of nuclear energy).

Collaboration sought: information exchange/training.

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## Lowering protein in infant foods

*In the quest to reduce obesity in Europe, the Chopin project looked at whether formula-fed babies were more prone to latter-life obesity than their breast-fed peers.*

In a pan-European collaboration, scientists enrolled more than 1 000 formula-fed infants, taking stock of their weight, height, body mass index (BMI) and other anthropometric criteria. Five European countries were chosen because they differ significantly in the prevalence of obesity as well as the traditional

nutritional habits of children. The babies were fed according to either a higher or lower protein-based formula and measured at intervals of 3, 6, 12, and 24 months.

To develop an accurate interpretive basis, anthropometric criteria were converted

into standard deviation scores based on World Health Organization (WHO) growth standards. Moreover, the primary hypothesis under investigation was whether protein intake, if exceeding metabolic needs, could potentially result in a higher risk of obesity in later years. This is based on the premise that when protein intake exceeds metabolic needs, greater insulin and insulin-like growth factor I are secreted.

continued on page 7

## Gut feeling for bacterial variations in Europe's babies

*The composition of gut bacteria is increasingly seen to be important in many aspects of health. Researchers have surveyed infants across Europe to determine what factors are responsible for population variations in intestinal bacteria.*

Intestinal microbiota can play a major role in the health of an individual. They make vitamins, are involved in immunity and allergy, prevent growth of harmful microbes, ferment fibre and, from a negative point of view, can be instrumental in cancer development.

From, and even at birth, gut flora are a highly variable and dynamic population. Scientists from the EU-funded project Infabio researched exactly how the faecal inhabitants of the human gut exert their influence — the mechanisms and risk factors involved. The countries involved were northern latitude Sweden, Scotland and Germany and southern countries Italy and Spain.

Specifically, babies from birth to six weeks of age were sampled for faecal bacteria by

consortium members at the Institut national de la recherche agronomique (INRA) in France. The team's aim was to determine the influence of delivery method, breast or formula feeding, maternal antibiotic treatment during pregnancy and weaning on the child's intestinal bacterial makeup. Geographical influence was also determined.

Faecal samples from over 600 infants were analysed using fluorescent *in situ* hybridisation together with flow cytometry (FISH-FC). Ten ribosomal RNA oligonucleotide group- and species-specific probes were used to identify the microbes.

Overall, there were large differences in microbial flora between the north and south which persisted from pre- through to the post-weaning period. Northern countries were

characterised by high bifidobacteria while southern regions displayed higher diversity and a larger proportion of bacteroides.

Breast feeding versus formula had a significant effect which continued to manifest itself after weaning. Interestingly, means of delivery were also found to exert a significant influence. Vaginal delivery favoured bacteroides as did breast feeding. As would be expected, use of antibiotics had an effect both on the infant and the pregnant mother. However, there was no evidence of the continued impact of antibiotic use after weaning.

Data from this study shows that from conception, lifestyle and feeding can have a major impact on the general health of a nation. Based on this study, recommendations on diet and feeding policy can be supplied to practitioners, the food industry and the public at large.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support.

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## Biosensor detects endocrine disrupting compounds

*ARC Seibersdorf research GmbH in Austria led the development of an effective, inexpensive biosensor capable of detecting endocrine-disrupting compounds (EDCs) in water samples.*

EDCs have arisen as yet another chemical threat to both wildlife and humans. They are produced from a number of anthropogenic sources, for example pesticides from agriculture. Research from the Mendos project aimed to develop biosensors to improve detection of EDCs in the environment.

Biosensors incorporate biological and inorganic components into a single device. In the case of the Mendos project, yeast cells were immobilised in hydrogel beads. The group experimented with different material

combinations. While polyvinyl alcohol (PVA)-based hydrogels boasted higher luminescence and sensitivity values, alginate versions were selected due to ease of counting yeast colonies.

Volume ratios and induction times were subsequently optimised for alginate hydrogels. Yeast cultivation was very fast and could be stored for long periods of time without degradation. Efforts to boost luminescence with coenzyme A (CoA) were made, but require further study due to the complexity of the system.

Finally, the new biosensor was subjected to water samples contaminated by EDCs, which it was able to successfully identify. In comparison with conventional detection methods, the biosensor offers speed, robustness, a long shelf life and lower costs. The Mendos research consortium therefore recommends it for use as an EDC screening tool for water samples.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; joint venture agreement; licence and marketing agreement; manufacturing agreement; financial support; information exchange/training; venture capital/spin-off funding; private-public partnership.

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continued from page 6 **'Lowering protein in infant foods'**

To conduct the test effectively, three primary groups were followed. A reference group of breast-fed infants, along with the two formula groups of high- and low-protein content. Overall, results of the study confirmed the relationship of high-protein content to obesity, showing that even as early as 3, 6 or 12 months, there were marked differences. For example, at time of birth there were no significant differences between groups with

relation to weight-linked parameters. Yet at the age of 12 months, the higher protein fed group showed significant weight gains but no significant differences in body length.

As regards the lower protein-fed group, weight, BMI parameters and endocrine markers were all lower than those of the high-protein group. These results and others support the hypothesis therefore that

reducing the high protein level in infant food would reduce the risk of obesity in later years.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; information exchange/training; available for consultancy.

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## Bringing lab-on-a-chip to a surgery near you

*If doctors were able to conduct efficient genetic analysis at the point of care, using inexpensive, portable equipment, it would revolutionise disease detection and treatment. European researchers are close to enabling this revolution.*

Today, anybody getting tests done in a GP's surgery or hospital outpatients will usually have to wait several days before getting any results. Using current technology, it is not possible to carry out a complete DNA analysis on a single device, and several steps are required with expensive and cumbersome equipment. Because of the different steps involved, and the need to move blood and tissue samples from one location to another, the potential for human error can reduce the reliability of the test procedures.

Now an ambitious EU-funded project, SMART-Biomems, is in the process of fabricating a novel microsystem — a lab on a microfluidic chip — which can be used in a portable diagnostic device, to simultaneously and automatically analyse various DNA samples with high precision.

Project coordinator Gianluca Vezzani explains: 'What we are developing here is a comparatively inexpensive, easy-to-use and portable point-of-care system which will have very real clinical benefits.'

He says that, while the SMART-Biomems system could be customised for any field where DNA testing is used, the prototype has been specifically designed for cancer testing and diagnosis. 'Because there are biochemical reactions occurring on the device, it has to be set up with specific reagents and biological protocols appropriate to the task at hand, and we chose cancer for the initial testing because it is such an important field.'

Since the project kicked off in December 2005, a lot of initial research and testing of different components of the system have

been carried out. In order that a prototype device could be properly assembled and validated, the duration of the project has been extended by four months until the end of March 2009. By that time, Vezzani is confident a working and fully tested prototype will be ready for demonstration.

For the final validation of the system, a clinically relevant human gene, TP53, will be tested. It is well known that mutations in this gene can potentially be the cause of cancerous tumours.

'We will use a known sample — where we know the mutations — and test the capability of the system to identify these mutations. We will then compare the results of our tests with results from a conventional testing procedure to check on the accuracy of the results and the time our microsystem takes to complete the analysis,' he says.

In the testing, a DNA sample will be inserted into the device, the power switched on to move the fluid sample within the microfluidic chip by the pressure control unit, and from there the whole process is automatic, thus eliminating the possibility of human error or contamination of the sample.

The device will be connected to a standard PC equipped with a camera to acquire images of fluorescence transmitted by the device. Software, which has been specially developed by the project, analyses the images and displays the results of the testing on the computer monitor.

'The idea is to detect cancer at a very early stage, before it has a chance to spread, because we know that specific mutations

in specific genes are likely to be the cause of potential tumours. The doctor can take samples on the spot, feed them into the device, and get a diagnosis in a short time span,' Vezzani says.

Once the devices are commercialised, doctors can routinely and affordably carry out on-the-spot checks of patients who are considered to be cancer risks, and catch



the disease at an early enough stage to treat it — saving thousands of lives.

Diagnosing cancer is just the start for the SMART-Biomems system, however, with other potential applications ranging from any sort of medical testing of DNA samples, to animal health and livestock breeding programmes, etc.

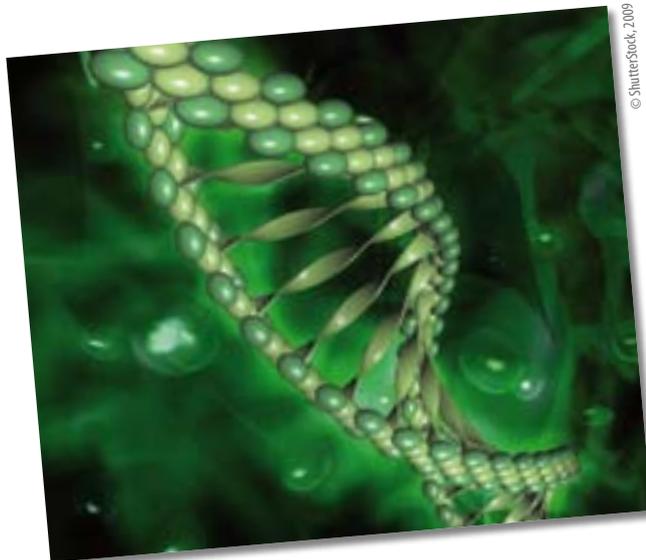
The only restriction is that samples must be liquid, so if, say, firm plant tissue needs to be tested it must be liquidised first. 'Otherwise it is simply a question of storing different reagents in different chambers on the system depending on what it is that you want to test,' says Vezzani. 'SMART-Biomems is what we call a fully integrated microfluidic device which moves a liquid plug of a specific volume through a network of microchannels and chambers where the reactions take place.'

Vezzani says there are companies involved in the project that are looking at patenting some parts of the core technology which has been developed with a view to commercialisation.

'Should the prototype work, which we are sure it will do, we think it would take two to three years after the end of the project to see a commercial device, and these could be available by 2012. Right from the start, we have tried to design a cost-effective system.' So in a few years' time, doctors throughout the EU may have a SMART-Biomems diagnostic system sitting on their desks next to their PCs.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90268>



## New database tool for microarray researchers

*Many achievements in molecular biology research have been made across Europe, yet up until this research there had not existed a public repository from which this data can be shared. ArrayExpress is a database which uses Oracle technology to allow scientists access to microarray data, that is, snapshots of gene expression levels at a genomic scale.*

The EU-funded Temblor project created links between original resources in order to facilitate molecular biology research being conducted across Europe. Its aim was to combine the different strengths of European groups working on various aspects of classification and characterisation of genes and proteins so as to improve the interoperability of biological databases.

As part of this project, ArrayExpress was designed as a public repository where

microarray-based gene expression data can be accessed. Microarray technology makes use of sequence resources created by genome projects, to answer the question 'What genes are expressed in a particular type of organism, at a particular time and under particular conditions?' Microarrays are considered to be one of the most important breakthroughs to be made in experimental life sciences.

ArrayExpress technology consists of the database itself, a data loader and a data

access interface. It runs on Oracle. However, very few Oracle special features are used therefore porting to other database management system (DBMS) platforms is possible.

The mapping used involves classes being mapped to tables one-to-one; furthermore, each object can be distributed across several tables according to the inheritance hierarchy. Some local modifications of the object model were done in order to improve performance of common queries.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4630

## Integration for ultimate information retrieval

*Genomics-related research serves to link multi-disciplinary academic fields and institutions. The EU-funded project Temblor participated in a massive drive to integrate the wealth of proteomic and genomic data available throughout the continent, extending globally in many cases.*

Unravelling and sequencing the genome of an organism is a feat in itself. In order to fully utilise the gene sequences however, this information must be linked to the related transcriptional vehicles and the proteins encoded. Linkage of this information to genetic diseases, their biomolecular basis and molecular interactions then empowers pharmaceutical development and therapy.

Aware of the potential of such levels of integration, the Temblor project resulted in enhancing European resources in these intrinsically related fields. New services were developed relating to protein-protein interactions, macromolecular structures, microarray data and integrative queries.

Among these, and central to the philosophy of integrated data, Integr8, the web portal enabled easy access to integrated information regarding deciphered genomes and their corresponding proteomes. Focussing on the sequence data of a gene the user is able to see genomic, transcriptional and protein structures interlinked.

The Wellcome Trust in Cambridgeshire, United Kingdom, as part of the Gene Ontology Consortium (GOC) since 2001, was responsible for the annotation to the human proteome. Subsequently, from 2006, it continued its genomic research and coordination activities as part of the European project 'Gene ontology annotation' (GOA). Annotations were then extended

to incorporate a range of disease-related proteomes.

The UniProtKB, the UniProt knowledge base, encompasses some 100 000 species and is the world's largest collection of information on protein families. It incorporates information on protein from humans through to plants, and continuing down the evolutionary ladder to viruses. It also includes the most popular animal models of *Drosophila*, *Xenopus* and the zebra fish.

Continual update of the datasets by GOA has, and will ensure that these supply a comprehensive source of reference annotations for the UniProt database. These annotations have resulted in worldwide collaborations as well as enhancing European visibility in the field of genomics and proteomics.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: information exchange/training.

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## Surface plasmon resonance sensor to detect endocrine disruptors

*A new concept of high-throughput surface plasmon resonance (SPR) sensors was developed to detect the presence of endocrine disrupting chemicals.*

There has been growing concern regarding the large number of endocrine disruptors (EDs) that can be found in the environment. These chemicals, even at low levels, are believed to cause adverse health effects like cancer, behavioural problems and reproductive and developmental abnormalities.

In response to this challenge, the Mendos project has developed an artificial receptor-

based optical sensor system for assessing and screening EDs in the environment. A laboratory prototype of an SPR sensor was produced, which can cope with a high throughput. SPR forms the basis for many standard tools for measuring the accumulation of material onto flat metal surfaces or the surface of metal nanoparticles.

The sensor represents a generic platform. It uses sequential chip scanning to read SPR

spectra from rows of diffraction gratings and offers several hundred independent sensing channels. By applying the right surface chemistry and biorecognition elements, the novel sensor can detect molecular interactions and work in parallel with other observations. It is also capable of detecting many analytes or screening many samples for a single analyte.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; information exchange/training; venture capital/spin-off funding.

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## Super-efficient cargo carrier molecules

*The efficient delivery of a biomolecule into a cell where it will have therapeutic value requires a carrier molecule. European research workers have evaluated cell-penetrating peptides (CPPs) for their ability as vectors using a novel assay.*

In the field of gene therapy, the effective delivery of genetic material into the cell where it will perform its function is crucial. Indeed, any biomolecule in the form of cargo must be translocated into the cell to its point of action.

CPPs hold the promise of acting as vectors of hydrophilic molecules into living cells for therapeutic purposes. Without the inherent problems involved with the use of viruses, CPPs appear to be the biomolecular answer for delivery of these remedial molecules.

Consortium partners in the CPP project sought to remedy one aspect of this technique that had been a stumbling block in previous research — that is, exactly how to isolate the most efficient CPPs using high-throughput screening (HTS).

The team tested fluorescent labelled proteins using their emission signals. The procedure required the elimination of luminescence of non-internalised peptides in order to identify those molecules that had been internalised. Another screening method was based on the tracking of non-labelled peptides. These were identified on taking up fluorescent dye when internalised.

In an extension of their work, the process of biotinylation was used to identify the best CPPs for carrying the cargo. Biotinylation capitalises on the binding properties of biotin with labelled avidin. Consequently, the cargoes formed a complex with the biotin-tagged CPP and avidin. Any intracellular protein was then quantified using the label, fluorescent tag or enzyme activity.

## Cell-penetrating peptides and the functional mimicry of proteins

*New methods were studied for the delivery of DNA single and double strand cargoes into cells. This included the potential for cell-penetrating peptides (CPPs) to mimic the functions of proteins.*

CPPs help in the cellular uptake of peptides and the proteins which contain them and have proven their use in intracellular delivery. However, not a great deal is known regarding the frequency and function of cell-penetrating sequences in native proteins. The CPP project compared peptide sequences to test the prediction that intracellular loops of G-protein coupled receptors (GPCRs) have a strong likelihood for occurrence of cell-penetrating motifs.

The loops are also sites for receptors, which sense molecules outside the cell, activate cellular responses, and are involved in G-protein interaction. Therefore, the research team hypothesised that short CPPs, derived from GPCRs, can pass through the cell membrane and modify G-protein activity in a way similar to receptor proteins.

The principle was tested by analysing two different model systems. The first used

## Putting drinking water to the public health test

*An in-depth study carried out by the Ashram project examined the effects on the human body of consuming the naturally occurring arsenic found in drinking water. The study looks at the association of arsenic with bladder, skin and kidney cancers and in particular the risk, mechanism and susceptibility of the arsenic component in relation to these cancers.*

Arsenic is a poisonous metalloid and this chemical is soluble in water. The arsenic found in groundwater is of natural origin, and is released from the sediment into the groundwater due to the anoxic conditions of the subsurface. Some geographic areas contain very high levels of naturally occurring arsenic. There has not been a public health disaster in these areas as it can be avoided by the use of bottled water. Inorganic arsenic is

a human carcinogen. As of 2004, EU legislation states that total arsenic levels in drinking water should not exceed 10 parts per billion.

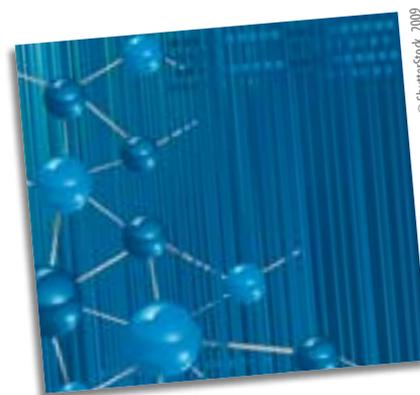
The EU-funded Ashram project was a large multi-country hospital based case-control study of arsenic and cancer risk. It was completed, based on multi-disciplinary work in the fields of epidemiology, toxicology, analytical chemistry and genetics. By examin-

Further research is planned which would involve the enzyme based assay (Cre-recombinase) in reporter mice to ascertain the specificity of CPP delivery. The ability of CPPs to successfully ferry therapeutic molecules into cells holds amazing potential for the biopharmaceutical industry.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support.

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the peptide M511 from rat angiotensin, which contracts blood vessels. The second employed the CPP known as G53-2. This comes from the human glucagon-like peptide receptor GLP-1R and instigates the release of insulin. Both peptides induced the same results as their original host proteins. The results therefore suggested that it could be possible to mimic the effects of signalling trans-membrane proteins through the use of shorter peptide fragments.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support.

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ing 1 200 cases and 600 control cases, the project looked at a larger population than had ever been previously tested in this field of aetiology.

The results showed that there was a positive association between exposures to arsenic and three cancer types; these are skin, bladder and kidney. It was found that the correlation was strongest in the case of skin cancer. It was taken into account and the necessary adjustments were made for variations in diet, tobacco consumption and occupation.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

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## Stepping up immune responses against swine fever

*Classical swine fever is a contagious viral disease that exacts a high social and economic cost. The EU-funded project IMPCSF has developed rapid screening and evaluation protocols for a range of novel vaccines and their delivery methods.*

The effects of an outbreak of swine fever are daunting for the pig market, especially for producers. Measures to contain the disease include a ban on meat movement, export, and slaughter and burning of carcasses on affected farms. These huge social and economic costs provided the catalyst for research by the IMPCSF project into marker vaccines that could provide early protection. This in turn may limit the duration and subsequent cost of any outbreak.

Scientists are faced with an array of possibilities for the immunogenic element of the vaccine, its system of delivery and the use of adjuvants to improve the performance of the vaccine. Immunogens include synthetic nanoparticles, virus-like particles, viral proteins or nucleic acids. For delivery, viro-

somes and ligands promoting their uptake are available.

At the Institute of Virology and Immunoprophylaxis in Switzerland, project partners developed high-throughput culture systems for the evaluation of the most potent combinations for vaccine development. Together with the most appropriate delivery mechanisms and adjuvants, the ability of the most promising vaccines to stimulate both innate and adaptive immune responses was evaluated.

Monocyte derived dendritic cells were used as antigen presenting cells to monitor T-cell responses. Particularly successful for antigen delivery was messenger RNA (mRNA). The team found that transfection using mRNA had many advantages over other methods.

In particular the fact that mRNA transfected antigen presenting cells can display the full range of antigenic determinants.

The team also developed a screening system for isolating promising vaccine adjuvants for potential use in emergency outbreaks. They used cells that naturally produced high levels of interferon (NIPCs) to produce vaccines that induce high concentrations of interferon-alpha.

Movement of meat products within Europe is a large economic concern. One of the possible drawbacks of this movement is the spread of diseases like classical swine fever. The development of effective vaccines and adjuvants could lessen the impact of imported viruses.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; joint venture agreement; information exchange/training; private-public partnership; available for consultancy; other.

