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- Biology and medicine 5
- Energy 15
- Environment 18
- IT and telecommunications 27
- Industrial technologies 36

In this issue

- Smart scaffolds for tissue engineering, *page 5*
- Increasing solar cell efficiency with silicon nitride, *page 15*
- Modelling greenhouse gas emissions from dairy farms, *page 18*
- Goodbye to faulty software?, *page 27*
- Ultra-low-power integrated circuits, *page 36*

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Capable hands

The EU's efforts to promote a competitive, dynamic knowledge-based economy place a strong emphasis on the key role of research and technological development (RTD). Its financial support enables leading experts across Europe and beyond to cooperate on a vast array of ambitious projects. The extensive scope of this activity is reflected on CORDIS, an interactive platform which enables visitors to keep a finger on the pulse of EU-funded RTD.

The Technology Marketplace (TMP), one of the many free, user-friendly services powered by CORDIS, is dedicated to the dissemination of research results reported by EU-funded projects, and the ICT Results Service updates readers more specifically on research into information and communication technologies. Flanking this web-based approach, the research*eu results supplement *features a selection from the latest coverage on these two services in hard copy.*

In our September issue, the lead article of the biology and medicine section showcases the 'Tissue reactor' project, which aimed to engineer connective tissue in vitro *using a bioreactor and to demonstrate the ability of this tissue substitute to overcome the limitations of current bone grafting materials.*

The energy section opens with results from the INDHI project, dedicated to transferring research results on high-efficiency silicon solar cells into industrial settings. As part of its efforts to boost the efficiency of solar cells, the INDHI team seized on the potential of silicon nitride.

The environment section highlights research results from the Midair project, which explored ways to mitigate greenhouse gas emissions from dairy production. As a starting point, the project partners combined modelling approaches and data collected on 15 model farms to get a firm grip on the extent of the problem and the underlying mechanisms.

The IT and telecommunications section recaps on a line of research which may, one day, make faulty software a thing of the past. The TYPES project set out to find ways of ensuring that software will always do what it is supposed to. Thumbs up from those of us who have simply learned to live with the bugs we cannot fix…

Our concluding chapter focuses on industrial technologies. Among many other promising technologies, it presents results from the ATHIS project, which developed new methods for integrated, miniaturised and distributed electronic systems operating reliably under high-temperature conditions.

Your comments on this issue and on the research*eu *publications are always welcome. Please address questions or suggestions to: research-eu-supplements@publications.europa.eu*

The editorial team

Erratum

The ISSN of this series is 1830-8864, not 1830-8664 as indicated in the first five issues of this year. The online version of all issues carries the correct number, 1830-8864.

More info on the technologies presented? Search CORDIS!

Where?

For the offers, access the Technology Marketplace: **http://cordis.europa.eu/marketplace** and for ICT Results articles, access: **http://cordis.europa.eu/ictresults**

How?

For more details on offers, go to **http://cordis.europa.eu/marketplace**, click on the search menu and select 'offers'. Then key the number of the offer in the box 'enter search term'. 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.

You need to know more than CORDIS provides?

Please refer to the contact point given in the online version of the offers and the ICT Results.

TABLE OF CONTENTS

BIOLOGY AND MEDICINE

Smart scaffolds for tissue engineering 5
Pre- and post-operation gait assessment
Combining medical knowledge to save lives 6
Blood supply cut for cancer cells 7
Molecular models of cancer control
Fighting cholesterol with olive mill waste water 8
Tracing the fate of plasma fatty acids
Protein profile of ageing T cells
Maximising the benefits of goat's cheese 9
Making yogurt even healthier
Pollution affecting frog reproductive system 10
Chloramphenicol resistance in south-east Asian aquaculture products
Antimicrobial resistance: online project information exchange tool
Genetic information on microsporidian pathogens 11
Understanding the impact of pesticides
Solving the genetics of nematode resistance in sheep
Direct-plating method for detecting microbial resistance 12
Improving wheat plant health and maximising consumer benefits
Under pressure to keep food fresher
Disease-detecting lab in the palm of your hand 13
Use of DNA microarrays for studying soil microbes 14
Understanding DNA replication
Measuring cavitation in white poplars

ENERGY

Increasing solar cell efficiency with silicon nitride 15
Bringing recycling to the solar cell industry
Distribution of electrical power and fault isolation 16
Sea, the energy of the future
Novel diagnostic techniques for negative ion sources
Refineries for bioethanol and power production 17
Producing bioethanol with thermophilic enzymes

ENVIRONMENT

Modelling greenhouse gas emissions from dairy farms 18
Sustainability and technology
Global measurements of carbon dioxide 19
Welfare and consumption — the road to sustainability
A new approach for safer drinking water 20
Role playing for environmental success
Better tools for water use management 21
Synthesising river basin management planning
Simulation models support flood forecasting
Using mortar to restore Europe's historical buildings 22
Monitoring on-road vehicle emissions
Effect of elevated CO_2 levels on poplar stomata
Reforestation solutions in arid areas 23
Monitoring poplar response to drought
Managing wetlands with Ecotools 24
Promoting sustainable management of Lake Victoria
Studying wetlands in Africa

	A healthy future for the Gulf of Aqaba	25
	Sustainability issues of Mediterranean coastal zones	
	Developing management tools for aquatic resources in north Africa	
	Mapping the course of life	26
	Assessing landslide risk with the help of a GIS	
	Geo-mapping the snow	
IT AND TELECOMMUNICATIONS		
	Goodbye to faulty software?	27
	Testing computer grid infrastructure	28
	From single-user to multi-user communications	
	Interactive grid computing aids particle physics	29
	3G wireless communications and beyond	
	New logic: the attraction of magnetic computation	30
	Low-cost home surveillance	31
	The wonder of metadata acquisition for the web	
	Meet Robo habilis	32
	Interactive tactile interface for visually impaired computer users	33
	From perception to action	
	Saving lives with a 10-kilo phone network	34
	Aerial systems aid in fire detection	35
	When surgery enters the world of virtual reality	
INDUSTRIAL TECHNOLOGIES		
	Ultra-low-power integrated circuits	36
	Smart testing at high temperatures	
	Power applications of high-temperature superconductivity	
	An innovative approach for the lock industry	37
	Novel semiconductor materials	
	Arrays of thermal imaging sensors	38
	Exploiting nanotechnology to spot the right smell	
	Innovative electronics for controlling multiple nanosensors	39
	Complementary to CMOS nanosensors	
	Experimental data for diesel engine research	40
	Measuring heat flux in internal combustion engines	
	On the quest for more fuel-efficient and cleaner engines	
	Automotive safety systems get more dependable	41
	Silent machines	42
	Pump up the power, not the volume	
	Non-destructive testing of marine bonded structures	43
	Along with safety, ensuring passenger comfort	
	Assessment of enzyme-treated wool samples	44
	No longer pipe dreams — cleaning strategy for pipe organs	
	RFID unlocks supply chain potential	45
	Software for automatic defect detection	46
	Remote processing of non-destructive inspection data	
	Advanced alloy research improves aircraft efficiency	
	Standards set for innovative coating methods sky high	47
	Corrosion-free magnesium alloys	

Smart scaffolds for tissue engineering

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Mimicking human physiology and engineering connective tissue which manages to combine strength with flexibility is a tough call. Researchers have investigated the dynamic culture of bovine and human cells as part of the drive to achieve the perfect tissue-engineered bone.

Connective tissue is involved in structure and support and includes collagen, cartilage and bone. Connective tissue substitutes are often needed to help repair or replace damaged tissues in cases ranging from trauma as well as congenital and degenerative diseases to cosmetics. The demand for cartilage and bone substitutes is high, and increasingly involved with improving the health of an ageing population.