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## Improved mutation screening for malignant melanoma

*Cutaneous malignant melanoma (CMM) causes the greatest number of deaths from skin cancer, worldwide. A team of scientists with a European project have identified and defined gene mutations associated with this cancer using a novel mutation analysis protocol.*

CMM is the result of the transformation of normal melanocytes into melanoma cells, by melanomagenesis. Recent data suggest multiple pathways involved in melanoma pathogenesis with a progression of mutations that alter cell proliferation and differentiation.

Members of the EU-funded project MAUVE investigated the types of mutation prevalent in the development of CMM. As CMM development hinges on the stepwise progression of mutation induced cell changes, an integral part of this research was the development of a new analysis for changes in DNA.

The basis for this development was the combination of two protocols that resulted in a highly efficient screening tool. The first of these methods was single stranded conformation polymorphism (SSCP) analysis capable of detecting DNA polymorphisms and mutations. This was merged with denaturing gradient gel electrophoresis (DGGE) that screens small fragments of DNA specifically for point mutations.

The team went on to analyse mutations linked with different stages and forms of melanoma development. The N-ras and BRAF onco-

genes provided a very good example of association with specific cell stages and types.

The gene known as N-ras functions as a biomolecular switch and is often deregulated in tumour cells so this can lead to invasion, metastasis and reduced programmed cell death or apoptosis. The scientists found that N-ras mutations were associated with congenital naevi.

By contrast, mutations in BRAF genes which are frequently associated with cancers including malignant melanoma are more often found in conjunction with dysplastic naevi. Dysplastic naevi are considered to occupy a developmental middle ground between the benign melanocyte and CMM.

Further work on tumour suppressor gene and cell division cycle inhibi-

tor mutations added to the evidence that melanoma development was largely linked to specific identifiable mutations. Significantly, these can be induced by exposure to UV-A and UV-B radiation.

Early detection of cutaneous melanoma is the best way to reduce mortality. This form of cancer is highly aggressive even in the early stages so prompt diagnosis is crucial. The potential markers identified in this piece of research could be instrumental in improved characterisation of cells from melanoma biopsies.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support.

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## Future new approaches for bowel disease treatment

*Inflammatory bowel disease (IBD) can seriously impact the patient's quality of life. Understanding the genetic basis of the pathology could pave the way for new therapeutic developments.*

The EU-funded 'Genetics of IBD' project sought to identify specific genes that affect disease onset and manifestation. Even though lifestyle factors have been shown to play a very important role at the onset of the disease, little is known about the genetic background behind it.

In order to facilitate the genotyping studies, project partners developed a micro-

array manufacturing system for the production of complementary DNA (cDNA) arrays. Microarrays for chromosome 6 were produced based on the rationale that the genetic predisposition is likely to play a factor in chronic inflammation states like IBD. Indeed, chromosome 6p has been linked to a series of inflammatory diseases including ulcerative colitis and Crohn's disease.

## Pharmacogenetic data for irritable bowel disease

*Inflammatory bowel disease (IBD) is affected by environmental factors but has a polygenic basis. Research by the EU-funded project 'Genetics of IBD' was conducted on a pharmacogenomic level to identify suitable drug therapies geared to the individual genotype.*

IBD is a condition that causes vomiting, diarrhoea, weight loss and is sometimes associated with other atopic diseases like arthritis and asthma. Although the disease can be triggered by factors associated with modern lifestyle, gene complexes associated with susceptibility have been found on chromosomes 6, 12 and 16.

Pharmacological treatment with glucocorticoids is successful, but only in about two out of three cases. Anti-tumour necrosis factor (TNF) alpha monoclonal antibodies can be administered to refractory patients not responding to steroid treatment but are limited in success to the same extent. To find the biomolecular basis for failure, these therapies provided the catalyst for the investigation into new pharmacogenetic therapies.

Two groups of refractory patients were studied by project partners at the University Hospital of Schleswig-Holstein. Altogether, some 570 patients constituted the largest and most diverse study group to date. The two cohorts of patients were given the Infliximab anti-TNF monoclonal antibody.

Previously identified single nucleotide polymorphisms (SNPs) in novel inflammation genes were scrutinised. Samples of DNA were first amplified using the semi-automated polymerase chain reaction and then subjected to a Taqman drug response analysis.

Data analysis used case-control statistics and multiple regression models. These methods ensured the identification of statistically independent predictors of response

In order to verify the initial assumptions, proteomics technologies were utilised for the differential expression of genes and for a systematic post-expression analysis. Through a complex genotype-phenotype analysis the applicability of molecular findings to the population will be defined. The overall aim is to pinpoint and identify abnormalities at the molecular and genetic level thus creating possible new routes for therapy.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; information exchange/training.

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to drugs. Moreover, the scientists took corroborative samples from other trials and re-tested the results to eradicate statistical errors known as false positives.

Outcomes of this comprehensive and thorough piece of research were that variants of the tumour necrosis factor system and the NOD2 gene, which is linked to inflammatory bowel disease, were analysed. Future research was planned involving the combined effects of different gene variants in both pathways with a view to clinical trials using the new markers. Genetic profiles of patients to indicate appropriate drug therapy constitutes a major step forward in the treatment of inflammatory bowel disease.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; information exchange/training.

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## Skin penetration of titanium dioxide nanoparticles in sunscreens

*Uncoated ultra-fine particles (less than 2 nm) of titanium dioxide (TiO<sub>2</sub>) have been used in sunscreens over the last decade. The Nanoderm project investigated the ability of skin to act as a barrier to ultrafine particles, preventing them from entering vital tissues.*

The last 10 years have seen an increase in the use of nanoparticles in body care and household products. Manufacturers use TiO<sub>2</sub> in sunscreen because of its high refractive index, its strong UV light absorbing capabilities and its resistance to discolouration under ultraviolet light.

Researchers from the Nanoderm project used standard tape stripping techniques of the outer skin layer to study the penetration of TiO<sub>2</sub> nanoparticles into skin. Novel microscopy pilot studies using ion beam analysis allowed scientists to visualise the penetration pathways of nanoparticles in

excised skin. The advantage of this approach was that only a few steps were needed to prepare samples.

Furthermore, larger samples could be studied to achieve an overview of large areas, as well as zooming in on an area of particular interest. However, the technique was time consuming and unable to visualise individual nanoparticles. The conventional method of high-resolution transmission electron microscopy (HRTEM) was able to visualise individual particles but suffered from a limited field of view. It also

continued on page 13

## Questionnaire for better health in kids

*In determining the quality of life of children suffering from chronic illnesses, an EU-funded project Kidscreen developed a means by which to attain more accurate and reliable information. By turning to the children, and asking them to report on themselves, the project attained greater value feedback and a more accurate, standardised screening tool.*

In computerising the questionnaire the project makes it available for administrators of hospitals, epidemiologists and other public health- and medicine-related fields. The purpose of developing the questionnaire lies in the drive to develop a standardised screening tool. Developed with the purpose of being proactive as well, using the questionnaire can help identify at-risk children. Based on their subjective perception, it is possible to identify any possible health risk and to aid in suggesting the required early preventative measures.

Related to affording protection, a proxy measure is also available for care-givers and parents. The questionnaire is suitably designed for children of 8 to 18 years of age and measures a number of dimen-

sions on health-related quality of life issues (HRQOLs). For example, it has five items measuring physical well-being, six items related to psychological well-being and another five items related to self-perception. Other concepts the questionnaire focuses on are school environment, home support and peers as well as questions relating to social acceptance.

There are three modules involved in Kidscreen each taking about 10-20 minutes to fill in, with scoring providing T-values and percentages stratified for differing countries, regions, age and even gender. Kidscreen has existed in paper-based questionnaires but

has, through this project's initiative, been made electronic for wider and greater use. Whilst Kidscreen has been tested and validated and shown to have overall satisfactory results, further development will continue to refine the product.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: information exchange/training.

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## Predator detection system of the wood cricket

*Based on knowledge of sensory ecology and microtechnology, this study of the wood cricket looked at the relationship between sensing, perception and action. The focus of the Cicada project was on how this insect escapes danger posed by its natural predator, the spider.*

This project examined the sensing system of wood crickets by tracking their air currents' perception. Based on bio-electronic technologies, the scientists evaluated the behaviour of the mechanoreceptor hairs on the cricket, which respond to the stimuli from attacking predators.

The main results collected led to a number of interesting conclusions. Firstly, it was noted that juvenile crickets differ from the older ones in their response to the predator (the spider). The younger insects were

observed to hide under leaves. Secondly, it appeared that the predator employed two tactics to avoid the detection system of the wood crickets. It either attacked very quickly, thereby surprising its prey, or very slowly, in order to mitigate its intention to attack. Understanding of the importance of the airflow around the sensory system of the cricket improved throughout the study. It was found to be characterised by a high density of non-interacting short hairs at the base of the cercus. This is where sensitivity to air currents is highest.

The Cicada project achieved a better understanding of the physiological basis of sensing. The information gathered will be transferred to the development of highly integrated artificial life-like miniature systems. The project also increased the advancement of biometric simulated perception systems. This allowed scientists to assess the relative importance of variables on performance and to provide conceptualisation tools for the design of biometric man-made sensors.

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

Collaboration sought: further research or development support.

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required far more steps in the preparation of samples.

The Nanoderm project also applied the technique of autoradiography for the first time to dermal penetration studies. The team used  $\text{TiO}_2$  and the radiolabel 48-V to track the passage of nanoparticles in skin cross-sections. Researchers applied different formulations of sunscreen and used different skin types, pre-treatments of skin and exposure times.

The results showed that in healthy skin titanium was detected in the outermost layers.

None of the 500 or so images demonstrated a clear pathway through the skin. The  $\text{TiO}_2$  nanoparticles had penetrated the outermost layers of skin through mechanical action and no diffusive transport had taken place. Deep penetration had occurred into the hair follicles, but this would be cleared through the natural excretion of sebum.

There was no clear evidence that nanoparticles affected cells, however Nanoderm recommended that sunscreen should not be applied to open wounds. They also concluded that no health effects were

expected from the application to healthy skin of sunscreens containing  $\text{TiO}_2$  nanoparticles.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; information exchange/training; available for consultancy; other.

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## Advances in mushroom pest control

*An effective and efficient strategy for the biological control of the principal insect pests (sciarids and phorids) of mushroom cultivation was developed along with ways to put it to practical use.*

In order to control the two major pests, the PRIME project developed strategies using mite and/or nematode biological agents. The phenology and predatory behaviour of the mite species during various production stages of the mushroom cultivation process was established. This was necessary in order to allow for recommendations for application rates and timing of introduction for the best pest control.

Beyond this, trustworthy, sustainable and cost-efficient means for mass rearing the mites was created so that their use in the industry could be of economical value. New

nematode isolates were sought in order to help control phorids in a more tolerable concentration. In this way, the new isolates could be utilised for selective breeding of the nematodes to better their control capacity for phorids. Ultimately, determining the possibility of combining both mites and nematodes to come up with the best biological control strategy for both mushroom fly pests was sought.

What followed was the gathering of information regarding timing, rates and method of application, as well as monitoring. Included in this effort was general know-

ledge of product use on other facets of mushroom growing. Also taken into consideration was information regarding the effects that other husbandry activities may have on the effectiveness of the product both during and after application. In this way, any necessary relevant and remedial actions could be taken.

Outcomes were to be promoted in product and company literature as well as sales and technical meetings held with growers and technical advisors. These efforts could further enhance the mushroom industry in the control of sciarid and phorid pests.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: marketing agreement.

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## Microbial inoculants for tropical agriculture

*The scientists from the Ubenefit project created molecular tools for determining the quality of microbial inoculants used in tropical agriculture and forestry. These tools were safe, inexpensive and easy to reproduce and can be used in laboratories that are only basically equipped.*

Researchers developed a simple procedure for isolating DNA from the root nodules of tropical legumes. Legumes are able to fix atmospheric nitrogen in the soil due to the presence of bacteria known as rhizobia in the plant's root nodules. Well-known species of legumes include peas, beans, lentils, clover and alfalfa.

The beneficial effects that can be gained from inoculating trees and crops have been known for a number of years. Although these techniques have been used around the world, the technology was not well devel-

oped in Africa. Therefore, increased uptake by local users was encouraged by promoting initiatives such as the Network of Farmers' and Agricultural Producers' Organisations of West Africa (ROPPA). This association has collaborated with millions of farmers throughout west African countries.

The distribution of nitrogen fixing symbiotic bacteria inoculants was implemented through international manufacturers, or they were produced by local units. Mycorrhizal fungi, which have a symbiotic relationship with the roots, were produced on

the plants. Small production units were tested under the supervision of farmers' organisations, while the distribution of inoculants to users was carefully controlled.

Primary end-users for this work include laboratories who wish to follow the behaviour of selected microbial strains during field trials. The techniques developed can be employed by quality control services in order to identify the strains in the inoculants. Farmers and foresters can also benefit from high-quality inoculants.

Funded under the FP5 programme 'INCO 2' (Confirming the international role of Community research).

Collaboration sought: information exchange/training.

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## Extraction of bioactive compounds from berries

*Researchers have developed new enzyme and processing tools, leading to improved extraction of health-giving bioactive compounds from berry and grape residues. This has resulted in less waste plus healthier products for the consumer.*

Doctors recommend that we eat more fruit and vegetables to improve our well-being and to reduce the risk of chronic diseases. Unfortunately, during the processing of berries and grapes, much of the dietary fibre and healthy phytochemicals are lost. The Maxfun project has developed enzymatic extraction techniques in order to extract anthocyanin and other phenolic compounds from grape and berry residue.

Researchers used both commercial enzyme mixtures, cutinases, rhamnosidases and rhamnolacturonan IIases (RG IIases), which were isolated during the project.

Researchers found that enzyme activity should be avoided so as to avoid the degradation of anthocyanins. Anthocyanins are water soluble pigments which belong to the flavonoid group of chemicals and are plant nutrients that benefit the human body.

The yield of juice and phenols was increased by selecting those enzymes that break down pectin, a natural gelling agent, and soluble fibre. Scientists also found that the use of ultrasound helped the enzyme mixture to breakdown pectin, thus reducing the amount of enzyme needed.

High-pressure processing affected the way in which enzymes broke down the cell walls of the substrate. However, it did not improve the extraction of phenols. The yield of polyphenols was increased when *Humicola cutinase* was applied to blackcurrant residue following processing, which had been treated with pectinase. During the processing of grapes, enhanced cell wall hydrolysis through the use of enzymes for breaking down pectin, did not improve the extraction of polyphenol.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; information exchange/training; private-public partnership; available for consultancy.

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## A portable micromodule for gluten extraction

*Scientists have been working on a micromodule to extract coeliac disease toxic gluten from food samples as a precursor to performing an assay. This technology could make life a lot more bearable for individuals who suffer with this often debilitating condition.*

Coeliac disease is an autoimmune condition which is triggered by gluten, a composite of the proteins, glutenin and gliadin. The effects of this intolerance are mainly related to damage of the bowel. Malabsorption is one of the main effects of the condition. This can lead to vitamin and mineral deficiencies, fatigue, and weight loss with failure to develop properly in young children.

A restricted diet that does not incorporate gluten is crucial for sufferers. This provided the impetus for the EU-funded project CD-CHEF to develop a disposable microsystem for the detection of toxic gluten sequences. Appropriately, the CHEF in the project acronym is derived from 'chip with integrated extraction and fluidics' which aptly describes the elements of the microsystem.



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Project partners at the Institute of Microtechnology Mainz GmbH in Germany developed a micromodule specifically for the extraction of gluten from all types of foodstuffs. The extraction method can be viewed as three separate modules incorporating a chip, an extraction module and a centrifuge.

The chip provides buffer storage for the extract as well as an interface for the propulsion system. The components for actuation consist of a syringe pump which operates on the basis of peristalsis and a valve which

enables sufficient pressure to be applied to the three modules.

The extraction module is essentially a silicon tube for the sample and the buffer which is pre-filled using the valve. The sample and the buffer are mixed together vigorously. Below the tube is a heating coil to achieve the required 90 °C for extraction of the processed food.

The micromodule contains a number of disposable elements to prevent contamination between food samples. These include the polymer block where the valve is housed, the silicon tube and its connectors to the chip. For reasons of cost effectiveness, all other components are reusable as they do not come into contact with the sample being processed.

The prototype demonstration model can be merged with biosensor equipment with no loss of portability. There has been wide interest in the product, from consumers to biotechnical companies.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; licence agreement; marketing agreement; manufacturing agreement; venture capital/spin-off funding; available for consultancy.

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## Successful manoeuvres in the subarachnoid space

*Researchers with the Minosc project have analysed magnetic resonance imaging (MRI) scans of the subarachnoid space of the spine. Their aim was to facilitate the treatment of spinal cord lesions.*

Spinal cord lesions are usually the result of trauma from injury but can be due to tumours, degenerative diseases or congenital conditions. Successful treatment often requires investigation of the affected area by insertion of a microendoscope into the area surrounding the spinal cord. The subarachnoid space is the cavity between the arachnoid and the pia mater. The meninges consist of three layers: the dura mater, the arachnoid mater, and the pia mater.

Members of the EU-funded project Minosc made it their aim to develop a flexible microendoscope to visually assess the lesions and to operate simultaneously with associated equipment. In order to fulfil this objective, the physical, anatomical and physiological properties of the subarachnoid space must be analysed to ensure the accurate manoeuvrability of the endoscope.

Project partners at the Israel Institute of Technology (Technion) specifically researched previously uncharted areas of

the thoracic subarachnoid space. MRI scans from 42 patients were merged to produce data on the dimensions of the spinal cord and the volume and shape of the dural sac and the subarachnoid space. These were taken at mid- and inter-vertebral disc levels to produce a complete map.

The measurements match those available from previous studies. They were recorded for the transversal plane which cuts the body into top and bottom portions. A low level of variance was evident as there was a high degree of symmetry. Another story was revealed in the sagittal plane however. Dividing the body into right and left portions, in the median plane, there was found to be a very significant coefficient of variation (as high as 42 %).

The findings in this study not only increase the knowledge of the structure of the spinal cord. The models also dictate the maximum dimensions of the endoscope so that it can perform accurate movements in the sub-

arachnoid space. This will no doubt increase the success of surgery for those with spinal cord lesions.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: joint venture agreement; licence agreement; venture capital/spin-off funding.

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## Portal for regulations to improve oil and gas services

*Keeping pace with new regulations, codes and changes in policy and potentially informing all interests involved is the purpose behind the EU-funded project Trends.*

With the pressure on the oil and gas service and supply industry to improve standards, operation procedures and technologies, has come the need to formulate policies and directives. In line with this is the requirement that all involved parties should be kept informed. Therefore, as part of an EU-funded project, Trends sought to develop a standardised means in which to keep pace with such developments and hence put forward a useful web-based portal and database.

The web portal aims to provide the latest information in the form of newsletters. It also provides pathways to regulations, details of emerging codes and standards, and user postings related to experience with the application of codes. In order to maximise user experience, the portal contains intelligent search features providing useful links to related data.

During the compilation of information, as well as utilising findings from other work programmes, the consortium was able to put forth several observations. Most of these fall within the category of standards and uniformity — or rather the challenges brought about due to

the lack thereof. For example, the interchangeability of information is not streamlined or easy due to the lack of compatible standards of databases. Nor is there any safeguard against losing information once a project or development is ended. In such cases, the lack of a common repository is at fault. There is also a lack of standardisation between eastern European and western European interest.

From these observations, the project has put forth a number of recommendations to tackle the problem. One solution that would go a long way to help is the development of standardised software for regulations, codes and standards. This could be developed at an EU level and should be easily interchangeable between any development activity. The software developed under the Trends project is suitable as a basis for such a development. Other solutions could be attained though several initiatives like data collection activities, improving collection methods and in developing more consistent application for risk-based inspection methodologies.

With these developments in place, great emphasis can be given by the oil and gas industry to improve the quality of health, society and environment. Moreover, they would also contribute significantly towards a high-quality, cost-efficient energy service. The industry has a vast amount of interests involved, from research and development (R & D) institutes to NGOs, GOs and even construction yards, consultants and universities. Involving all these in an environment of useful and helpful dialogue would contribute towards maintaining and increasing European leadership for standards in the sustainable energy industry.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support; information exchange/training.

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**See also page 26 (Offshore oil and gas environmental risk management)**



## Biofuels on the road

*As the consumption of fossil fuels for road transport steadily increases, the need to cut down carbon dioxide (CO<sub>2</sub>) emissions in the long term is becoming more pressing. There is therefore an urgent demand to develop not only alternative, but also additional fuels.*

Biofuels are beginning to be increasingly used, notably for transport where the European Commission has set an ambitious target of 10 % share in overall petrol and diesel consumption by 2020. Specifically, bioethanol, offering a clear advantage in terms of security of supply, has been the focus of many research initiatives aiming to overcome current technical barriers to their wider use.

The Afforhd project, under the coordination of the VOLVO Powertrain Corporation, carried out a well-to-wheels analysis to estimate pollutant emissions, energy efficiency and industrial costs of all significant alternative fuels. This allowed project partners from automotive and biofuels industries

to suggest improvements in dimethyl ether (DME) fuels, which were incorporated in the design of a new generation of heavy-duty vehicles.

DME is a multi-source fuel that can be produced not only from fossil resources such as coal, petroleum and natural gas, but also from synthetic gas generated by the gasification of biomass. As a chemical, it is non-toxic and benign to the environment, and as a diesel fuel it was proven to offer the desired potential for ultra-low exhaust emissions due to its soot-free combustion.

An additional aim of the lifecycle assessment was to compare different production routes of renewable fuels from an environmental point of view. The estimated contributions of emissions from production, distribution and final use of each fuel have demonstrated the superiority of DME over methanol (MeOH) and Fischer-Tropsch diesel.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support; information exchange/training, available for consultancy.

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## Assessing economic potential of compressed air

*The EU-funded project AA-CAES, looked into ways of improving compressed air technology to bolster wind turbine electricity generation. It also investigated the financial feasibility of such hybrid technologies, developing models to determine their potential.*



Compressed air as an energy source works on the principle that when compressed in porous caverns, the air can be stored at 100 bars or more. When it is returned to the surface, the compressed air is heated and used to drive a generator via a turbine that produces electricity.

Of the two plants developed worldwide, however, none experienced an efficiency conversion of more than 55 %. New research initiatives however, have looked into utilising the excess energy loss to drive wind turbines instead. The marriage of the two technologies, whilst seemingly an unlikely coupling, makes sense in that wind turbines are not a consistent source of energy generation, relying on wind and weather conditions.

However, to bring the two together, research had to be conducted in a great many areas. Suitable heat storage devices and the development of economic plant models with the required safety operating standards had to be considered. The development of fast-response sliding-pressure turbines was also investigated. Project partners at the Universität Köln worked on the development of detailed economic models for mass storage of electricity in European markets.

The research developed three economic models particular to the project but retained applicability to any mix of power generation and therefore could be applied to any energy market. The first model, GEMS, was based on an investment and dispatch principle of the German power system. It looked into ways in which power generation costs could be reduced both on a long-term investment and short-term operation basis. The GEMS model was then adapted to the Dutch market to derive the GEMS-CHP model. Here it included heat and power generation but excluded lignite plant and pumped hydro storage. The third model, DIMEX, is a linear optimisation model taking into account technical constraints and economic parameters to determine optimal plant dispatch and its generated revenues.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: information exchange/training.

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## Emission-free compressed air energy storage

*A novel form of emission-free compressed energy storage was developed to compensate for shortfalls during periods of peak demand for electricity.*

Conventional compressed air energy storage (CAES) power plants store off-peak energy by compressing air into underground caverns. During periods of peak demand for energy the compressed air can then be released from underground, then heated and used to drive turbines as it expands.

Such CAES power plants are not emission-free because the compressed air is heated with a fossil fuel burner prior to expansion. However, new technology in the form of advanced adiabatic compressed air energy storage (AA-CAES) enabled the medium- to long-term storage of electricity, with zero emissions. It employed heat recovered from the compression of air to heat the expansion process.

The AA-CAES project established a database for experimental literature, data and models concerned with the thermodynamic and

transport properties of humid air. Researchers addressed a number of challenges including the generation of thermodynamic data for homogenous and saturated states. Data was also generated for transport, viscosity and the thermal conductivity of humid air under high pressure. The team also developed models calibrated with reference data for the properties of humid air.

The AA-CAES project sought to develop the technology as a means of electrical storage for disconnected grids, such as those found on islands. It can

be used to compensate for shortfalls during periods of peak power usage, as a result of increased use of intermittent renewable energy such as that from wind turbines.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support; available for consultancy.

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## Thermal stress and component failure in nuclear plants

*New research by experts in France has indicated that the effects of thermal stress on key components of nuclear power plants are not the same as those of mechanical stress.*

As EU Member States come under pressure to reduce their carbon emissions, many are looking to extend the use of existing nuclear power plants (NPPs) or to construct new plants. France is a prime example. Its primary energy producer, Électricité de France

(EDF), participated in a research project aimed at assessing the long-term risks associated with thermal fatigue.

The project entitled Therfat, which was supported by Euratom, concentrated on Tee connections. While much is known about mechanical failure, little research had been carried out to date concerning thermal failure. EDF logged considerable time in the laboratory subjecting model Tee connections to varying degrees of thermal stress. The goal was not only to reproduce conditions similar to those experienced in real NPPs, but also to simulate extreme thermal shocks.



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## Best practice selection for the energy industry

*The advancement of hydrocarbon energy industries in Europe has been enhanced through the development of a best practice selector tool, enabling industry-wide standards and quality assurance measurement.*

The Trends project aimed at propelling the continuous advancement of the performance of quality, health, safety and environment (QHSE) of the energy industry and spur on the activities of this industry. The means of achieving this goal was through promoting sustainable development of European hydrocarbon energy industries and furthering capability through efficient, safe and responsible utilisation of hydrocarbon and renewable resources. In so doing, it was vital to form a dialogue among consultants, class societies, RTD institutes, universities, GOs and NGOs.

With such a wide area of coverage needed, it was concluded that the optimal method

of sharing information would be through e-learning, a cost efficient option reaching the widest audience. This is of key importance regarding the challenging and demanding training needs of QHSE and corporate social responsibility (CSR). This is because the needs had not been well established and industry-wide standards had been limited. With no set standard, there was great variation in both competency and content and hence no measure of quality assurance.

Given this lack, a best practice selector tool was developed which could choose the best practice training through the use of various descriptors and do so according to the cus-

tomers' needs. In this way, companies can join forces towards improved and seamless standards when it comes to their training needs. With such an accomplishment, the comparison and evaluation of courses and programmes is facilitated, resulting in better training quality across companies.

The results were encouraging as the components were able to withstand loads greater than those defined in the relevant specifications of the American Society of Mechanical Engineers. Thus, EDF was able to validate existing theory regarding component behaviour under thermal duress.

In comparison with mechanical stress, it was learned that the number of load cycles for crack initiation is the same for thermal stress. However, while mechanically-induced cracks propagate and subsequently cause component failure, thermally-induced cracks tend not to spread significantly.

EDF stressed that the results not only apply to Tee connections, but also to other critical NPP components.

Funded under the FP5 programme EAECTP C (Euratom research and training programme in the field of nuclear energy).

Collaboration sought: further research or development support; information exchange/training; available for consultancy.

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As a follow-up to this project, it was planned that the tool be more thoroughly developed and maintained by the Virtual Risk Institute so that knowledge and expertise could be kept up to date and available.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support; joint venture agreement; information exchange/training; private-public partnership.

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## Looking more closely at offshore wind turbines

*Whether online condition monitoring (CM) techniques add value to operation and maintenance strategies of offshore wind farms and how these techniques can be improved has been explored within the Conmow project.*

The estimated costs for the operation of offshore wind farms located at remote sites under harsh conditions are significantly increased by unexpected failures leading to corrective maintenance work. A reduction in the number of these unexpected failures could be achieved if adequate CM techniques were applied, both

for early failure detection and fault tolerance control.

Experience with CM techniques in offshore wind farms was limited before the launch of the Conmow project and showed the numerous difficulties in ensuring their successful application. Moreover, little

information was available on operation conditions as wind turbine designs have changed rapidly over previous years and larger differences exist between different wind farms.

Researchers at the Prüftechnik Dieter Busch Condition Monitoring GmbH & Co Kg thus focused on the integration of CM systems into the supervisory control and data acquisition (SCADA) systems. Valuable information such as temperature, pressure and status

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## Big business encouraged to think responsibly

*A United Kingdom-based consultancy led a review into the subject of corporate social responsibility and the part it plays in management considerations in the offshore oil and gas industry. The research revealed some interesting conclusions.*

This review was conducted as part of Trends-2, an EU-funded project. The aim of the Trends-2 project was to investigate ways to satisfy Europe's future demands and needs for sustainable, secure, safe and clean energy supplies. It is within that scope that this review took place.

The point of departure for the consultancy's research was for it to examine the degree to which health, safety, environment and quality (HSEQ) management was seen as being integrated with corporate social responsi-

bility (CSR). Case studies were conducted into offshore oil and gas companies across Europe. In addition, workshops were organised to elucidate the theme to interested parties. These workshops were held at Modena University in Italy.

The key findings of the research shed light on the state of corporate social responsibility actions in the offshore oil and gas industry. It was concluded that there seems to exist a lack of guidance and management tools, such as environmental and social impact

assessments. It was noted that whilst the industry would clearly welcome more evidence of the business benefits to be accrued from investment in CSR, there is a danger that this emphasis would damage the trust of external stakeholders. Finally, it was recommended that further research be carried out. In particular, this would investigate the feasible extent and depth of CSR, the limits, if any, for companies and the role of governments, regulators and other stakeholders.

Funded under the FP5 programme EESD  
(Energy, environment and sustainable development).

Collaboration sought: further research or development support; information exchange/training; private-public partnership; available for consultancy.

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## Designing powerful yet silent wind turbines

*In order to see more intensive use being made of wind turbines as a renewable energy source, it is perhaps paramount that their design is optimised in order to reduce the unwanted noise they generate. The Sirocco project has paved the way for the creation of a new generation of wind turbines with improved acoustic performance.*

Wind energy is rapidly becoming a popular source of generating electrical power. It has considerable advantages in that it is a renewable energy source and reduces carbon dioxide (CO<sub>2</sub>) emissions. However one of the main difficulties associated with the wind turbine is the noise pollution it creates and it can be argued that this is the main reason for limiting the widespread use of wind energy in Europe.

The noise generated and the likelihood of it becoming stressful to those living or working in close proximity to turbines is dependent on a number of factors. It is determined to a large extent by how it compares to the existing background noise. This could potentially make the difference between turbines sounding like a gentle hum in the distance to being a distressing pulsating noise when not masked by background noise.

The Sirocco project investigated how to adapt the design of the turbine in order to reduce the noise created without reducing its generation efficiency. The scientists looked at improving the acoustic performance of the wind turbine whilst maintaining the strict geometrical and aerodynamic constraints applied. They tested amongst other things, the possibility of controlling the properties of the boundary layer of wind turbine blades.

The research highlighted promising avenues for further investigation into a new generation of turbines. It also revealed that more investigation is needed in order to fully understand the mechanisms of noise in wind turbines. It was noted that in this context the collaboration between industry and other institutions should take centre stage. The project was the first step in achieving this goal since it brought together a net-

work of companies and institutions that work together across Europe with a common objective of reducing noise emitted by wind turbines.

Funded under the FP5 programme EESD  
(Energy, environment and sustainable development).

Collaboration sought: further research or development support; financial support; information exchange/training.

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signals could then be used without the need of a clear alarm from the SCADA system.

A vibration monitoring system, equipped with acceleration sensors was installed for this purpose at multiple turbines within the test facilities of the Energy Research Centre of the Netherlands. Prüftechnik Vibroweb XP<sup>®</sup> collected operation data as well as load measurements through dedicated web interfaces for further analysis and algorithm development.

On the other hand, Prüftechnik Vibnode<sup>®</sup> systems that use displacement sensors were installed at the low-speed section of the drivetrain and were proven to be superior to vibration sensors. Analysing electrical power measurements could trace increased vibration levels due to misalignment of the generator shaft which indicated mechanical abnormalities or even premature faults.

Continuously measuring the vibration behaviour and performing preliminary evaluations

over the whole range of operation conditions resulted in reduced amounts of data for later offline analysis in the diagnostic centre. To facilitate the generation of reports and access for non-specialists to these reports, the Prüftechnik reporting tool Omnitrend<sup>®</sup> was further developed.

Funded under the FP5 programme EESD  
(Energy, environment and sustainable development).

Collaboration sought: information exchange/training; other.

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## Using treated wastewater for irrigation

*Technology transfer from Europe to Africa enabled the conversion of wastewater into a valuable resource for agricultural applications at a low cost.*

The INCO 2 programme sponsors cooperative research projects between EU Member States and third countries. One example is the Ubenefit project, which brought European expertise in wastewater treatment to countries in sub-Saharan Africa.

During Ubenefit, the Institut de l'environnement et recherches agricoles (INERA) helped to establish a peri-urban wastewater treatment system in Burkina Faso. The introduction of inexpensive stabilisation ponds helped bring microbiological water quality indicators in line with standards set by the World Health Organization (WHO). For instance, counts of faecal coliforms and worms dropped to 104/100 ml and less than one per litre respectively.

The treated wastewater was subsequently used to irrigate new stands of fodder and fuel-producing trees planted during Ubenefit. This represented significant progress considering that up until then untreated sewage was the primary source of irrigation water for agricultural applications in Burkina Faso.



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An added advantage discovered by INERA was that elevated levels of phosphorus and nitrogen in the treated wastewater eliminated the need, and the cost, to apply additional fertiliser. Consequently, the Ubenefit project achieved not only health-related, but also financial and environmental benefits.

Funded under the FP5 programme 'INCO 2' (Confirming the international role of Community research).

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## Data management for weather measurement

*Changing weather cycles are not always caused exclusively by man-made instances. An EU-funded research project ASOF-N set out to understand the variances and their causes in the North Atlantic and Polar regions.*

The north-west European climate is rather warmer than expected, scientists note. So much so, in fact, the warm weather is consid-

ered an anomaly. Whether polar region warming or elements in the Nordic Sea area, scientists seek to understand the various factors involved and their controlling processes.

Part of the research involved taking conductivity, temperature and depth (CTD) profile measurements. During 10 cruises, these measurements were taken over a period from 2003 to 2006 with institutes across Europe participating in the gathering and assessment of these readings.

In all cases Sea Bird Electronics' technology was used, employing a profiler with a single CT-sensor package. However, raw data readings are prone primarily to two sources that present erroneous readings. The first is sensor drift and the latter, noise caused by the ship motion. To reduce these, regular salinity

samples were taken to counter the first, and to reduce the noise, data was averaged to a vertical resolution of 1 dbar. An additional reading was obtained at regular mooring intervals for reliable current readings.

Disseminating the information is as important as collecting it. In this, the project has gone to great lengths to ensure that all partners have secure access to the information. In addition the information is standardised and archived at the Alfred Wegener Institute in Bremen, Germany. This allows data requests to be processed and provided without the customary long waiting periods either for format conversion or for data transfer. The information is accessible to scientists, particularly oceanographers, via the web. An additional benefit is that the database is easily and immediately editable, thus allowing for immediate correction or updating if necessary.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support.

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## Reconstruction of Greenland precipitation patterns

*Scientists have reconstructed precipitation patterns over the Greenland Ice Sheet (GrIS). The aim was to achieve a greater understanding of how climate variability of the North Atlantic Ocean (NAO) affects winter precipitation patterns in Europe.*

Researchers from the Pacliva project studied variability in snow accumulation and large-scale circulation patterns over the GrIS. Four regions of the GrIS were identified, three of

which are associated with distinct large-scale circulation patterns. These included the central-western, the south-western and the south-eastern GrIS. These large-scale

patterns influence Europe's climate in different ways. However, changes in the accumulation of snow in the north-eastern GrIS are mainly affected by cyclones originating in the Greenland Sea.

Ice core records for different regions across the GrIS helped to determine variability in calcium levels from airborne dust, and sodium levels, chiefly from sea salt deposition. This provided information concern-

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## Whatever the weather

*The changing face of climatic conditions, occurring over such a brief period, leaves scientists wondering exactly how much of this change is a result of human activity. Understanding this climatic variation requires reading the past. The EU-funded project Pacliva has taken historical evidence and compared it to the facts acquired from modern research to better understand patterns of climate change.*

In the case of understanding rapid climatic change, it is of primary importance, that scientists look at past weather conditions and changes to compare and understand the significance of current fluctuations. In doing so Pacliva, has turned to the North Atlantic.

Using the threshold counting method researchers have looked at data from over the last 1 200 years. They were able to determine that in the North Atlantic Ocean (NAO), the pattern is at least non-consistent over multidecadal and longer time periods. It also indicates that a NAO-like pattern existed as far back as the Early Holocene period, but that the changes seen then are dissimilar in pattern to those experienced now.

The modern changes to the NAO pattern occur both at a surface and subsurface level, implying the importance of advective dynamics. Since part of the project deliverables was to establish the whereabouts to reconstruct climatic conditions, the scientists found that changes occurring during the Early Holocene were experienced only on the surface level.

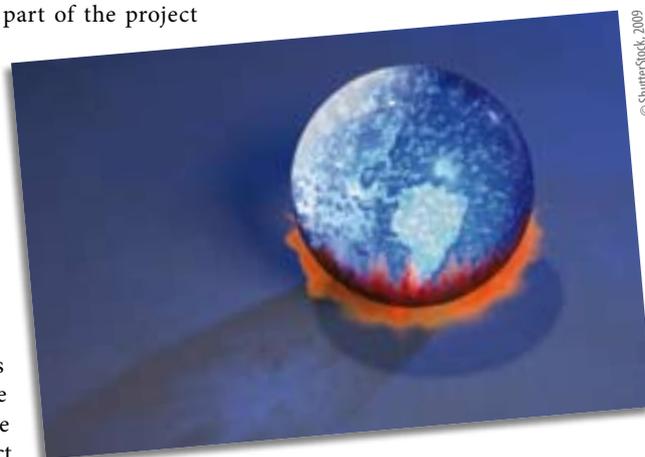
Another objective was the import and the amalgamation of the datasets from the project

with the Pangea database. This will make the information available for next-generation model experiments under further European initiatives. Further research is planned, using transient model experimentation with data over the last millennium.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support.

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## Dense ceramic tiles from recycled fly ash

*Waste material from industry, in the form of fly ash, was recycled and reused in ceramic tiles for corrosive environments.*

Countries in the western Balkans worked alongside the Reintro project to find ways

in which their industrial waste could be used to help in waste treatment. One innovative solution was to add fly ash from coal-fired power stations to clay to produce dense ceramic tiles.



The resultant product fulfilled the criteria for a whole raft of standard tests. The tiles had high mechanical strength and excellent resistance to biological and chemical corrosion. They also had a low tendency to form biofilms of microorganisms on their surface.

These properties meant that the tiles were highly suited for application to a number of different challenging environments containing polluted soil and ground water. They included sewage pipes and water treatment plants. The tiles could also be used in ports and harbours as well as livestock farms, dairies, abattoirs and the fertiliser industry.

The use of fly ash as a raw material for tiles has helped to preserve natural raw materials while maintaining the product's quality. This in turn leads to reduced costs and creates jobs.

Funded under the FP5 programme 'INCO 2' (Confirming the international role of Community research).

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4562

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ing distinct regional atmospheric circulation patterns over the North American Arctic, Greenland and central to northern Europe.

The results revealed that in the north-eastern part of the GrIS, high levels of calcium suggest dry deposition transported from the west. This agrees with the current belief that most dust deposited over the GrIS comes from Asia. Results also indicated that a significant fraction of the snow deposited

each year in north-east and central Greenland is due to wet deposition. This takes the form of snow, rain and especially fog. The difference in the results was great enough to enable reconstructions of the regional deposition regimes and the associated circulation patterns.

The Pacliva project also studied the variability of nitrate and snow accumulation records from six Greenland ice cores, which

covered the period from the present to over 200 years ago. The results showed that over the last 75 years there has been an increase of around 60 % in the average concentration of nitrate.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: information exchange/training.

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## Prêt-à-sauver fashion for disasters

*European researchers are helping rescue workers and disaster victims by creating innovative clothing from smart fabrics. The clothes can monitor people's health, identify their location and even detect dangerous chemicals in the atmosphere.*

Firefighters, paramedics and rescue workers could soon carry a new weapon into the danger zones with European researchers completing work on smart clothing for disasters.

Smart clothing incorporates technology and microelectronics to perform a wide variety of functions, from communication to health monitoring. It is an important emerging field, with the market thought to be worth over EUR 300 million with current growth rates about 20 % a year, according to reports from the 'Smartfabrics conference 2006'.

Europe is one of the world leaders in the area and that leadership will be maintained through the smart clothing research undertaken by the Proetex project. 'Proetex arose from partner inputs and from emergency teams like firefighters and civil protection units,' explains Annalisa Bonfiglio, coordinator of the Proetex project. 'Gradually, we arrived at the awareness that technical garments for improving safety were especially needed in the field of emergency work and we decided to start a common effort towards this goal.'

The Proetex project is an ideal test case for smart clothing for a variety of reasons. It responds to an immediate need: better equipment improves the safety and effectiveness of disaster response. Rescue workers are often laden with equipment, whether it is oxygen or medical equipment, so any additional gear they use must be as light as possible and low power consuming.

Fortunately, this is the very strength of smart clothing. With microelectronics incorporated into the garment, or even into the very weave, designers can minimise on bulk while maximising the benefits. The complete Proetex package consists of a raft of sensors incorporated into different elements of the overall system: vest, jacket, shoes and a belt for victims.