As for the source of bone grafting material, many problems present themselves. Autografting is expensive, and transfused products potentially involve risks linked to disease transmission and donor suitability. Synthetic material tends to wear and does not behave like the real thing. The EU-funded 'Tissue reactor' project strove to refine protocols for the production of a bioreactor-based connective tissue production line that would supply engineered material.

Project partners at Manchester University researched into optimising the production of several cells involved in connective tissue structure. Types of cell included endothelial cells, both bovine and human, smooth muscle cells and pericytes that are undifferentiated to a certain extent and can form the walls of small blood vessels.

These cells were cultured using static and dynamic procedures as well as a bioreactor environment. The cells were plated onto three different types of structure: polymer polyglycolic lactic acid (PGLA), calcium phosphate (CaP) ceramics and a composite of the two materials. They were then maintained for up to six weeks.

As a means by which the success of these methods could be determined, several state-of-the-art techniques were utilised. Biological and biochemical assays, scanning electron micrographs and immunohistochemical staining showed when the stages in tissue production occurred. Adherence to the scaffold, division and production of an extensive extra-cellular matrix incorporating collagen and binding molecules for the matrix were monitored.

Further refinements need to be made to optimise specific cell requirements for human cell proliferation. PGLA scaffolds alone were found unsuitable for bioreactor production of human pericyte and other co-cultures. When CaP was used on its own or in a complex, however, it was shown to strengthen the scaffold. These results can be used as a base for further research to produce bone tissue constructs that overcome the limitations of current bone grafting materials.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4114

Pre- and post-operation gait assessment

A multi-modal and multi-sensor software application framework capable of evaluating a patient with muscle or skeletal problems has been developed. The chance of patients' rehabilitation will be greatly improved.

For a number of medical situations, movement analysis is required — after a stroke for example, or an accident that resulted in serious muscle or skeletal injuries. Movement analysis is also important in sports sciences for performance enhancement and injury prevention. In order to perform such an analysis, accurate knowledge of human functional anatomy is obviously required. The ability to visualise and manipulate anatomical objects and thus computer-simulate human anatomy is therefore an indispensable medical tool. Moreover, software presentation of human anatomy facilitates effective biomedical engineering.

The Multisense project has developed a multi-sensor and multi-modal interface focused on portraying three-dimensional muscle and skeletal structures. It is multimodal since the Multisense application is capable of multi-point body tracking, equipped with a haptic interface and speech recognition, and able to synthesise. Data collected from the many sensors are synchronised, offering both conventional imaging modalities like computer tomography and unconventional organ representations.

The developed application performs a dual task as it tracks the interaction of objects and evaluates a patient. Small tracking volume and real time are prerequisites for effective object tracking. In contrast, patient evaluation demands bigger volumes, but not necessarily real time. The Multisense application not only successfully addresses both tasks but also easily switches from one use to the other. This exceptionally friendly user application has been designed to improve clinical relevance and substantially aid the medical professional.

Moreover, the optical object tracking solution reduces installation costs since it allows multiple usage of expensive hardware. Armed with this innovative optical system, the integrated application estimates joint range movement and location, and segment length. A patient's pre- and post-operation walking ability can now be accurately evaluated.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4049

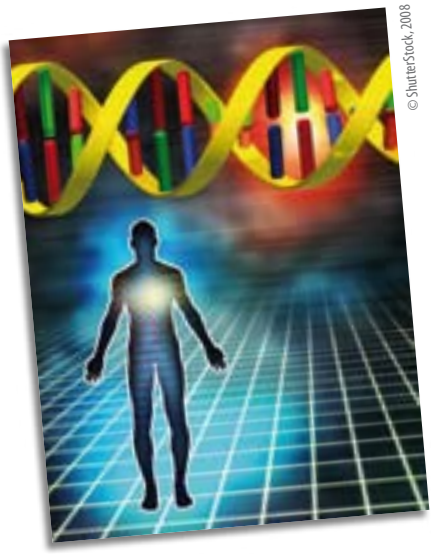
See also page 35 (offer 4069)

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

Combining medical knowledge to save lives

European researchers hope to gain more insight into cardiovascular disease (CVD) by combining clinical, laboratory and metabolic records with genomic data.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CVD is the biggest killer among chronic diseases, claiming 17 million lives globally every year. Yet doctors can only attribute 50 % of CVDs to known risk factors.