The inner garment includes sensors that provide continuous monitoring of life signs like breathing, cardiac rhythm and body temperature. The outer garment (jacket) detects external threats like high temperatures and toxic chemicals. The first warns rescue command of local conditions, while the second can alert the rescue worker to dangerous gases.

The jacket incorporates accelerometers to track the wearer's motion and position and GPS to track location. Integrated light and sound alerts can be activated to make finding a lost or injured firefighter easier. The jacket also has GPS and a textile antenna. A small box of electronic controls manages all the data from various sensors. Finally, textile batteries are also included to provide a light power source.

The firefighter boots developed by Proetex are ergonomically designed and include a pocket for a gas sensor, but researchers hope that later models will include batteries, more sensors and communication devices.



'Monitoring rescuers and firefighters during emergency operations is especially important, not only because they risk their own lives, but also for improving their efficiency,' according to project information. 'For instance, being able to locate a large number of rescuers across a large area using an efficient, portable telecommunication system embedded in normal garments is already an important means for improving coordination of the rescue operations.'

The project is in the second of three phases and later versions of the system could integrate biosensors to monitor sweat, dehydration, electrolytes, stress indicators, oxygen and carbon dioxide. The system can also monitor the wearer's pose, indicating whether the person is lying down or standing.

'This project is especially challenging for the integration of many different technologies on a common "platform", in this case the garment,' reveals Bonfiglio. 'My research field, textile applications for plastic electronics, is extremely interesting... The mechanical properties of textiles (for example flexibility) are very similar to those of the polymers used in plastic electronics.'

There is more research to come and the project partners are looking into potential commercial opportunities, reveals Bonfiglio. But the effects of this Sixth Framework Programme (FP6)-funded project will extend further than the emergency services or even the market. Not only are the results useful in themselves, this research tackles many of the fundamental problems that affect smart clothing regardless of sector, namely reliability, effectiveness and comfort.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90102>

## Decreasing the impact of noise

*Flight procedures that promise significant reduction of noise nuisance in the vicinity of airports and can be applied to current fleets as well as to future aircrafts have been evaluated. The Sourdine II project has taken steps to accommodate further growth of the air transport industry, while minimising its impact on the environment.*

Airports across Europe are faced with the conflicting problems of increasing their capacity to meet the continuing growth of air traffic, while reducing their impact on the environment. The impact of aircraft noise on quality of life for the surrounding communities is already being addressed by the introduction of more silent aircraft engines and airframes.

Although noise abatement procedures may also provide for significant noise relief to communities around airports, their effective implementation has been fraught with difficulties. In the framework of the Sourdine II project, a selection of arrival and departure procedures have been assessed with respect to safety, environmental impact and acceptance by airlines.

Continuous descent arrival procedures in particular attracted the interest of Aeropuertos Españoles y Navegación Aérea (AENA), a project partner that participates in the

management of airports in eight countries. Variations in aircraft performance and complex airspace structures are the main factors that have up to now limited their widespread implementation.

To quantify the benefits of continuous descent arrival procedures detailed modelling was required. The AENA Total airport and airspace modeller (TAAM), a fast time simulator was used to automatically randomise aircraft performances. By allowing model parameters to reflect the spread of real-life operation characteristics, multiple iterations of the same scenario could be provided.

More specifically, standard terminal arrival routes (STARs), currently used to organise and expedite air

traffic flow, were described as a succession of waypoints of exact latitude and longitude. Moreover, altitude and speed restrictions imposed for each type of aircraft were considered in the simulations.

Bottlenecks for the implementation of continuous descent arrival procedures, identified in the real-time simulations, may help operational concept developers to find possible improvements.

Funded under the FP5 programme Growth (Competitive and sustainable growth).

Collaboration sought: information exchange/training.

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## Minimising combustion hazards

*Aiming to deliver the lowest pollutant emissions attainable by current gas turbine designs, significant insight into the mechanisms underlying unsteady combustion was gained by the Muscles project. Improvements in numerical modelling capabilities provided for exciting progress in the understanding of turbulence phenomena.*

In the design of combustion engines, perhaps the most difficult challenge is the simultaneous optimisation of efficiency, stability and pollutant emissions. Premixing fuel and air in lean proportions prior to combustion has enabled large reductions in pollutant emissions, especially nitrogen oxides ( $\text{NO}_x$ s). Unfortunately, this well-established system in combustion engine manufacturing technology is prone to flame instabilities.

Modelling and numerically simulating the intricate coupling of chemically interacting flows during combustion has therefore become profoundly important to the design of gas turbine engines. The Muscles project partners succeeded in modelling the interaction between turbulent mixture and chemical reaction by calculating the statistical probability for all occurring states during turbulent combustion processes.

The approach adopted by researchers at the Universität Karlsruhe in Germany involved the computation of the probability density function (PDF) of the most important parameters. These included turbulence length scales, velocity and mass

fractions of individual species in the burned fuel mixture, in addition to appropriate time scales for chemical reactions. The probability density functions of each parameter would have to directly solve transport equations of their joint probability density function (JPDF).

The JPDF combustion model was extended to describe highly diluted combustion under turbulent conditions and was applied to simulate flame extinction in the lean limit, known as lean blow-out. Further reduction of pollutant emissions will require even leaner mixtures of fuel and air, as well as new schemes exploiting this combustion technique to its maximum potential. By extending the lean blow-out limit, lower temperatures could be reached and consequently, less  $\text{NO}_x$  emissions produced. Initial calculations were successful in predicting the lean blow-out limit of the combustion system and have opened the way to reducing the test costs of combustor development programmes.

Funded under the FP5 programme Growth (Competitive and sustainable growth).

Collaboration sought: further research or development support.

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**See also page 40 (Cleaner by design)**



## Stormwater management gets best practice review

*Water management has become serious business, and the compilation of know-how or best management practice (BMP) is imperative to maximise water use. Stormwater has only recently been considered a viable source of water as such. Using it to its maximum efficiency to support and enhance water use in urban spreads has become of prime interest to water management bodies.*

Treatment and control of stormwater in urban settings is a relatively involved process — one in which a veritable wealth of information has been collected from a wide-spread collection of sources. Geographically dispersed sources across Europe have collected a body of information that now needs to be assessed from the perspective of best management issues.

The Daywater project therefore set out to compile a report on the BMP of stormwater emphasising the design, operation, maintenance and costing, looking at the various systems currently implemented across Europe. It noted that while systems varied in practice, there also appeared to be common trends. For example rainwater harvesting was seen as a popular trend in Germany and France, but practised to lesser degrees

in Italy, Spain and Greece, whereas cleaning streets was universal.

Nonetheless, the report compiled best management principles with various differences in mind, accounting for such factors as particle settling characteristics, effective runoff, infiltration capability and pollutant removal to name a few. In doing so, multiple effective BMP models were designed and the report provides comprehensive literature showing the best methods for treating and controlling stormwater.

While further research will be needed on quantifiable sustainability, the report still serves well in providing a clear idea of which BMP works best for northern European and temperate regions.



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Funded under the FP5 programme EESD (Energy, environment and sustainable development).

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## Water management tools for the Thau lagoon

*Researchers studied the impact of agriculture and other economic activities on the aquatic environment of the Thau lagoon in southern France. The information was used to develop new water management tools.*

The DITTY project has developed a scientific and operational basis for the sustainable use of the Thau lagoon in southern France. At 21 km in length and 8 km wide, it is the largest of a series of coastal lakes in the south of France. It is also the centre of a thriving shellfish industry. An integrated approach was developed for the lagoon, its catchment area and its connections with the sea using a geographic information system (GIS). The results showed that the method employed was within the framework of the European Water Directive for transitional coastal waters.

One major area of concern to both the research team and lagoon's end-users was the threat to water quality and shellfish from bacterial contamination. Therefore, a method was developed which simulated the impact of microbial contamination from wastewater and urban development. A maximum allowable flux (MAF) was calculated for each river draining into the lagoon. The MAF was defined as a threshold value, above which shellfish farming zones are considered to be subject to the impacts of bacteriological contamination.

The results were discussed from a water management perspective with the lagoon's end-users. It was particularly important to calculate the change in bacteria levels in the lagoon during flood events and compare the values with the MAF. Flood events represent the greatest risk of contamination by bacteria. If the flux of a given river was below the MAF, no improvement to the wastewater processing was necessary. If changes in bacterial levels were found to be higher than the MAF values, action was taken by wastewater treatment plants. This involved the best way to reduce the levels of bacteria.

A decision support system (DSS) was developed for the lagoon which gave end-users different scenarios according to financial, socio-economic and environmental constraints. The different scenarios were then ranked according to the requirements of the end-users. The 'OMEGA Thau' programme was used to identify new management tools and forecast environmental crisis through the use of early warning systems.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support; information exchange/training; available for consultancy.

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## Examining seismic data of the Dead Sea region

*Studies of seismic hazard along the Dead Sea fault based on historical activity have been collected and analysed. This has provided a framework for further and more conclusive information and helped to pinpoint what is still needed to determine seismic risk in the future.*

Many regions in the Middle East are along the Dead Sea fault, an area prone to major seismic events. Large earthquakes are devastating because of the loss of life as well as costly due to severe structural damage. Given the rich cultural heritage of these regions and their ancient cities, citadels, fortresses and archaeological sites, the APAME project sought to inventory and study their seismic hazard vulnerability. This was done by combining historical, archaeological and earthquake hazard studies.

The case study of the project revealed that a vast amount of data was collected and important results were provided. However, the absence of critical seismological data such as seismometer and accelerometer recordings prevented the construction of full seismic hazard analysis. Sample scenarios from previous studies and from Lebanon offer some seismic hazard assessment but what is still needed is a thorough para-

metric seismic catalogue that canvasses south-eastern Turkey, Syria, Lebanon, Israel, Palestine and Jordan. Precise locations of these regions and the intensity of their historical and instrumental seismic events are required.

Recent earthquakes may offer insight on the velocity structures, crustal behaviour at depth and surface and rate of active deformation along the Dead Sea fault. In all likelihood, non-linear hazard mapping programmes are not currently available to take such conditions into account. However,



the APAME project can offer evidence of seismic hazard of the past via archaeo-paleoseismic studies which can serve to enhance current and future knowledge.

Funded under the FP5 programme 'INCO 2' (Confirming the international role of Community research).

Collaboration sought: further research or development support; information exchange/training.

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## Turning back time on volcanic eruptions in the Middle East

*The most extensive database cataloguing and mapping the archaeological damage caused by powerful earthquakes that occurred in the Dead Sea fault zone has been compiled by an EU-funded research team.*



Earthquakes in the Middle East have a long history of ravaging the area and leaving destruction in their wake. Recently, western Turkey experienced large seismic events that incurred loss of life and billions of euros of losses. The Dead Sea fault which incorporates sites in Jordan, Lebanon, Syria and Turkey is still a volatile region for large-scale earthquakes.

The APAME research team set to work looking at textual and archaeological references in the region from prehistoric, Greek, Roman, Byzantine and Islamic periods. It involved excavation at various

sites including sites in the Jordan valley and the 'lost villages' in Syria. Each site was the location of extensive field investigations and included the collection of topographic maps, detailed logs, photos and samples which were used for isotopic dating.

The information collated was then compiled into a comprehensive database of this tremendous body of work. In addition, maps of the localities where damage was recorded were prepared as a general site map at a scale of 1:1 000 000. It includes an index of Damascus and the vicinity, the topographical names, geographical coordinates and grids. A list of large seismic events with corresponding maps is also available. In addition, the research also allowed for the improvement of existing methodologies. It is important that this work continues so the catalogue can continue to be updated.

Funded under the FP5 programme 'INCO 2' (Confirming the international role of Community research).

Collaboration sought: further research or development support; information exchange/training; private-public partnership; available for consultancy.

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## Facilitating rural development in 'new Europe'

*Rural development in central and eastern Europe faces many difficulties, in particular in its journey coordinating existing policy with that of the EU's common agricultural policy (CAP). This project readdresses this balance by utilising research to create an environment more conducive to change.*

The CAP has had its own set of problems and, despite many reforms, it remains somewhat problematic. In the case of the newer EU Member States, it remains a challenge to adapt their rural development strategy in order for it to fit into the EU's framework and policy for rural development.



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The IDARI project set its sights on demystifying the debate over CAP and its potential to unlock jobs and add value in rural areas in the newer EU Member States. Since it is the case that the true potential of CAP reforms can only be realised if stakeholders in rural areas better acknowledge innova-

tions available and the need for institutional change, the main aim of the project was to educate.

The researchers prepared a research framework which utilised classic concepts of

institutional analysis with findings from cognitive sciences. Ten teams adapted and used this framework in their countries. Out of this the researchers were able to come up with decision-making tools that can be used by a wide range of participants.

This part of the research explored the cases where cooperation is desirable but unattainable in current circumstances. It examined the direct and indirect effects on the existing networks of policy. In particular it examined direct effects on cooperation between rural people if the best suited development policy were implemented. An academic paper on these results was also prepared. It is entitled 'The Governance of Cooperation — Policy Implications for Rural Central and Eastern Europe'.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: information exchange/training; available for consultancy.

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## Offshore oil and gas environmental risk management

*Experts from across Europe worked together through the Trends-2 project to develop better environmental risk assessment (ERA) tools.*

Europe needs energy and the search for gas and oil continues until alternative renewable energy infrastructures have been established. This fact has resulted in an extension from current production sites towards the continental margins, deep water areas, and the Arctic. When working in such challenging and vulnerable environments, technologies and work practices must be continuously improved to guarantee a more sustainable energy supply.

The Trends-2 project was part of a thematic network under FP5. It addressed health and safety, environmental and quality (HSEQ) issues with regard to hydrocarbon production. The project assessed the latest risk assessment tools by considering ERA technologies for operational and accidental discharges from offshore production. Trends-2 also highlighted limitations to the use of a risk quotient (PEC/PNEC) with regard to ERA, which is applied offshore.

Risk assessment in the marine environment involves comparing an ecosystem's exposure to a particular chemical with the sensitivity of the ecosystem to this chemical. The exposure can be represented by the PEC (predicted environmental concentration) The sensitivity can be expressed as the PNEC (predicted no effect concentration). A com-

parison of the PEC and the PNEC, the PEC/PNEC ratio, has been used widely in aquatic risk assessment models.

The Trends-2 project also assessed different modelling tools for accidental and operational discharges and made four main recommendations. These included the need for calibration between the different models used for risk assessment. The effects of offshore oil and gas production on the marine ecosystem need to be better understood in order to provide correct information for running ERA models. A more unified approach was required for accidental and operational risk assessments. It was also necessary to develop better models for forecasting risks, which take into account the random nature of the underlying processes and the factors which control them.

Ideas resulting from Trends-2 are now being pursued through involvement in major initiatives concerning the development of environmental decision support systems. These are being undertaken through the IST programme of

the Seventh Framework Programme (FP7) and through interaction with oil and gas industries and the industry body Eurogif.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support; financial support; information exchange/training.

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**See also page 16 (Portal for regulations to improve oil and gas services)**



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## Improving ash tree genetic resources for sustainability

*The common ash tree produces a highly valuable wood used in furniture; it is also planted for reforestation of abandoned farmland. This project explores the little-known subject of ash genetic structure and hybridisation between common ash and other species.*



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The 'Realising ash's potential' (RAP) project was concerned with testing and promoting improved genetic resources of the ash tree (*Fraxinus excelsior*). This project is in line with the European strategy for sustainable development, which set as a priority to support the sustainability of forests.

The project partners focused on deriving knowledge on the genetic background of ash, identifying pure species and hybrid populations. This knowledge can be used to help formulate conservation management practices. Helping to identify the optimal use of ash has other environmental benefits including making reforestation of this tree compatible with sustainable systems of production.

This in turn could lower the EU's dependence upon tropical hardwoods.

A European ash provenance trial was established in France, where it grows naturally in rich soils with good water content. A core collection of 33 provenances common to all the partners involved in the task were identified. Data analysis showed very important differences exist between the provenances. These differences were ranked. In the nursery growing phase, two narrow-leaved ash provenances were compared with common ash provenances as a control of specific purity.

The data results following seven-year old provenance-progeny testing revealed that variability between progenies within provenances is very important in comparison with variability between provenances for all the characters under study. Data following a 10 year commercial provenance test revealed that the hybrid provenances performed badly in general. Also, five registered provenances were characterised for growth characters; stem straightness, flushing, number of forks and steep branches.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support.

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## The common ash shows its strength

*Fraxinus excelsior, the common ash, is valued for its fast growth, strength and elasticity. Researchers in the EU-funded project 'Realising ash's potential' (RAP) have been investigating the biochemical characterisation of time of bud flushing to avoid damage by late frosts.*

For a hard wood, the growth rate of the common ash is very rapid. Ironically, rapid growth and fast colonisation have lent this tree the 'weed' status in some situations where it is an unwelcome fast-growing visitor. However, members of the RAP consortium have researched to help exploit the valuable traits that the ash offers to growers and the wood industry.

As part of the drive to promote ash, scientists based in Dublin from the Irish Agriculture and Food Development Authority (Teagasc) have investigated the biochemistry of bud flushing. One of the inherent problems of ash growing is necrosis of apical buds in late spring frosts. This then induces forking, or division of the stem. Needless to say, forking greatly reduces wood yield and quality. The time of flushing and growth of buds is a highly heritable trait. Breeding for earlier flushing is therefore very achievable as long as appropriate genetic markers can be selected.

To identify potential molecular targets, 14 different oxidative products associated with different stages in bud development were assayed. A second string to the tests confirmed the concentrations of these possible markers in provenances (from four different geographic areas) with known differences in flushing time.

Five markers showed significant differences between late and early flushing provenances. Of these, elevated concentrations of mannitol, sucrose and trehalose could be usefully incorporated into breeding programmes as these molecules play an important role in bud growth differentiation.

Further research and utilisation of selection tools at the tree breeding stage can lead to a more competitive timber market. Furthermore, at a time when renewable

crops and forestation are becoming more desirable in a setting of environmental crisis, the ash could rise to its full potential.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: further research or development support; information exchange/training.

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## Dating historical earthquakes for future visualisation

*Earthquakes are without doubt, the most violently destructive event mankind faces. Not only do they threaten modern society, but they also threaten to eradicate our ancient past. Radiocarbon dating now presents a means by which historical events in seismic areas can be verified.*



The Middle East is characterised as the birthplace of civilisation. Our most ancient cultures stem from this region. Ancient cities, fortresses and other historical archaeological sites festoon the region, giving us more than just a casual glance into who we once were. This heritage however, exists in an active earthquake region, and an EU-funded project, APAME, sought to develop methods to investigate its history.

One such method is radiocarbon dating of archaeological sites, conducted in an effort to interpret data collected on historical seismic events. A total of 38 samples were analysed in Jordan originating from such sites as Deir-al-Achayer, Jarmaq, and Rachaya. The samples

were used in order to provide age boundaries to faulting episodes.

At the Rachaya site two events were determined, one as far back as the Holocene period, and another — the most recent event — from the well known 1759 earthquake. Additional analysis at various sites in Lebanon, Syria and Turkey also confirmed the viability of radiocarbon dating. The process not only helps to confirm seismic events, but also assists in building a map of such instances that, when compiled, helps scientists achieve a fuller, more comprehensive understanding of faulting behaviour in the region.

The results are currently stored in the Catalogue of Historical Earthquakes according to time and latitude of occurrence. This provides a strong means by which visualisation of earthquake recurrence can be attained.

Funded under the FP5 programme 'INCO 2' (Confirming the international role of Community research).

Collaboration sought: further research or development support; information exchange/training; private-public partnership; available for consultancy.

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## Enhancing clam production in Italy

*Support and evaluation of environmental and economic systems pertaining to clam production have been pooled together via a database and assessed through the participation of economists and stakeholders.*

Sacca di Goro, a lagoon district in Italy, is an area known for its clam production, a main source of revenue in the local economy. The DITTY project has filled a vast database with geographic information systems (GIS) maps for land use, land cover and hydrology of the watershed and for the Sacca di Goro lagoon.

Under the auspices of the project, the environmental and economic systems related to clam farming in the Sacca di Goro were described and evaluated using qualitative

analysis. Additionally a network analysis model on nitrogen cycling in the area was designed taking into account various techniques of ecological flow networks. Biochemical models were developed and tested. Many factors were taken into account accordingly, such as benthic vegetation, sedimentary fluxes, nutrient, phytoplankton, zooplankton and bacteria.

Finally scenarios were developed and measured according to the primary economic ac-

tivities in the watershed-lagoon system. The resulting information was acknowledged and considered by decision-makers and end-users. Main options that were derived involved the further development of clam farming in the lagoon or in the adjacent sea. The Sacca di Goro was then included in the LaguNet network (<http://www.dsa.unipr.it/lagunet>) which is an Italian network for ecological research examining coastal lagoon ecology.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support; information exchange/training; available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4555

## Linking biomonitoring to policy action

*A means to integrate human biomonitoring (HBM) data with policy actions has been created using a multi-step approach.*

The ESBIO project has devised a coordinated means for HBM with an emphasis on children in Europe in accordance with Action 3 of the EU Action Plan. Through strong scientific support, the project proposal sought to surmount particular deficiencies in EU HBM through rendering substantial added value.

This involved a series of important measures. One of these included the notion of

integrating biomonitoring with environmental and health monitoring and for HBM results to be translated into a response system. Another important strategy consisted of synergism between environmental health research and an overall EU HBM surveillance network.

What followed was a multi-step approach determining what is involved in transforming HBM data into policy action. The key

was to prioritise various measured pollutants and EU Member States as much as possible. It was hoped that the new approach could determine deviation in one or more measured biomarkers, establish the seriousness of the deviation and create priorities to handle it. Finally a means to communicate with the general public and policy-makers in a clear manner and to propose and motivate various policy options was sought.

Funded under the FP6 programme Policies (Research for policy support).

Collaboration sought: information exchange/training.

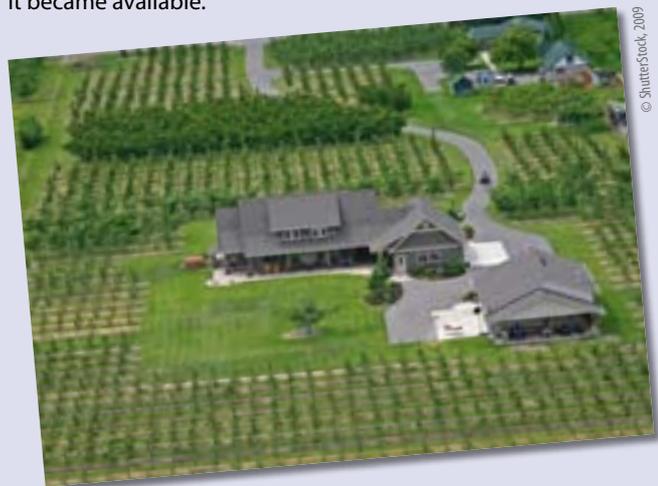
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## Aerial photography enables efficient tree spraying

*Aerial photography was used to develop contour maps of trees to be used by spraying systems to achieve more efficient delivery of agrochemicals to orchards.*

The application of chemical sprays can be reduced by as much as a third by matching their volume and direction to tree size. The 'Preci spray' project developed a precision spraying system for the pest management of apple orchards which benefited the environment through the use of less agrochemicals and pollutants. Researchers developed a system that created tree contour maps from aerial photographs, which were then communicated to the spraying system.

The prototype digital aerial photography system developed was based on existing work and components. As a result of new developments in electronics and digital photography more suitable equipment was then used to update and improve the system as it became available.



The prototype system was based on the mission computer which used a commercial laptop plus a GPS unit and pilot display unit. The system facilitated the planning of missions by helping to guide aircraft. The GPS unit was used as a navigation aid by the pilot. A second GPS was added and linked to the digital camera for recording the exact position for each photograph taken. The computer received image files from the camera along with the position data from the GPS and the information stored on the hard disk.

Tests were carried out to ensure that the photographs taken were of sufficient quality. Maps of orchards were produced so that pictures could be evaluated. Statistical analysis was used to check the accuracy of position data derived from photographs. These were then compared to manually measured control points on the ground.

The software that supported the digital aerial photography system was developed to perform a range of operational functions and tasks. These included mission planning and simulation where flight paths and the location of points to be photographed were defined. Other functions included flight execution and the storage of image and navigation data. The data was evaluated for accuracy through the use of statistical analysis and mapping and measuring tools.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: joint venture agreement; licence agreement; private-public partnership.

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## Global database for molecular consortium

*With the advent of multidisciplinary research dedicated to molecular interaction, the need has arisen for a single, broad and uniformly accessed knowledge base. The integration of molecular, genomic and polemic databases was the goal of the Temblor project.*

A consortium of major public interaction data providers has gathered together to develop a single data source for the field of molecular interaction. Seeing how similar projects benefited other research projects such as those dedicated to protein and DNA sequences, IMEx formed to provide a similar service.

The consortium is comprised of members that are specialists in a number of fields including molecular interaction, software development and instrumentation. Together, they aimed to construct a database that would provide universal curation potential along with various forms of membership categories. These membership types are determined by the extent of commitment from a member. For example, a member registered as an archival member is committed to producing a relevant number of documents. Alongside this, they also commit to importing the data according to

IMEx standards and make the information globally accessible.

It was intended that the Temblor project would result in the construction of a database that would directly contribute to and complement the different strengths of various European groups. The database provides various forms of search functionality, including text-based, structure and sequence-based searches against a gene-centric view of all genomes. Moreover, submitted documentation may also be utilised over a work-sharing mode, making it possible for various contributors to work simultaneously on the same text.

To encourage the use of submissions, the IMEx con-

sortium has a creative commons attribution license. This allows for public use of all records in their partners' databases (BIND, DIP, MPACT(MIPS), MINT and IntAct) so long as accreditation is cited. Currently, a number of interests have membership and the consortium is strongly encouraging the acquisition of more partners.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: information exchange/training.

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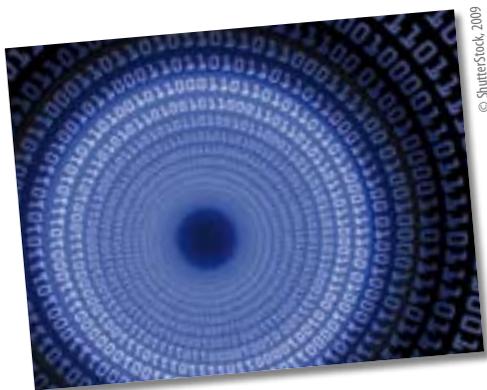


## Engineering superconducting qubits

*Although the future of quantum computing looks promising, the first steps have just been taken towards actually realising a quantum computer that may outperform conventional computers in many ways.*

The very features that make quantum mechanics so weird and wonderful, when compared to everyday experience of the classical world of computing, are those that also underpin its potentially revolutionary applications. A new quantum information technology could emerge in the future, based on research in the field of information processing in accordance with its fundamental laws.

Intensive research within the framework of the Squbit-2 project aimed at manipulating quantum information using solid state systems



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and more specifically, superconducting electronic circuits. Most information manipulation is currently done digitally and data is processed and stored as bits. The two states of a conventional bit may take different forms, such as two different voltages across a transistor on a chip.

Recent developments in nanotechnology have, however, allowed the design of superconducting circuits with small tunnel junctions, offering the possibility of manipulating single Cooper pairs and building quantum bits. The energy levels of qubits result from the interplay between the charging energy of a single Cooper pair and energy characterising the tunnelling of Cooper pairs across Josephson junctions.

Utilisation of niobium (Nb) in ultra-small tunnel junctions has been the challenge undertaken by the Squbit-2 project partners at the Physikalisch-Technische Bundesanstalt in Germany. The use of Nb instead of the conventionally used aluminium (Al)

appeared to be more attractive. It was proven to provide for an extension in the working frequency of quantum computing devices built on superconducting circuits with Nb-based tunnel junctions.

Josephson junctions with linear dimensions as small as 70 nm were fabricated from the standard trilayer of Nb/Al-AlO<sub>x</sub>/Nb. To overcome limitations of the standard shadow evaporation technique used for the fabrication of submicron Al-based tunnel junctions, an alternative fabrication process was proposed and optimised.

Electron beam lithography, dry etching, anodisation and planarisation by chemical-mechanical polishing, were combined to fabricate tunnel junctions of high quality. These complied with the desired relation between the charging energy of Cooper pairs and Josephson coupling energy. Further research has been programmed to also improve the characteristic coherence times of qubits build on Nb-based junctions.

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

Collaboration sought: further research or development support; financial support; information exchange/training; available for consultancy.

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## Reading data stored in quantum bits

*The possibility of macroscopic electrical circuits exhibiting quantum behaviour is rather counter-intuitive. However, recent demonstrations of quantum coherence in superconducting electronic circuits opened up an entirely new direction towards the practical implementation of quantum computation.*

Among physical systems suggested as potential implementations of bits of quantum information, solid state systems offer a more realistic possibility of scaling to a large number of interacting qubits. More specifically, superconducting microelectronic circuits with Josephson junctions incorporated therein can realise artificial two-level systems.

Researchers at the Chalmers University of Technology in Sweden coupled a single Cooper pair box to an extremely sensitive electrometer to measure the excess or absence of charge on the superconducting island. The charge state of this charge qubit was determined by the number of Cooper pairs tunnelled across Josephson junctions and was measured by a single-electron transistor configured for radio frequency readout.

Despite the encouraging results, one aspect that eluded researchers concerned the efficiency of the measurement to extract all

the relevant information within a restricted time. Under the auspices of the Squbit-2 project, funded under FP5, an alternative readout scheme was introduced, which exploited the effective capacitance of the single Cooper pair box.

By integrating the single Cooper pair box into a resonant LC circuit, a closed loop with just a capacitor and an inductor, its effective capacitance could be determined by monitoring the induced charge. The artificial two-level and measurement systems incorporated into a single device provided for fast, and more importantly, a well-suited readout for a single Cooper pair box.

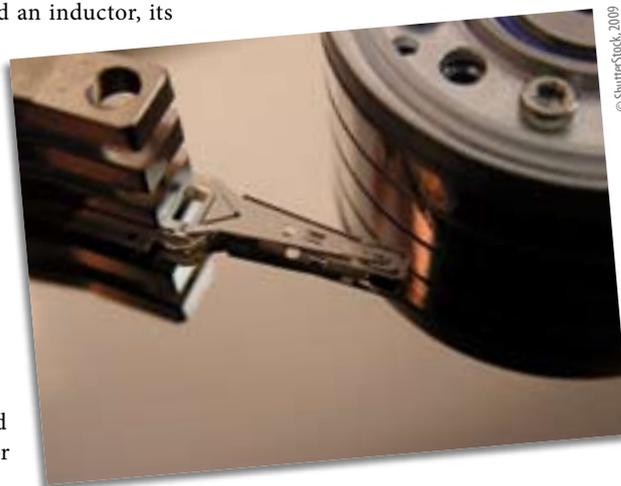
Furthermore, it offered significant advantages for

readout of multiple solid state quantum bits coupled to each other and ultimately, the realisation of quantum gates. These advancements provided strong indication that solid state quantum systems could be used in the not so distant future as the fundamental elements for the manipulation of quantum information.

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

Collaboration sought: further research or development support; information exchange/training; available for consultancy.

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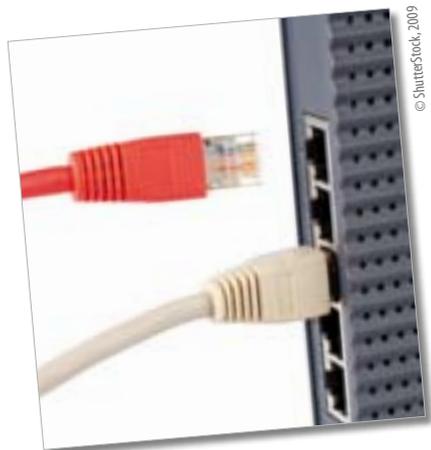


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## Improving performance on a PC-based router

*Open source software has always been an attractive option for computer system development. The international computer network built during the 6NET project found a perfect complement in open high-performance routers based on personal computers that can accommodate the rapidly changing landscape of the internet.*

Internet protocol version 6 (IPv6) has been designed as an update of the current version, IPv4, which is beginning to show its age. The much vaunted improvement over IPv4 is focused on the simple fact that IPv6 offers a virtually infinite number of internet addresses. Countless trillions of assignable IPv6 addresses along with many improvements in areas such as network auto-



configuration are seen as a significant benefit compared to its ancestor.

Within the rapidly changing landscape of IP protocols, the 6NET project partners contributed with several novel ideas. Liberouter has been developed at Cesnet, the operator of the academic network of the Czech Republic, as a dual-stack gigabit router that would host both the IPv4 and IPv6 versions of the internet protocol. Based on the standard personal computer architecture and equipped with a high performance hardware accelerator of packet forwarding, it promises improved throughput at a lower cost.

In the Czech academic network, PCs with operating systems such as Linux and Berkeley Software Distribution (BSD) variants had been used as routers since the early 1990s. Nonetheless, they lag behind their modern commercial counterparts in performance, ease of configuration and functions offered in the control plane.

To more efficiently handle the trade-off between interrupt latency and throughput of the peripheral component interconnect (PCI) bus, an accelerator that performs packet switching in hardware, Combo6 was developed. Complemented by alternative network interface cards, it is presented as a standard four-port Ethernet card to allow configuration to be performed with standard Unix utilities.

Instead of merely creating a new command line shell for the new PC router, a more general configuration system, Netopeer, was developed. Based on the idea of a platform-independent description of the router configurations, it allows configuration of large networks using XML as its internal data format.

One of the main virtues of the Liberouter is its openness. All its software and even hardware schematics are available at the Liberouter webpage, <http://www.liberouter.org>

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

Collaboration sought: private-public partnership.

<http://cordis.europa.eu/marketplace> > search > offers > 4585

## When robots will have whiskers

*Engineers have started to admire the refined designs and adaptability of biological systems like the whiskers of mice and rats. On the other hand, biologists are more and more interested in using artificial systems as a testbed for their research.*

The tactile perception that mice and rats have with their whiskers is almost as good as the perception of humans with their fingertips. Considering the thousands of tactile receptors on fingertips, it is amazing that only about 30 whiskers on each side of a rodent face allows them to move in complex environments and darkness.

This unique potential of whiskers as versatile touch sensors that necessitate minimum contact with objects and are independent of light was the factor that drew the attention of the Amouse project partners. To investigate the suitable morphology of arrays of artificial whisker sensors mounted on the sides of a moving robot, engineers worked in collaboration with biologists and neuroscientists.

The artificial mouse was equipped with 12 artificial whiskers and a camera to serve as a biomimetic model for studying how rodents process tactile sensory information. Furthermore, the interplay between different sensory systems — visual and somatosensory — could be investigated.

More specifically, questions about the importance of the whisker arrays' morphology on the ability of the artificial mouse to move through an experimental arena without being obstructed were addressed. Avoiding collisions is of paramount importance for mobile robots. In the past, it had been implemented with optical sensors that depended, however, on an illuminated environment and moreover, involved computationally expensive image processing.

Estimating distances and recognising the shape of objects encountered with a mechanical probe was the challenge undertaken by project partners at the Max Planck Institute for Psychological Research. The deflection angle or velocity signals of the artificial whiskers provided the essential information about the location of the target object and formed the basis for its shape recognition. Measuring contact distances at varying protract-

tion angles allowed discrimination between round objects with a varying curve and even cubes or cylinders.

While the shape of objects with a smooth surface could be identified with a single whisker, two or more whiskers arranged vertically to each other provided more advanced sensory capabilities. More important perhaps are the new clues offered to scientists that could help them understand how rodents recognise shapes using their whiskers.

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

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4551



## In search for the optimal schedule

*An operational model has been developed that adapts to changes in the schedule of industrial tasks when their simultaneous demand for the same resources exceeds the availability of these resources. It has been designed to allow for better execution monitoring, as well as interaction with human operators.*

How to more efficiently use a finite number of machines in a factory to manufacture different products was the question that motivated research undertaken within the Ametist project. A variation on this problem was the allocation of channels in a telecommunications network or of the central processing unit (CPU) and peripheral devices in a multi-tasking operating system. A schedule would have to be established to resolve conflicts between two or more tasks competing for the same resources.

The diversity of similar scheduling problems treated by different scientific and engineering communities has often led to ad hoc methods which are reinvented without leading to an application-independent scheduling methodology. Inspired by the formal methodology of verification, a unifying framework for building mathematical models for a large class of problems and application domains was proposed by the Ametist project partners.

Their ultimate aim was to prove that open reactive systems would behave correctly in all the contexts in which they could be found. They established timed automata as the underlying model for real-time distributed systems where the next state is determined as a function of the current state. Furthermore, to address the uncertainty about systems' future evolution, both with respect to demands and available resources, they sought an alternative to the so-called zone-based abstractions.

Instead of matrices of constants to which clocks of the timed automaton are compared and have their roots in verification methodologies, vectors of clock variables were used. The automaton was viewed as specifying a game between the scheduler of an open reactive system and its environment. On the other hand, the scheduler controlled the allocation of resources to competing tasks. Among the different sources of

uncertainty, the duration of each task was defined as a continuous random variable.

As in a deterministic case, the identification of the optimum task schedule was then reduced to establishing the shortest path in discrete weighed game graphs. Such an approach did not change the inherent computational complexity of the problem. However, it provided more freedom in choosing the method that provided the best trade-off between its computational complexity and the quality of its solution.

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

Collaboration sought: further research or development support;  
information exchange/training.

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## Supporting interactive applications in grid environments

*Management of available computing resources in a grid was limited to accepting requests for job submission from its clients, who were responsible for scheduling and controlling the applications to be executed. New tools can provide for both automatic scheduling and execution monitoring of applications running in parallel.*

The continued evolution of numerical simulation techniques and their acceptance by scientists and engineers fostered a rapid increase in the demand of computer cycles. Supercomputer centres capable of supporting the most realistic simulation of surgical procedures or air pollution combined with weather forecasting are all oversubscribed.

Connecting supercomputer centres with commodity clusters of personal computers

or workstations emerged as a promising alternative at a lower cost. However, the distributed nature of such a heterogeneous multi-site computing environment, which is characterised by different hardware architectures, represents a significant challenge in its effective exploitation.

Among the goals of the Crossgrid project was to provide a grid-enabled computational framework that would hide irrelevant complexities and present users with familiar abstractions. Crossbroker is the component developed by project partners at the Universitat Autònoma de Barcelona that manages submission of parallel application programs.

More specifically, this middleware service is responsible for selecting the most suitable resources for the application programs submitted by users.

This selection will be made by taking into account the requirements set for its execution, as well as by sorting the available resources in order of preference.

Computational intensive simulations that have been programmed using a parallel programming model and a parallel computing library such as the message passing interface (MPI) library are supported by Crossbroker. Furthermore, applications made of multiple programs depending on each other can be submitted in a batch-like way.

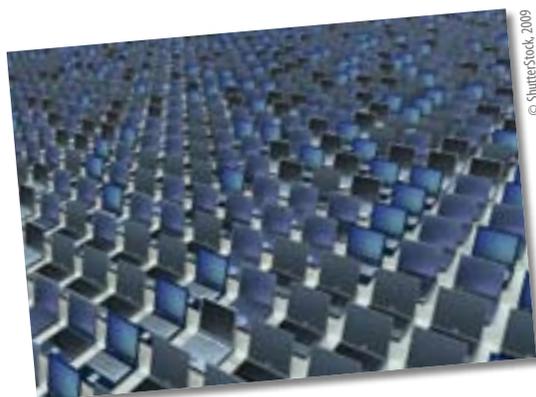
After taking all the necessary steps to guarantee the successful submission of application programs that can also accept input from the users during execution, the application is allowed to run. A command line interface allows query of the status of programs running on a single or multiple clusters and finally retrieves results.

The Crossbroker offers a unified approach to running applications distributed over multiple sites of a grid in an automatic and, more importantly, transparent way.

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

Collaboration sought: further research or development support.

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## The invisible network

*Shall I make this call with the landline, mobile or VOIP? Laptop or PDA?  
Let the phone and the network decide for themselves, say European researchers  
planning a future of seamless communications.*

At one time there was no choice. If you wanted to speak to someone you picked up the phone on the desk and called them. Today, you can also use a mobile cellular phone which could be either GSM or 3G. Or you could use VOIP from your desktop PC to route the call over the internet. You could do the same with your laptop. And your internet connection could use ADSL, cable, wifi, 3G or even wimax. And then there's your PDA...

We have never had more choice of how to communicate but neither have we had so many head-spinning acronyms. Wouldn't it be better if we had one mobile device that could find its own way to set up a call from A to B? That is the vision of E2RII, an EU-funded project that pulled together 32 organisations in 14 countries to plan a future where such things are possible.

'Most users don't care about the technology, what they care about is communicating,' says project coordinator Dr Didier Bourse of Motorola Labs near Paris. 'You may be in different environments — at home, in the office, on a train, and so on — but what you want is to be connected and to enjoy a seamless experience. At the same time, network operators want to make the best of their networks and use them as efficiently as possible.'

They call it 'end-to-end connectivity', and to achieve it the exchanges, routers and other hardware between A and B must be able

to adapt to several different technologies, hence the principle of 'end-to-end reconfigurability' (E2R) which gives the project its name.

E2RII was the second phase of a series of projects that began with E2R itself, which ran between 2004 and 2005. The partners exploited concepts of 'software-defined radio', where many functions that are normally hard-wired can be done in software, and 'cognitive radio' and 'cognitive networks', where communication nodes become more and more intelligent and reconfigurable.