Understanding the other risk factors would help doctors target their treatments more accurately, possibly helping to save more lives. A better understanding might also mean individuals could make a more focused effort to reduce their risk of developing a cardiovascular condition.

Many of the risk factors for CVDs, like smoking, gender and low-density lipoprotein (LDL) cholesterol, are well known. But CVD is a complex condition, with very wide variations among the population. By gaining an increased understanding of the risk parameters, doctors would be in a better position to identify those more at risk of CVD.

Enter Multi-Knowledge, an EU-funded project that has developed an IT platform that can combine clinical, laboratory and metabolic information with high-throughput genomic data about the same individual.

Other studies have combined genomic data with clinical data, but the Multi-Knowledge team did that exercise on a much larger scale, says Dr Zohar Yakhini, the project's technical coordinator. 'People normally collect clinical data that they are interested in, while we have just collected data from a cohort that consists of mostly nominally healthy people,' Dr Yakhini says. 'The clinical data that we are working with is much richer than we have seen in the past; that is a novelty of the project.'

By combining information in this way, doctors and researchers will be able to analyse the correlation between the gene expression profile in the blood of an individual and their risk of developing CVD. 'We find pre-clinical conditions to be associated to certain genomic signatures in this population,' he says. 'This means that disease processes that start early might already manifest themselves in the genomic data.'

For example, doctors could use the information to identify blood gene expression signatures that link smoking and CVD in some patients, and cholesterol and CVD in others. If achieved, this level of understanding would provide a powerful tool in preventative medical care. Simple lifestyle changes could reduce an individual patient's risk of developing a CVD to almost zero.

The Multi-Knowledge system works by combining heterogeneous data into a single computing platform. It sounds simple, but the task was complex.

Gene and protein expression analysis is a very data-intensive application. Gene expression occurs when information encoded in DNA gets converted into structures present and operating in a cell. These are the mRNA molecules. Expression profiling of those molecules, using microarrays, produces very large quantities of information that can be difficult for non-specialists to analyse.

The Multi-Knowledge team developed a data collection system and the protocols to combine the data with additional information collected in a distributed set-up. In this respect, the project will have an important influence on emerging standards for heterogeneous medical data collection.

The data, which can come from many sources and take many forms, are stored in a data repository that houses both raw information as well as analysis results. All participants in the study can access data and use the analysis tools that are part of the system. The data analysis tools allow users to connect the repository with external databases and annotations.

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After all this work in the background, the information is presented to users via a portal. The platform is an elegant approach to combining various forms of medical data, but its relevance to the clinic depends on its usefulness.

So the Multi-Knowledge team tested the new platform by using it to study CVD risk factors in a nominally healthy sample. One such well-known risk is smoking. The Multi-Knowledge team therefore tested this well-known risk factor in 50 apparently healthy young adults. They were looking for an over-expression of genes that provoked an inflammatory response.

The system passed with flying colours. There was a clear over-expression of genes that provoke an inflammatory response in those patients who smoked. The team also identified distinct inflammatory expression genetic signatures for smoking and for other risk factors, such as high LDL cholesterol.

The project, which received funding from FP6, finished at the end of June 2008. Team members currently continue to work on various elements of the system. 'Not all elements of the system are integrated together, so we are working on that,' Dr Yakhini says. 'Other elements of the system have already been deployed in several sites, like the data analysis tool.'

Ultimately, the developments will influence the various new approaches to medical information taken by the consortium partners. 'From a commercial perspective, we are not necessarily going to develop a full commercial system,' Dr Yakhini says. 'It will likely be the case that respective partners will take pieces of this work and incorporate it into other products that they already have. From an industry standpoint this is also a favourable result.'

continued on page 7

Blood supply cut for cancer cells

All cells require an adequate blood supply for their continued growth and survival. Scientists have researched this fundamental process in relation to the development of vascular tissue in cancers.