'The idea is to guarantee end-to-end connectivity,' says Dr Bourse. 'We are looking both at terminals — such as a phone — and networks. Terminals will be more and more intelligent, so one of the key challenges was to define how in future we will split the intelligence and functionality between the network and the terminal. What do you need on the network side to make these different technologies work together and how far can you distribute the intelligence to the edges?'

At present, most of the intelligence lies in the network. As you travel across Europe with your mobile phone, the local network automatically locates you, routes your calls and then hands you over to the neighbouring network. This is known as ubiquitous access.

In the medium future, the watchword is pervasive services. 'You buy your device and you can update the software, like a PC, but over the air,' Dr Bourse says. 'The device can evolve to cope with new technologies, so you can access new services. Developers or vendors will be able to modify the communications standards of equipment without having to invest in a new hardware design.'

Further ahead lies dynamic and flexible resource management. Dr Bourse asks us to picture a cube — the communications cube — where one side represents radio frequency, a second side represents the range of radio technologies available and a third side maps all the possible services.

Today's devices operate at only a few points within the cube. At any one time, your mobile phone will use a given frequency (perhaps 900 or 1 800 MHz), a technology (say, GSM) and a service (such as voice or text). In future, Dr Bourse envisages systems that potentially could use the entire volume



of the cube, selecting whatever frequency, technology and service is available to get your message across efficiently. And you won't even know it is happening.

Of course, there are many obstacles to overcome first, not least the present rather rigid allocation of radio spectrum. E2RII included telecom regulators amongst its partners, alongside businesses and universities, to ensure that its innovative technical concepts and solutions made regulatory as well as business sense.

There were even partners in China, India and Singapore, to bring in needed skills and help build a wider consensus on the way ahead. The project also worked with similar initiatives in North America and Japan.

The partners have developed many proposals for equipment, network management and applications. They made more than 450 contributions to conferences, journals and workshops and the effects of the project are already being felt through its input into European and worldwide standards. Some reconfigurable products influenced by E2RII thinking are starting to appear.

Although E2RII finished at the end of 2007 its work is now being carried on by a project called 'End-to-end efficiency' (E3) which seeks to build on the concept of cognitive radio systems to make the best use of the communications cube. As Dr Bourse says, 'the ultimate goal is really to make the system much more efficient.' E2RII is one of five large integrated projects in the EU's 'Wireless world initiative' and was supported by FP6.

Promoted through the ICT Results service.

<http://istresults.cordis.europa.eu/index.cfm?section=news&tpl=article&ID=90243>



## Safe, simple measurement of noise from motorboats

*Motorboats can be lots of fun, but they can also be noisy. The new SoundBuoy is designed to ensure that the sound levels of new boats are properly measured during the certification procedure.*

The Recreational Craft Directive (RCD) passed by the EU defines thresholds for the acceptable levels of noise motorboats can emit. New boats must pass a specific test in order to acquire certification. Accurate measurement of noise levels in the marine environment is a major challenge for boat manufacturers and regulators alike.

In the context of the Soundboat project the SoundBuoy was developed to facilitate the certification procedure. Moving beyond the traditional anchored systems of the past, the Soundboat team, led by Triskel Consultants Ltd, employed a free-floating platform. This reaps multiple benefits, including portability and the ability to approach the buoy from any direction.

Another important advance was the incorporation of GPS technology and a transmitter. Information regarding noise levels and the buoy's exact position are transmitted to the test boat in real-time. A tablet PC on the boat analyses the data and advises the captain regarding course headings via a bluetooth-enabled earpiece. The SoundBuoy is therefore safer than its predecessors as the captain is able to concentrate on steering the boat.

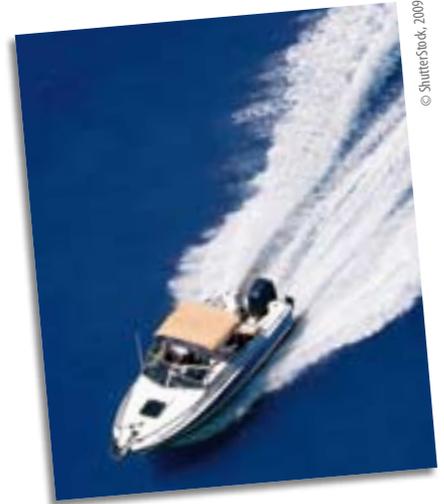
The sound level meter aboard the SoundBuoy measures the noise levels according to the relevant ISO standard. Once the requisite data has been obtained, it is stored in an encrypted file, which is subsequently sent directly to the certification body. Alternatively, the encryption can be disabled when the system is to be used for testing purposes.

Triskel Consultants Ltd and its Soundboat partners are proceeding with the commercial exploitation of the SoundBuoy.

Funded under the FP5 programme Growth (Competitive and sustainable growth).

Collaboration sought: marketing agreement; manufacturing agreement; available for consultancy.

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## Video platforms for spinal injuries

*People suffering from spinal injuries require specialised care which is usually very expensive and limited in the time it can be provided. Thrive, an EU-funded project has investigated using ICT tools to extend both the quality and duration of such care.*

In understanding what would be required of such a tool, Thrive undertook a study of the potential that various remote assistive technologies could provide. In doing so, they had to devise the best methodologies in which such treatment measures could be engendered. Gathering specialists from a number of multi-disciplined backgrounds, the project focused on what care could be given to patients while returning home without compromising quality of treatment standards.

In short, the project actually developed three protocols relating to medical, nursing and therapy based on remote rehabilitation and teleconferencing platforms. The protocols were validated using a test group and it was found that a video-conferencing platform specifically tailored to meet patient needs was highly suitable. Additionally, it provided the family and social environment with suitable communication networks. This includes the extended family and care

givers. It was also found to be beneficial when measured in terms of quality of care and patient quality of life.

Going forward, the project will specify, further validate and eventually submit the protocols to the competent authorities with the intention of being able to make them marketable. Currently the protocols are being technically upgraded to incorporate more advanced developments that had occurred within the ICT industry.

Funded under the FP5 programme 'Life quality' (Quality of life and management of living resources).

Collaboration sought: information exchange/training.

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## Sieve electrodes for somatosensory system study

*Sieve electrodes were developed as part of a study into the somatosensory system. The Rosana project explored fundamental issues arising from the artificial stimulation of the somatosensory system, which convey the sensation of touch, temperature, pain and movement of the joints. This information was used in the development of tactile prostheses.*

Scientists studied the relationship between stimuli to the skin and electrical activity of the sensory nerves. They also investigated the normal activity of processing neurons and the way incoming electrical signals and processing neurons interacted. This enabled researchers to produce artificial stimulation patterns for provoking neural activity in the somatosensory system.

This work required a suitable sieve electrode for investigating animal behaviour. Therefore, researchers developed a polyimide-based, flexible, 27 to 54 channel bi-directional regenerative sieve electrode that could be implanted.

The materials used for processing the sieve electrode complied with the international standard ISO 10993 for evaluating the biocompatibility

of medical devices prior to clinical studies. Supplies for the sieve electrode included a number of types of adapters and connectors.

Initial results indicated that the sieve electrode was able to receive physiological signals from an animal model. The main benefit of using a sieve electrode for recorded signals was the high level of selectivity. The sieve electrode also showed the modification of nerve anatomy following the regeneration of neurons.

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

Collaboration sought: further research or development support; available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4665

## Culture vultures go beyond, way beyond Google

*European researchers are pushing online culture and heritage research way beyond Google by using a smart search system that is multilingual, multimedia and optimised for cultural heritage. Better yet, this promising system has wide application in other fields.*

European researchers have developed an optimised search system that can access an enormous quantity of cultural heritage resources that reside online. Current technology like Google takes a scattergun approach, dishing up dozens of links of sometimes variable quality.

'Right now, if you do a search online, you get lots of irrelevant overload,' explains Pasquale Savino, coordinator of the MultiMatch project, which set out to create state-of-the-art search technology for cultural heritage information.

The MultiMatch system targets searches using a variety of smart search methods. Better yet, the concept can be applied to other fields, like sport, politics, economics and technology. 'Consider that many portals already offer a specialised catalogue, but in many cases the selection and classification of data is done manually, while the MultiMatch platform can perform this work automatically,' Savino reveals.

Savino says MultiMatch trumps standard search in three, vital ways. 'The system does not simply query the web, it also searches through archives, many of them not publicly available,' he notes. These archives include the National Library of Austria (ONB), Biblioteca Virtual Miguel de Cervantes and the Israel National Library, though currently the system accesses just a portion of these resources for research purposes.

It also supports multimedia searches, and not simply by looking for pictures by name. It can look for pictures using other pictures. If a user has one picture, say of Picasso's Guernica, the system can search for images in a similar style. It can do the same types of search for sound and video resources, too.

MultiMatch is also fluent in six languages. A search entered in Polish can be targeted to look for results in Spanish, German, English, Italian and Dutch — the other five languages that the system currently recognises.

Finally, MultiMatch presents its results in an aggregated way, with resources clearly identified by type and sorted by priority, whether it is relevance, historical period or some other criteria. It is a prioritised, sorted and easily grasped layout of results, a bit like a newspaper created on the fly, for your particular query.

MultiMatch began by selecting well-known cultural heritage sites like the Biblioteca Virtual Miguel de Cervantes, to populate its database. Next, it used well-known cultural heritage websites to train web crawlers.

A web crawler is an automated program that accesses a website and traverses through the site by following the links present on the pages. Crawlers index links and information found on the various websites.

The MultiMatch crawlers are self-learning, so after they were shown cultural heritage websites, followed by sites that were not related to cultural heritage, the crawlers 'learned' what to look for. Over time, the system becomes self-refining, as it learns appropriate and inappropriate websites.

The system can also identify relevant material via an in-depth crawling of selected cultural heritage institutions. And the system is not just multilingual, it speaks metadata as well, the lingua franca of the semantic web — an attempt to help machines understand the context and significance of specific types of data. The result is that MultiMatch can take advantage of whatever metadata descriptions are in place, typically in an archive.

But MultiMatch goes further. If there is no metadata, it tries to infer the semantic content of a page — what it means and what it refers to — and this, too, is self-learning, and so will improve over time.

MultiMatch can also automatically extract information which can then be used to create cross-referencing, via hyperlinks, between related material, such as the biography of an artist, exhibitions of his/her work, a video documentary or critical appraisals, and so on.

'We hope, in the future, to take functionality further, so that you could search for cubism, for example, or any art movement. The query would return a categorised and prioritised table of contents for that very specific topic. The system can not do that yet, but it is something we want to develop in the future,' Savino explains. It would be like a personal-

ised Wikipedia created on the fly that caters uniquely to your obsession with Cubism.

In the meantime, Savino and the MultiMatch team are focusing on three prototype demonstrators to test the prototype of the system. One will support teachers trying to develop a lesson plan, the other two will focus on archiving and tourism applications that are still to be finalised.

The teams, however, do not expect any surprises in the tests: the system has been working reliably in the lab up to now. Once it is validated, however, several of the partners will incorporate aspects of the work into their commercial products. 'There is also the possibility that one of the partners will develop a new product from our results,' notes Savino, though he emphasises that the current platform version is a prototype and would need more work to make into a commercial product.

The lead partner, Savino's ISTI-CNR, will keep the demonstrator running online for at least one year after the project finishes, in the winter of 2008, to carry on further work. In the meantime, MultiMatch technology will be used in two other EU-funded projects: Europeana, a major effort to provide online access to 2 million digital objects from the continent's archives, museums and libraries, and the 'European film gateway', a similar project specialising in moving images.

'These projects are mainly using the technology we developed to ensure interoperability between different archiving systems, and multilingual search and discovery,' confirms Savino. It is an indication of the value of the MultiMatch search technology. The MultiMatch project received funding from the ICT strand of FP6 and its technology was showcased at the ICT 2008 meeting in Lyon.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90300>



## Preventing traffic accidents before they happen?

*A new automotive safety systems built by European researchers will alert drivers to potential hazards by using information from the car, other road users and the roadside infrastructure to predict and prevent traffic accidents.*

Scientists and researchers across Europe are working in concert to build a new automotive system that fuses information from a wide variety of sources to predict hazardous situations that could lead to an accident. The system will give drivers early warning of accidents waiting to happen, and thus help drivers avoid crashes and other problems.

A novelty of the system is that it uses comparatively simple and low-cost technologies, many of which already exist. By combining the various information streams and analysing them for potential problems, the researchers hope to develop a powerful safety system that can be deployed rapidly and at little cost.

'We use information from in-vehicle sensors, car-to-car communication and communication with roadside infrastructure to create a picture of driving conditions in real time,' explains Andrea Migliavacca, coordinator of the I-WAY project. The EU-funded project still has some time to go before com-

pleting, but it has already scored a number of notable research successes.

'We are very pleased with our video system for road observation,' reveals Migliavacca. 'Our partners wanted a simple, low-maintenance and easy to install unit that could still provide useful information, and we have developed a unit that responds to their needs. They're very happy with it.'

The external video is used to ensure the driver stays in the correct lane and is one of a series of subsystems used in the I-WAY platform. Some parts, like the radar, have come off the shelf, while other elements, such as the car-to-car communication, were supplied by other European research.

'We did not try to reinvent the wheel,' says Migliavacca. 'If there was another European project working on a system we could use, we took that. So we got the car-to-car communication technology from the "Car to car" communications consortium. They have done a lot of work on this area that we benefited from.'

Car-to-car information turns other road users into scouts. If another car encounters a hazard, it can broadcast that information to nearby vehicles. Similarly, roadside sensors and communi-

cation systems, used by the highway control centre to track road conditions, can transmit important information to drivers as they pass by. They can warn of oncoming lane closures, temporarily lowered speed limits, road conditions and traffic jams, among others.

Internal sensors complete the package of subsystems. The team developed in-car cameras to monitor the driver as well as grip and electrocardiogram (ECG) sensors on the steering wheel. The grip and ECG sensors, combined with the eye-tracking internal camera, can reveal the state of the driver, if he or she is stressed, for example.

I-WAY has completed the first generation of the basic subsystems, and over the coming months it will integrate these systems and test the control software. 'This is a situation assessment software, basing its assessment on the information from all the various sensors,' reveals Migliavacca. 'It is primarily intended for highway driving and is not aimed at accident mitigation, rather it is intended to anticipate hazardous situations and help prevent accidents.'

The computer that will run the assessment software is another early success of the project. 'It is a stack computer,' Migliavacca explains. 'It is special hardware to manage all the inputs. It is a very good, well engineered solution and it is so successful that it is already available on the market and selling quite well.'

Migliavacca takes particular pride in this result, noting that it is unusual to develop commercially successful technology mid-way through a project. In addition to the integration work, the project will continue to improve the basic subsystems.

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<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90166>



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## Network services with the best value

*One of the main challenges in the development of future grid and peer-to-peer network systems was addressed within the framework of the Catnets project. To ensure the most efficient and effective provision of services and resources to network users, a highly dynamic allocation mechanism was proposed.*

The ability of a free-market economy to balance and more importantly, satisfy the conflicting needs of millions of humans means it constitutes a promising organisational principle for large-scale application-layer networks. For example, in distributed systems for on-demand provision of digital music, a decentralised organisation principle would be needed

to allocate both music-playing services to users and digital music files to the music-playing services.

The ultimate aim of the Catnets project, funded under FP6, was to introduce principles of economics to computer science research and develop a new coordination mechanism. Moreover, to evaluate a decen-

tralised organisational principle, based on the economic paradigm of Catallaxy, extensive simulations were planned.

The technical realisation of the economic paradigm built on software agents that bought and sold network services and resources using a heuristic and adaptive negotiation strategy. Changes in prices attributed to certain services would reflect changes in the relationship between demand and supply. Upon receiving this information, both users and service provider agents will adapt their strategies about where to buy or

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## Grids get down to business

*New technology developed by European researchers allows companies to deploy their business processes using grid computing and, even better, it validates a platform that gives easy access to grid resources. It is a big deal.*

Grid computing, desktop networks that share computer resources, were a big deal in the 1990s when they first started to appear. They allowed the search for extraterrestrial intelligence (SETI) to borrow from volunteer computers the enormous computing resources required to analyse the background hum of the universe. So far the enthusiasts have had no luck finding proof that ET phoned home, so the world lost interest in grids.

But serious science has taken to the power of supercomputing for solving grand challenges like protein-folding analysis, climate modelling and earthquake simulation, with European projects spearheading the way.

Quietly and discreetly, European researchers have created a system that allows managers to design and deploy business processes across a grid. They have thus validated a platform that delivers on the promise of easily accessed grid resources. People are listening again.

Rightly so, as this is a big deal. Grids have, for the most part, remained the preserve of large, scientific institutions and companies. They are difficult to set up, even more difficult to manage on a day-to-day basis, and developing a new task or workflow can take many months.

No longer. The EU-funded A-WARE project has developed a platform that allows easy access to grid resources and has validated its approach by enabling grid deployment across large enterprises.

The work is barely finished and already the project partners have potential customers keen to get their hands on their work.

Airbus actually joined the project to get access to just this kind of grid functionality. A major European petroleum company is in the final stages of becoming customer number two. Many big businesses are clamouring for the software.

It is an understandable enthusiasm. Grids allow different computing platforms, like Windows PCs, Mac OS X laptops and Linux servers to share resources. 'It is very important for companies like Airbus, because they have so many different types of computer for each department. Maybe PCs for inventory and Solaris desktops for design, for example. Grids can link those together,' explains Claudio Cacciari, a researcher with the project. 'This helps to correct the legacy issues that computer networks develop over time.'

'But we also designed the system so that it could understand business processes rendered in languages like business process modelling notation (BPMN). The A-WARE platform works with existing enterprise application standards.'

This means that business experts do not need to be grid experts to develop new processes on the system. It will have an enormously positive impact on companies by both extending the functionality and flexibility of their enterprise systems, and by enabling powerful, but easy to use, grid applications.

Airbus tested this system out, too. The company's engineers

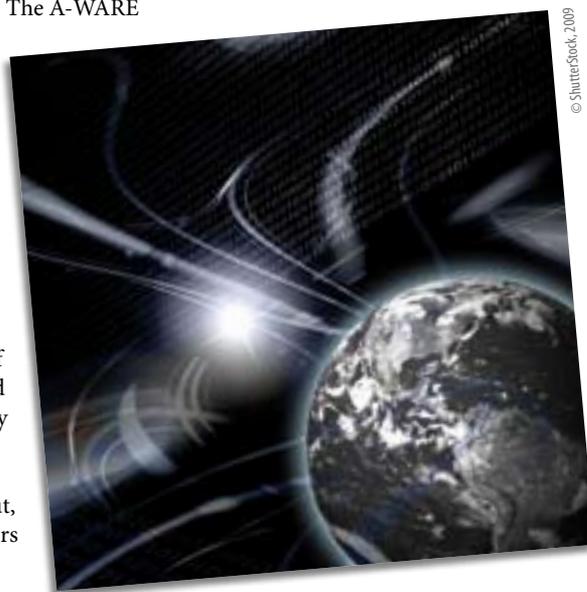
wanted to model the acoustic impact of the engine, placed in slightly different places, on the pilot. This is a complex problem, involving large calculations of fluid dynamics. But that is the beauty of the A-WARE system. It offers the simplicity of a network with the high-octane horsepower of a grid, and the process-development software of an industrial-strength enterprise application.

The A-WARE system works on three layers: the grid layer, a web-based portal layer that gives easy access to grid functionality and resources, and middleware to link the two. It applied the platform to business processes because it is a compelling test case — a complex environment where easy-to-use systems are essential. It has proved to be a canny commercial choice, too.

But A-WARE's work will have a greater impact by setting the standard for easy-to-access grid computing. It opens the way for the regular use of grids in a many other sectors. It is grid computing for the rest of us.

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<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90092>



continued from page 36 'Network services with the best value'

sell, and the state of the network would continuously change.

The development of the simulation environment was directly driven by goals of the Catnets project. To compare the efficiency of network systems based on a decentralised economic approach to manage service and resource allocation and of centralised baseline systems, possible operation scenarios were thoroughly investigated.

The generation of each scenario was done manually using a graphical user interface to

specify the topology of the application-layer network as well as software agents located on every network node. An automated procedure taking network requirements as input supported, however, the generation of a topology for large-scale networks and furthermore it allowed the automatic distribution of agents.

Critical questions on the scalability of coordination mechanisms and their allocation efficiency for different numbers of participating entities were addressed by means of metrics. Based on computer science and

also borrowed from microeconomic theory, these provided valuable insights into how real-world application networks mapped into scenarios performed in different operation situations.

Funded under the FP6 programme IST (User-friendly information society).

Collaboration sought: further research or development support; information exchange/training.

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## DNA-based nanodevices of the future

*Chemically altering the native structure of nucleic acids holds the promise of creating molecular nanowires which are possibly more conductive than native DNA molecules. DNA-based nanowires could then open the way to a new generation of complex nano-electronic devices for assembly into computing networks.*

For millions of years DNA has been responsible for storing genetic information in all living creatures. An international consortium of seven universities and research centres sought to put this long chain molecule into a new context. Detached from its biological origin, artificial DNA double helices were modified in such a way that they could be used as key structural elements for self-organised molecular nano-electronics.

The ambitious goals of the 'DNA based nanowires' project to unravel new ways for the bio-synthetic engineering of nanowires bear a unique promise for nano-electronic device miniaturisation. These were not restricted to the exploitation of the ability of DNA

to recognise complementary sequences giving rise to the self-assembly potential of DNA derivatives. Project partners at the Hebrew University of Jerusalem focused on the seemingly contradictory results involving the ability of DNA to transport electric charges.

For this purpose, an experimental approach was developed which enabled the measurement of electric currents flowing through DNA molecules and more importantly, reproducible results for a wide variety of samples. More specifically, currents through double-stranded DNA (dsDNA) molecules embedded in a self-assembled monolayer of single-stranded DNA (ssDNA) and chemically attached on both ends to a metal substrate on opposite ends, were measured.

By means of a conductive atomic force microscope, the current flowing through dsDNA molecules was found to measure 220 nA at 2 V. This result confirmed the ability of dsDNA molecules to transport electric charges under controlled conditions as well as demonstrated the efficiency of ssDNA as an insulating layer. However, researchers have turned to a new type of DNA-based molecule, G4-DNA, as dsDNA molecules were proven to be very sensitive to environmental conditions.



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

Collaboration sought: further research or development support; licence agreement; information exchange/training.

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## Measurement uncertainty guide

*A written guideline has been provided for the evaluation of measurement uncertainty in testing, enhancing a common metrological frame of reference. The current global economy relies on measurements and tests that can be trusted and accepted at an international level without creating technical trade barriers. This calls for a sound metrological foundation.*

The LVD project supported measurement and testing (M & T) laboratories and related infrastructures in newly associated States (NAS) in order to fully implement the Low-voltage Directive (LVD). The LVD applies to all electrical products which operate in the voltage range of 50 to 1 000 V AC and 75 to 1 500 V DC. The general underlying principle of the directive is that such electrical products must not jeopardise the safety of people, domestic animals or property.

Given this, the importance of testing is apparent. Testing determines the characteristics of a product, a process or a service according to set procedures, methodologies or requirements. It can therefore assess whether or not a product conforms to such specifications.

Measurement uncertainty in testing involves the quantitative measure of the quality of

measurement results allowing those results to be compared with other results, references, specifications or standards. Measurements are subject to error since the result of a measurement may differ from the true value of what is being measured. Unfortunately there is usually limited time and resources to determine and correct measurement errors.

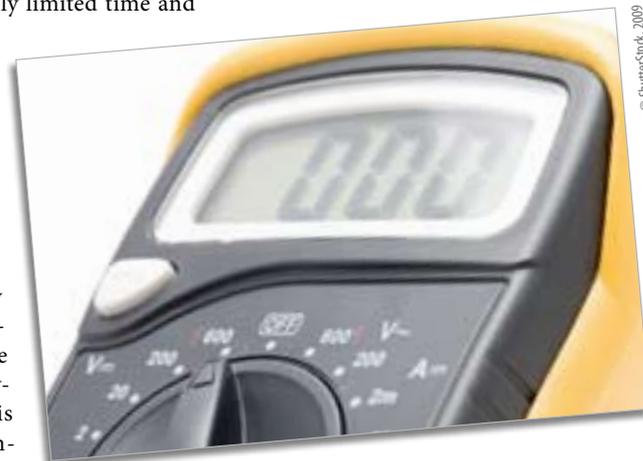
In light of this, the LVD project has provided a written practical guideline for the evaluation of measurement uncertainty in testing. The guideline is based on the GUM method, a widely-used method which is accepted and recom-

mended by accreditation bodies such as the International Organization for Standardization (ISO). The guide summarises the GUM method, suggests model functions and explains and illustrates the use of generic model functions relevant for electrical measurements. Additionally the guide includes examples of uncertainty evaluation.

Funded under the FP5 programme Growth (Competitive and sustainable growth).

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4589

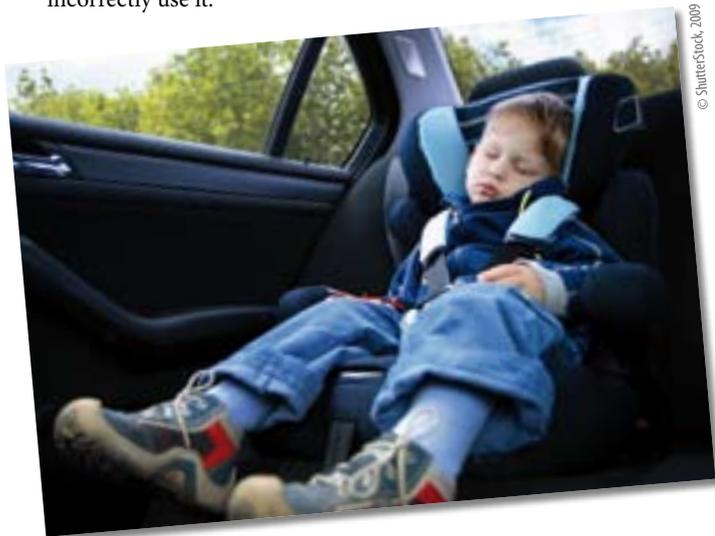


## Critical gaps in child in-car safety practices

*Major steps can be achieved towards improved standards and more efficient design of child restraint systems through a decisive increase of the basic scientific knowledge. Data on the misuse of child restraint systems that was accumulated during the CHILD project could be used to propose new test procedures for determining their effectiveness.*

Most European countries mandate the use of child restraints, but there are often gaps in child passenger safety legislation, particularly as children get older. Children travelling in vehicles therefore remain at risk of serious injury because their parents often use the wrong child restraint system, or incorrectly use it.

Child restraint systems may be misused in a variety of ways, including facing the wrong direction and the child not being properly secured in the restraint. There are also instances of not ensuring that the restraint is of the correct type and size for the child. To give an indication of the level of misuse, each partner in the CHILD project was tasked with producing a comprehensive review of incorrect use of child restraints in their own country.



The outcomes were used to propose new test procedures for evaluating the effectiveness of child restraint systems on the new Q-series of child dummies.

Reconstruction of actual crashes with fully instrumented dummies was considered by CHILD project partners as the most appropriate methodology to establish correlations between dummy measurements and child injuries.

Engineers at the PSA Peugeot Citroën's laboratory worked with partners from and outside the CHILD project consortium to develop the test matrix for evaluating design modifications to child restraint systems. This includes almost all categories of child restraint systems, among which were rear infant carry cot and seats with harness and most importantly, numerous misuse configurations.

A sufficient number of crash reconstructions had to be carried out before new injury limits could be established. New knowledge about the danger to which children are exposed by the misuse of restraint systems could contribute to their improved design that may correct some forms of misuse.

Funded under the FP5 programme Growth (Competitive and sustainable growth).

Collaboration sought: further research or development support; private-public partnership; available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4557

## Using electricity to shape aluminium vehicle parts

*Among the principal processes available for the manufacture of vehicle parts from aluminium alloys, metal forming results in a high-standard product. Offering the desired mechanical properties and accuracy for complex-shaped geometries, it drew the attention of the EMF project partners.*

More extensive use of lightweight materials in vehicles has been identified as an important means of achieving significant weight savings and subsequently, reducing fuel consumption and pollutant emissions. Materials like aluminium alloys are, however, less formable than mild steel and significant amounts of spring-back after formation results in undesirable shape inconsistencies.

The high workpiece velocities achieved during electromagnetic forming (EMF) can enhance the formability of aluminium alloys. Relying on the force generated by a magnetic field to produce the desired shapes in electrically conductive sheet metals, EMF has been established as a technically feasible and efficient means for either the expansion or the compression of cylinders (tubes).

With the aim of drawing guidelines for the optimal selection of raw materials and EMF process parameters, researchers at Daimler-

Chrysler AG worked on identifying forming limits for aluminium alloys of interest. Moreover, relationships between characteristics of the electrical subsystem and deformation responses of the selected alloys were investigated.

Initial tube geometry (diameter and wall thickness) and material formability were identified as the most important factors that would need to be taken into account for tube pre-forming. In addition to material properties, induced forces that depend directly on electric current pulses and influence the forming velocity have a significant role in the success of the pre-forming process.

To avoid defects such as wrinkles due to excessive tangential stress or fracture caused by excessive pressure, manufacturers would need to select appropriate settings for the EMF equipment. More specifically, computer-aided trial and error techniques

proved to be indispensable in establishing the appropriate settings that include the pressure profile and the axial feeding of material over time.

Funded under the FP5 programme Growth (Competitive and sustainable growth).

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4586



## Rolling out flexible displays for the mass market

*European researchers have developed a cost-effective method for manufacturing flexible displays in much the same way that newspapers are printed. Their work promises to revolutionise packaging, advertising and even clothing.*

Ultra-thin and energy efficient displays that use organic compounds to emit light have been stirring up excitement in the consumer electronics industry for several years. Organic light-emitting diodes (OLEDs) are already being used commercially in some high-end flat-screen televisions, offering superior image quality, wider viewing angles and lighter power consumption than the current generation of liquid crystal display (LCD) and plasma flat-panel TVs. But OLEDs' unique properties mean the displays using them can be put to a far wider range of uses, from electronic paper to adaptive clothing — so long as production costs can be brought down.

'Lowering production costs is extremely important if OLED devices are to become more widespread, and particularly if they are not just going to be restricted to high-end applications,' explains Arto Maaninen, technical manager of the printed electronics department of the VTT Technical Research Centre in Finland.

Maaninen led the team of researchers behind the EU-funded Rolled project, which developed a technique for manu-

facturing OLED devices at considerably lower cost than current methods.

Whereas the OLEDs now making their way into TV sets and some mobile devices are manufactured in a glass substrate, the Rolled researchers print their OLEDs onto flexible protective films, a procedure known as roll-to-roll processing that allows thousands of devices to be rapidly and cost-effectively produced in a single print run.

As part of their work, the researchers developed printable nano-particle indium tin oxide (ITO) coatings to form the anode, and they developed a new low-work function metal cathode, with the light-emitting organic layer sandwiched in between.

As an electric current passes from the anode to the cathode layer, the organic compound emits light that, depending on the application, can create a high-contrast TV image or a simple coloured sign. Each OLED sheet is just a fifth of a millimetre thick — equivalent to three or four sheets of paper.

'The biggest cost saving is on equipment. The equipment needed to print OLED displays is widely available, so the initial manufacturing costs are lower compared to other techniques. The material costs are about the same, but you can produce many more units in a much shorter period of time,' Maaninen says. 'This brings down overall production costs three to fivefold.'

That opens the door to OLEDs finding their way into all manner of everyday items. The biggest of several markets for cheap, flexible OLED displays may be in product packaging. Sheets of them could, for example, be used to create more visible logos and more attractive

promotional wrappings to differentiate products on supermarket shelves, or they could be used as part of smart packaging to improve product quality and safety.

'One demonstrator we developed consists of a two-colour OLED display: one showing a green tick, the other a red cross. It could be used on packaging to let consumers know if a product has been opened or tampered with,' the Rolled coordinator says.

The tiny amount of energy OLED devices need to operate mean they could be powered by a small watch battery, solar cells or even radio waves. 'It might be possible for a store to use its shelves as an RFID antenna that would power the OLEDs in the product packaging,' Maaninen says.

The project team developed on that concept — an extension of near field communication (NFC) — in another demonstrator that consisted of a simple business card showing the EU flag. A single-coloured OLED lit up the stars of the flag if a mobile phone with an RFID transmitter was placed near it.

Using flexible OLED displays in smart product packaging or even to replace paper billboard advertisements still remains some way off, however, as too does the vision of clothing embedded with OLEDs to display different messages, pictures or colours.

'Our flexible OLED devices could be used in clothes — the biggest barrier would be making them robust enough to survive being worn and put through a washing machine,' Maaninen says.

Having developed the technical ability to produce flexible OLEDs roll to roll, the Rolled project partners are now working to meet the needs and requirements of potential end applications. Their aim is to carry out the first market trials within the next two years.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90273>



## Cleaner by design

*Pollutant emissions are one of engine designers' central concerns. To refine sophisticated models of the aero-engine combustion and establish the influence of combustion conditions on particulate emissions, laser-based measurement techniques have been developed within the Muscles project.*

The safe, reliable and clean operation of internal combustion engines depends to a large extent on the control of the air and fuel mixing process prior to ignition. The mixture does not only affect the combustion process but importantly, the formation of

pollutants and release of unburned hydrocarbons (HC).

Designers face a challenge in finding a trade-off between high compression ratios needed to reduce carbon dioxide (CO<sub>2</sub>) emissions

and lean combustion with low temperature zones to reduce nitrogen oxides (NO<sub>x</sub>) emissions. Sophisticated large eddy simulation (LES) methods have driven progress made in modelling combustion instabilities and resolving these opposing requirements.

During the course of the Muscles project, laser diagnostics were extensively used to collect new experimental data and validate these performance prediction tools. Laser-induced fluor-

continued on page 41

## Coating-enabled design of aircraft turbine engines

*A theoretical approach to studying abrasible seal coatings incorporated into the casings of gas turbines has been initiated within the SEAL-COAT project to provide recommendations for structural improvements.*

Increasing mileage in air transportation along with increasing pressure to reduce pollutant emissions impose high demands on the efficiency of modern gas turbine engines. Many research efforts have achieved constructive improvements, such as optimised aerodynamic design and higher bypass ratios leading to reduced fuel consumption.



Further efficiency improvements can be expected by minimising clearance between the rotating blades and engine compressor housing. The SEAL-COAT project focused on abrasible seal coatings that allow the blade tip to cut a track into the seal material without causing wear to the blade itself. By providing for self-adjusting clearance, the over-

tip leakage of air in the compressor can be more optimally controlled.

These coatings are being validated by using samples worn by the contact with a prototype blade rotating at a controlled speed and intrusion rate. More extensive analysis of the influence of coating properties and conditions dur-

ing rig tests on the coatings' performance is conducted by means of computer codes. A widely used finite element (FE) code, ANSYS, was used by project partners for this purpose at the University of Technology of Belfort-Montbéliard.

Both target and contact elements were employed to model the contact between the blade tip and abrasible seal coating, as well as to estimate heat generated as energy dissipated by friction. One key aspect to the calculations was the input data for reference coatings, which included more than their elastic properties for coupling mechanical to thermal analyses. The modified consistency of coatings with roots in the thermal spray coating process posed another difficulty which was addressed.

Experimental measurements were used to validate the results of calculations in each studied case before a reliable starting point could be established for improved coating-enabled design of engine components.

Funded under the FP5 programme Growth (Competitive and sustainable growth).

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4606

## Validated software tools for engine design

*Verified tools for modelling complex phenomena inside internal combustion engines will help manufacturers meet increasingly stringent emission standards.*

Vehicle exhaust is responsible for polluting the air in our cities and also contributes to climate change. European legislators have moved to severely limit the allowable exhaust emissions. In the race to satisfy the new requirements, engineers are turning to computer-based methods to facilitate and accelerate the design process.

Ford Werke AG combined its talents with those of other automobile manufacturers and research institutes in the Minnox R & D project to reduce emissions of nitrogen oxides (NO<sub>x</sub>). They oversaw

the collection of experimental data from a production test engine operated under different loads.

Ford's engineers subsequently came up with a novel way to estimate the temperature of metal engine components by combining computational fluid dynamics (CFD) and finite element methods (FEM). FIRE, a CFD package developed by Minnox coordinator AVL, was used to address heat transfer between the engine block, gas combustion and coolants. FEM software was used to provide information regarding additional

thermodynamic parameters for the different material phases.

Validation of model output showed that not only is accuracy improved, but the time required to perform simulations is also significantly less thanks to extensive automation of the procedure. This leads to better modelling of pollutant emissions since production of NO<sub>x</sub> depends strongly on engine temperature. The new tools will be exploited to optimise engine design to maximise NO<sub>x</sub> reduction.

Funded under the FP5 programme EESD (Energy, environment and sustainable development).

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4445

continued from page 40 'Cleaner by design'

escence (LIF) was specifically used by project partners at the Laboratoire d'énergie et de mécanique théorique et appliquée to measure temperature within fuel droplets.

Within the duration of a single laser pulse, typically lasting a few nanoseconds, fuel droplets of sub-millimetre dimensions could be scanned. More specifically, the fluorescence intensity of an organic dye dissolved in the fuel for two different colours was used to estimate tempera-

ture variations within sufficiently small fuel volumes. While the volume of evaporating fuel droplets changed rapidly, this technique has a sufficiently short response time to carry out accurate temperature measurements.

Aiming to improve this measurement technique so that it can be applied to aero-engines under real operating conditions, measurements of the droplets diameter were incorporated. However, further research work will be needed before three-

dimensional temperature maps can be generated for sprays of aviation fuels, such as kerosene, inside the combustion chamber.

Funded under the FP5 programme Growth (Competitive and sustainable growth).

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4565

**See also page 23  
(Minimising combustion hazards)**

## Using oxide-based ceramics in gas turbines

*Ceramics offer the best alternative for the next generation of innovative structural materials capable of withstanding the extremely high temperatures present in gas turbines.*

The need to continually improve the performance of gas turbines demands the use of new materials for vital components. The superalloys currently being used have almost reached their physical limits. The CERCO project addressed the possible benefits of using ceramics in gas turbines.

These advantages included being able to raise the turbine inlet temperature to more than 1 400 °C. A fully operational stationary gas turbine would then experience a gain of around 20 % in thermal efficiency and a 40 % increase in output power. This is compared to an all metal engine with air cooled components. The use of ceramics was also expected to reduce nitrogen oxides (NO<sub>x</sub>) emissions to less than 10 ppm.

The main obstacles to greater use of structural ceramics in gas turbine engines have included the demonstration of the components in real engines. A further obstacle has been the development of materials tailored to specific loading conditions.



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## Next-generation industrial gas turbines

*Metal organic chemical vapour deposition was the key to producing ceramic building blocks for the gas turbines of tomorrow. Ceramic components offer distinct advantages over their metallic counterparts in high-temperature applications, such as industrial gas turbines.*

The expected gains in efficiency could translate into significant financial and environmental benefits. For this reason, the CERCO project was granted funding to deliver a technically feasible solution.

Materials scientists with the Institute for Energy of the EU's Joint Research Centre (JRC), a CERCO partner, investigated the potential of a common ceramic: zirconium dioxide (ZrO<sub>2</sub>). They employed low-temperature metal organic chemical vapour deposition (MOCVD) to deposit extremely

thin layers of ZrO<sub>2</sub> on Nextel 720 multifilament fibre tows.

The challenge involved not only developing and refining the MOCVD procedure, but extending it to perform continuous deposition. During the lifetime of CERCO, the JRC's Institute for Energy managed to achieve a coating capacity of several thousand metres of Nextel 720 multifilament fibre tows in a relatively short period of time. The ZrO<sub>2</sub>-coated materials were then used by the CERCO consortium to construct highly robust components for the new gas turbine.

The overall aim of the CERCO project was to use ceramics to improve the performance of small stationary gas turbines.

This was achieved by selectively replacing metallic hot section components with parts comprising uncooled ceramics. Oxide-based ceramic matrix composites (CMCs) using fibre coatings were developed and characterised according to mechanical strength, density and behaviour under high temperatures. Manufacturing techniques were also developed for complex turbine prototypes such as a shroud and combustor.

Test results indicated that the material developed performed well even over long-term use at temperatures up to 1 050 °C. Beyond this temperature the material became degraded, although it could still be used for short-term high-temperature applications. These included rocket nozzles and thermal protection systems.

Funded under the programme 'Brite-Euram III' (Industrial and Materials Technologies).

Collaboration sought: further research or development support.

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Funded under the programme 'Brite-Euram III' (Industrial and Materials Technologies).

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4583

## Solar reactor to degrade organic compounds

*Two different types of solar reactor were developed and their effectiveness in degrading organic compounds was compared.*

The Solwater project developed and assessed fully autonomous solar reactor systems. These were to be used in remote locations for purifying drinking water without adding chemicals. A specially designed photocatalyst was prepared by coating Ahlstrom non-woven paper with

the Millenium PC500 anatase, a mineral form of titanium dioxide (TiO<sub>2</sub>).

The detoxification system used photocatalysts activated by sunlight. Researchers designed a compound parabolic collector (CPC) prototype photoreactor with plane and concentric

support for the catalyst and a solar multi-step cascade falling-film photoreactor (STEP). These were used for testing the photocatalytic behaviour of the catalyst in the presence of a range of organic pollutants.

Different types of reactants were treated; 4-chlorophenol and gallic acid were used as model organic pollutants. Other reactants included the horticultural pesticide formetan-

continued on page 43

## Metal oxides for gas sensor applications

*Nanocrystalline materials promise improved sensitivity for gas sensors. Fundamental materials and processing issues, which are critical for their high performance, were addressed within the Nanophos project.*

Material engineering of metal oxides is currently one of the most effective methods used for the optimisation of semiconductor metal oxide gas sensors. Significant improvements in such operating parameters as sensing selectivity and gas sensitivity can be achieved and moreover, new attractive possibilities for environmental monitoring can then be explored.

Tin oxide (SnO<sub>2</sub>)-based sensors attracted the interest of the Nanophos project partners at the Università degli Studi di Lecce in Italy. Among the list of semiconductor oxide materials, SnO<sub>2</sub> offers high sensitivity to a broad range of gases at relatively low operating temperatures. The sensitivity of SnO<sub>2</sub> could, however, be enhanced by changes in its microstructure, including reducing the oxide particle size to a few nanometres.

The critical particle size where substantial improvements could be observed depends not only on the material itself, but also on the processing method. For the deposition

of thin films of SnO<sub>2</sub>, pulsed laser ablation deposition (PLAD) was considered the most suitable nanostructure formation technique. Controlling the size of nanoclusters formed by altering the laser parameters or the ambient gas conditions is one of its most remarkable features.

The dimensions of the film crystallites were found to be influenced by oxygen (O<sub>2</sub>) pressure during the deposition of the SnO<sub>2</sub> film, as well as the substrate temperature. When deposition of the thin SnO<sub>2</sub> films was performed in vacuum, the presence of Sn and SnO could be identified by means of spectroscopic diffraction and real space imaging techniques.



Avoiding the accumulation of amorphous material having grains smaller than the Debye length of the SnO<sub>2</sub> within the resulting film provided for increased sensitivity. More importantly, it resulted in a shorter response time.

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

Collaboration sought: further research or development support; information exchange/training; available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4627

## Innovative solution for gas nanosensors

*The application of nanotechnology principles in the design and manufacture of photonic sensors is set to revolutionise the field and provide advanced gas sensing functionalities.*



The EU-funded Nanophos project focused on the development of innovative technologies to aid the detection of a number of gas agents, including carbon monoxide and a series of hydrocarbons. Research teams at the Université Paul Cézanne in Marseilles worked on the detection of the hydrocarbons butane and propane.

Their working principle was to utilise a grating coupler, thus enabling light waveguide coupling. In turn the waveguide is covered by the gas-sensitive layer, the refractive index of which changes upon exposure to

hydrocarbon gases such as butane and propane. It is this change in the refractive index, which is detected as the change in the angular shift of the mode-line corresponding to the light guided into the waveguide.

The grating coupler sensor head, the result of this research, was demonstrated to detect quantities as low as 1 000 ppm of propane or butane diluted in dry air or nitrogen. In addition, other gases such as ozone did not appear to interfere with the gas sensing functionality.

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

Collaboration sought: further research or development support; private-public partnership.

<http://cordis.europa.eu/marketplace> > search > offers > 4587

continued from page 42 'Solar reactor to degrade organic compounds'

ate, a mixture of pesticides used in vineyards, and the dyes indigo carmine and Congo red. Each reaction was carried out simultaneously in the two photoreactors, which were exposed to exactly the same amount of sunlight.

The two types of photoreactor were equally efficient in the total degradation of 4-chlorophenol and formetanate. However, the indigo carmine and Congo red dyes

required longer treatment with the STEP photoreactor. The breakdown of gallic, oxalic and citric acids and catechol, a precursor to pesticides, was examined closely.

Experimental results showed that the photocatalytic breakdown of gallic acid under solar radiation within the CPC photoreactor was more rapid than adsorption. Furthermore, the CPC photoreactor with the catalyst fixed

on a flat plane was found to be more efficient in degrading gallic acid than when the catalyst was fixed on a concentric tube inserted in the cylindrical reactor tube.

Funded under the FP5 programme 'INCO 2' (Confirming the international role of Community research).

Collaboration sought: further research or development support; information exchange/training; available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4674

## Nanotechnology paves the way for new sensors

*The field of sensor devices has received renewed impetus through the application of nanotechnology principles for the development of innovative sensors.*

The EU-funded Nanophos project focused on the development of nanostructured photonic sensors, essentially creating devices with



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advanced gas sensing functionalities. The project partners worked mainly on the synthesis of novel materials in order to achieve diffractive optical interrogation concepts in free-space and waveguide geometries.

The National Hellenic Research Foundation used polymer or sol gel matrices for the *in situ* synthesis of novel devices employing nanoparticles. The aim of the researchers was to achieve reversible modifications in the light scattering properties of these devices without affecting the overall composition of the

device. The properties were altered through exposure to environmental agents.

In addition, the refractive index has been altered locally adding to the overall modifications. These innovative sensing media can be used for the remote detection of humidity, alcohols and ammonia. Data from demonstration trials are available and the developers are keen to strike agreements in order to further explore this line of research.

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

Collaboration sought: further research or development support; joint venture agreement; financial support; venture capital/spin-off funding; private-public partnership.

<http://cordis.europa.eu/marketplace> > search > offers > 4546

## Reproducing ceramic artefacts

*Materials used for ceramic artefact production have been characterised and tested for their applicability in ceramic artefact reproduction.*

Prior scientific literature has been quite expansive in terms of raw materials and processes used in the production of ancient ceramics. However, much work remains to be done in the testing of such results through reproduction. Therefore the Ceramed project ventured to do just that using five key ceramic categories found in the Mediterranean.

The work was carried out by a multidisciplinary team composed of (ethno)archaeologists, archaeometrists, materials scientists, technologists and craftsmen. In order to distinguish raw and related materials such as clays and mineral pigments, spectroscopic tools and methods were employed as were archaeological ceramic artefacts including Iznik and Majolica pieces provided by project partners.

Results and reproductions can prove useful for both archaeometry and (ethno)archaeology and may support technological and archaeological advancements in the achievement of a museum quality label. In turn this can positively affect the high-quality ceramic artefact sector of the museum market.

Funded under the FP5 programme 'INCO 2'  
(Confirming the international role of Community research).

Collaboration sought: further research or development support; information exchange/training; available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4558

## New optical gas sensors

*Hydrogen (H<sub>2</sub>) and ozone (O<sub>3</sub>) gases are easily detectable as they are reactive, but researchers face problems with detection of less reactive saturated hydrocarbons, like butane. Within the Nanophos project, zinc oxide (ZnO) thin film sensors have been successfully applied as butane gas detectors.*

Among the types of gas sensors currently under study, research undertaken during the Nanophos project was focused on optical sensors. ZnO thin film sensors have grown increasingly attractive for detection of small concentrations of both reducing and oxidising gases, due to their high sensitivity and selectivity.

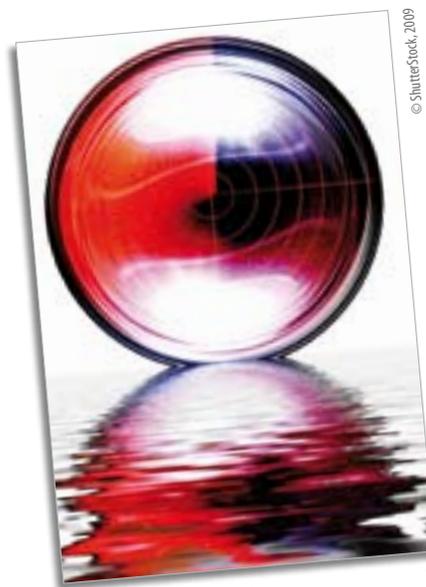
When gas components interact with the sensitive film surface, changes in its chemical or physical properties are observed. The possibility of improving the precision of gas concentration measurements was explored by project partners at Institutul National de Cercetare-Dezvoltare pentru Fizica Laserilor, Plasmei si Radiatiei in Romania.

Various basic materials, such as ZnO, silicon dioxide (SiO<sub>2</sub>) and metal acetylacetonates, and their combinations had been tested and studied in the past for this purpose. Nanophos project partners isolated ZnO, highly transparent in the visible wavelength range, as a promising candidate.

The refractive index of ZnO sensing media changes upon reaction with reducing gases, including hydrogen (H<sub>2</sub>), nitrogen oxides (NO<sub>x</sub>) and sulphur oxides (SO<sub>x</sub>). By pulsed laser deposition (PLD), SiO<sub>2</sub> substrates of high transparency in the visible and near infrared region of the electromagnetic spectrum were coated with a ZnO thin film.

A KrF excimer laser light source with a wavelength of 248 nm was used to deposit high-quality ZnO, as well as gold (Au)-doped ZnO thin films. The response of ZnO films, used as sensing elements, was then tested for different concentrations of butane diluted in nitrogen by the m-line detection technique.

Butane concentrations as low as 100 ppm were detected, opening the way for the development of optical gas detectors with compelling advantages over conventional electrical devices. Integrated into a miniaturised optical gas sensor by means of



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integrated optical circuits (IOC), they could provide a promising alternative solution.

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

Collaboration sought: further research or development support; financial support; venture capital/spin-off funding; private-public partnership.

<http://cordis.europa.eu/marketplace> > search > offers > 4566

## Clean water from solar energy

*Low-cost solar technologies were developed to supply safe and potable water, thereby helping to preventing waterborne diseases in developing countries.*

Researchers developed a fully independent solar reactor system for purifying drinking water in remote locations. Furthermore, the system did not require the addition of chemicals. Instead, solar energy was used to eliminate traces of organic contaminants from drinking water in rural households of the developing world.

The Solwater team recognised the need for a robust and low-cost system for measuring solar radiation in isolated rural areas. This challenge was met with the construction of two kinds of radiometers, which were based on cheap photovoltaic sensors. The devices measured the power of electromagnetic radiation including visible light.

The radiometers' electronic systems used microcontrollers. These took the form of a computer system-on-a chip and contained a processor core, memory and programmable input/output peripherals. The microcontroller was used to calibrate each measured radiation with calibrated measurements appearing on an electronic liquid crystal display as W/m<sup>2</sup>.

The autonomous radiometer system created by the Solwater researchers stored measurement data on its memory. The sampling time could be set for between 0.2 seconds and two hours and was capable of recording 4 000 state changes. Once long-term measurements were completed, the data was transferred to a computer using a serial

RS-232 connection and suitably developed software. When the radiometer system was permanently connected to a personal computer, the data was transferred automatically and solar radiation plotted in real time.

Funded under the FP5 programme 'INCO 2'  
(Confirming the international role of Community research).

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4623



## Water disinfection treatment using photocatalysts

*Everyone needs access to clean water and EU scientists are working towards achieving this goal. European researchers investigated water disinfection treatments, which combine titanium- and ruthenium-based photocatalysts using solar energy.*

The Solwater project developed methods for the purification of drinking water for remote and isolated communities in Latin America. Researchers studied the disinfection of drinking water by photocatalysis using titanium dioxide (TiO<sub>2</sub>) and ruthenium Ru (II) complexes in a solar photo-reactor. Both TiO<sub>2</sub> and Ru (II) complexes were shown to be successful when applied individually. The combined effect of using both compounds, one after the other, was not found to be more efficient than using them separately.

In experiments where Ru (II) complexes were immobilised on polymer strips the concentration of *E. coli* bacteria decreased four decimal places within an hour. When a control was used, which comprised only light and no catalyst it was clear that Ru (II) complex had a major impact on bacterial deactivation. The results showed that Ru (II) caused a rapid drop in bacteria concentration but remained the same for the control.

The disinfection capability of Ru (II) complexes immobilised on paper was also com-

pared with TiO<sub>2</sub> immobilised on Ahlstrom paper matrixes. Photosensitised disinfection was more rapid for Ru (II) due to a higher reaction constant, giving a better disinfection performance.

The effect of using Ru (II) together with TiO<sub>2</sub> was investigated. The two different catalysts were connected in series so that researchers could determine how a hybrid catalysed system would perform. It was found that the experiment where only Ru (II) was used gave the best results for disinfection. This was followed by experiments using TiO<sub>2</sub>. No synergistic effect was detected when the two catalysts were used in series.

Funded under the FP5 programme 'INCO 2'  
(Confirming the international role of Community research).

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4642

## The magnetostrictive properties of Terfenol D

*Enterprise Ireland have highlighted some unusual results from their research into the magnetic properties of Terfenol D. The EU-funded IELAS research consortium examined alternatives to traditional current transformers in an effort to reduce volume, weight and cost. One of its members, Enterprise Ireland, focused its attention on magnetostrictive materials, which change their shape in the presence of a magnetic field.*

A series of experiments were performed to evaluate the magnetostrictive potential of a special alloy called Terfenol D. Analysis of the data revealed some surprising results in comparison to what was expected based on theory described in the scientific literature.

For example, alternating current (AC) caused Terfenol D to expand as much as

three times more than direct current (DC) of the same strength. Secondly, the deformation sometimes occurred in the form of contraction rather than expansion. The Irish engineers determined that momentum alone could not explain the observed response and that it was likely due to a previously unknown transitory magnetic structure.

Finally, evidence of self-inductance was uncovered. The insertion of an extra coil in the experimental setup showed that the current's time signature diverged from the expected sinusoidal shape. Furthermore, self-inductance also causes eddy currents inside the Terfenol D rods, which Enterprise Ireland believes are responsible for the discrepancy between the AC and DC results.

Funded under the FP5 programme Growth  
(Competitive and sustainable growth).

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4669

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>

### Conference and exhibition on wind energy

*The 'European wind energy conference and exhibition' (EWEC) 2009 will take place from 16 to 19 March 2009 in Marseille, France.*

EWEC brings together wind energy professionals and technical experts from all over the world. The conference programme and exhibition attract thousands of participants from Europe and beyond every year.

This year's agenda will include the following topics:

- 'Strengthening the EU policy framework: rapid integration of large quantities of wind power';
- 'Taking wind power technology to the next level';
- 'Opportunities and challenges in the new financial environment';
- 'Leading EU markets: achieving the vision';
- 'SWT (sun, wind and thermal) and hybrid systems';
- 'European Wind Technology Platform: implementing the SRA (Strategic Research Agenda)';
- 'Emerging EU markets: 20% dream or reality?';
- 'Reliability, materials and lubrication';
- 'Mediterranean markets: challenges and opportunities';
- 'Aerodynamics and aerocoustics';
- 'Remote sensing';
- 'Condition monitoring of turbines and components';
- 'Integration of wind power plants';
- 'Climate change policies as a driver for wind energy investments';
- 'Structural design and aeroelasticity';
- 'Integrating wind in electricity markets';
- 'Offshore market deployment and prospects';
- 'How local benefits foster public acceptance of wind energy'.

For further information, please visit:  
<http://www.ewec2009.info>

### Conference on biofuels

*'World biofuels markets 2009' will take place from 16 to 18 March 2009 in Brussels, Belgium.*

Speakers from politics, science and industry will discuss a wide range of topics related to the field of biofuels, including:

- algae fuels;
- global markets;
- renewable diesel;
- biofuels from waste;
- new feedstocks;
- biorefineries;
- forestry and biofuels;
- airlines and biofuels.

The organisers are expecting 200 speakers, more than 100 exhibitors and 1 500 visitors.

For further information, please visit:  
<http://www.worldbiofuelsmarkets.com>

### Forum on water

*The fifth World Water Forum entitled, 'Bridging divides for water', will be held in Istanbul, Turkey, from 16 to 22 March 2009.*

The World Water Forum is organised every three years by the World Water Council. The aims are to raise the importance of water on the political agenda and support the deepening of discussions towards the solution of international water issues in the 21st century, as well as to formulate specific proposals, raise public awareness and generate political commitment.

This specific event will address some of the following topics:

- global change and risk management;
- advancing human development and the Millennium Development Goals;
- managing and protecting water resources;
- effective water governance and management;
- finance in the sustainable water sector;
- education, knowledge and capacity development.

For further information, please visit:  
<http://www.worldwaterforum5.org>

### Convention of European universities

*The fifth European University Association convention will be held from 18 to 21 March 2009 in Prague, Czech Republic.*

One of the objectives of the convention is to influence the priorities set for the Bologna process post-2010, and to ensure that the specific concerns of universities are properly taken into account in the conditions set for the further construction of the European research area (ERA).

To do this, university leaders present at the event will be asked to contribute to identifying 10 theses for the future of European higher education and research looking towards 2020.

This year's convention will also have a new format, where in addition to the main plenary sessions, priority issues will be addressed under four thematic clusters:

- the university as an inclusive and responsive institution;
- universities as research institutions;
- governing and managing complex institutions: new challenges in higher education — impact and institutional response;
- global outreach — Europe's interaction with the wider world.

Each cluster will comprise plenary sessions and working groups.

For further information, please visit:  
<http://www.eua.be/prague>

### Ageing eye conference

*The 'Ageing eye conference' will take place at the Kunstmuseum Bonn, Germany, from 20 to 21 March 2009.*

Age predisposes to diseases affecting virtually all parts of our body. This is especially true for the eye where the two major eye diseases, age-related macular degeneration and glaucoma, account for two thirds of all cases of blindness in Europe. The conference will provide the European and the global perspective on the major causes of blindness, state-of-the-art research of the pathogenesis of the major age-related eye diseases and their socio-economic impact. The current options for treatment and rehabilitation will be discussed and future treatment strategies will be envisaged.

The conference will address these questions and bring together key scientists from basic and applied research that will contribute to foster a multidisciplinary discussion, to promote our understanding and to stimulate further research into ageing eye diseases.

For further information, please visit:

<http://www.eurovisionnet.eu/news/news-ageingeye-meeting.html>

### Joint conference on software practice and theory

*The 'European joint conferences on theory and practice of software' (ETAPS) will be held from 22 to 29 March 2009 in York, United Kingdom.*

The event is the primary European forum for academic and industrial researchers working on topics relating to software science. ETAPS, established in 1998, is a confederation of five main annual conferences, accompanied by satellite workshops and other events.

The five concurrent events are: the 'International conference on compiler construction' (CC), the 'European symposium on programming' (ESOP), 'Fundamental approaches to software engineering' (FASE), 'Foundations of software science and computational structures and tools' (Fossacs), and 'Algorithms for the construction and analysis of systems' (TACAS).

ETAPS 2009 is the 12th event in the series.

For further information, please visit:

<http://www.cs.york.ac.uk/etaps09>

### Workshop on extending database technology

*A workshop on extending database technology for life sciences will be held on 23 March 2009 in St. Petersburg, Russia.*

With the rapid advances in information technology in recent years, life sciences research has been boosted to a new level. High-throughput instruments, such as scanners, mass spectrometers and sequencers, have led to a tremendous growth in the amount of life science data. The diversity and volume of this data present significant challenges for extending data management technology. In order to perform complex and computationally intensive analyses, proper data management techniques and tools are needed.

This workshop will be a forum for presenting and discussing ideas, challenges, and opportunities for data management technology in the life sciences area. New and existing concepts and techniques will be considered in the light of the increasing interest in life sciences research and the significant advances in system infrastructures and available data sources.

For further information, please visit:

<http://www.inf.ethz.ch/personal/akal/EDTLS09>

### Course on child health and the environment

*A course dedicated to the link between child health and the environment is scheduled to take place from 23 to 27 March 2009 in Stockholm, Sweden.*

The objective of the course is to provide state-of-the-art knowledge about the environmental threats to child health in Europe in the context of health risk assessment. Overarching themes will be specific susceptibility and exposure of the developing foetus, infant and child to environmental toxicants and the importance of modifying factors, e.g. nutrition and genetics.

The course is intended for PhD students, post docs, senior scientists and other professionals.

The course is organised by RA-Courses, a project funded under the EU's Marie Curie actions and the 'Postgraduate programme in environmental factors and health' at Karolinska Institute, Sweden, in collaboration with the EU-funded Cascade network of excellence.

For further information, please visit:

<http://www.cascadenet.org/projectweb/4667c4853b2a6/Courses.html>

### Congress on energy efficiency and renewable energy sources

*The '5th international congress and exhibition for south-east Europe on energy efficiency & renewable energy sources' will take place in Sofia, Bulgaria, from 6 to 8 April 2009.*

Its goal is to encourage investment in energy efficiency and the introduction of renewable energy in the region. The forum is an excellent platform for dialogue and business contacts. It uniquely combines scientific and industrial issues from all perspectives of energy efficiency and renewable energy sources, providing industry professionals with the latest technologies, strategies and best practices to lower costs and improve reliability.

For further information, please visit:

<http://www.viaexpo.com/congress-ee-vei/eng/congress.php>

### Congress on food and nutrition

*The '3rd international congress on food and nutrition' will be held from 22 to 25 April 2009 in Antalya, Turkey.*

Building up on the successes of the first two events, the 2009 congress will be aiming at highlighting the most important and emerging areas of food and nutrition sciences, as well as exploring relevant topics that will be the most interesting and useful for the future. Providing accurate and updated scientific information from the most recent R & D activities on the selected disciplines is also targeted.

This congress provides a forum for exchange of ideas and authoritative views by leading scientists (such as food scientists and technologists, nutritionists, and medical professionals) as well as business leaders and investors in this exciting field.

For further information, please visit:

<http://www.tubitak-food2009.org>

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