Tumour development depends on angiogenesis, the development of new blood vessels. Expansion of a solid tumour is dependent on this process, and the density of the blood vessels determines whether the cancer can become metastatic and to what extent. Partners in the 'Anti tumor angiogenesis' project worked on exactly how the protein signallers operate in the process of angiogenesis with a view to genetically manipulating and therefore inhibiting the pathways involved.

As part of the consortium, the team based at the Technical University of Dresden tackled this research at the biomolecular level focusing on proteins called vascular endothelial growth factors (VEGFs). VEGFs are important signalling proteins in angiogenesis. These molecules bind to receptors on the cell surface, VEGF receptors (VEGFRs). VEGFs and their receptors therefore are important molecules in angiogenesis and make an ideal target for gene therapy.

The team developed a gene promoter for VEGFRs that was a quarter of its original size. However, it could still transcribe for and produce the receptor molecule. Its efficiency was verified by the so-called lacZ reporter gene analysis in experimental tumours. As such, it has been patented as a potential gene therapy vector.

The same group of scientists also aimed to block tumour angiogenesis, but to maintain the tumour's vascular permeability. This is important when cytostatic therapies are used that work by blocking receptors on the surface of the cancer cells. They mutated receptor VEGF2 and the mutants were then introduced into human endothelial cells. These cells could then be presented for further analysis by the western blot technique for subsequent protein identification.

The results of this research could have wide significance. Angiogenesis is an important phenomenon medically and a better understanding of its biochemical pathways will be beneficial, particularly in tumour control where there is excessive vascularisation.

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 > 4033

Molecular models of cancer control

Action of the enzyme heparanase increases the chances of tumour cells becoming metastatic. Researchers investigated the three-dimensional molecular structures involved in a bid to inhibit the action of the enzyme.

An important progression in the development of cancer is when a localised tumour can spread to other parts of the body. One of the array of molecules that facilitates this process known as metastasis is heparanase. In a cancer, heparanase activity is elevated. Its molecular target is heparan sulphate (HS), which is present in the lining of the endothelium of blood vessels. Increased activity here by the enzyme promotes angiogenesis and subsequent metastasis when the ball of cells has developed an increased blood supply.

As one of the keys to cancer treatment, the EU-funded Heparanase project aimed to study the inhibition of the enzyme. Enzyme action depends on the presence of a specifically shaped binding site for the enzyme to lock onto its target molecule before products can be released. Knowledge of the actual structure of molecules involved in the pathways therefore is crucial.

The team at the Institute of Chemistry at the Slovak Academy of Sciences performed molecular modelling studies on possible heparanase substrates and inhibitors. In particular, they concentrated on the influence of ions and substituents at key points in the molecules.

Quantum chemical and molecular mechanics calculations showed that counter-ions like Na^+ have a stabilising effect on the three-dimensional structure of sulphated oligosaccharides like HS. Basically they interact with negative ions such as $^-NSO_3$ and ^-COO. These charged interactions seemed to be particularly important at the linkages between subunits of the sugar chains.

The team refined its research to two particular binding domains of the enzyme with seven different oligosaccharides. Using molecular mechanics and the Monte Carlo conformational method for peptide structure, the researchers studied the binding action. Data were collected on the interaction between ligands with a metal electron donor like Na^+ and substituted groups on the receptor site.

Knowledge of the specificity of the molecular interactions that result in angiogenesis can form the basis for the design of tumour inhibitors. Furthermore, the escalation of the disease can be prevented by blocking the requirements for tumour metastasis at a molecular level.

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 > 4093

continued from page 6 **'Combining medical knowledge to save lives'**

'But I think many of the consortium partners will continue to work together after the lifetime of the project, finding more pieces in the puzzle that will ultimately yield effective diagnoses tools combining clinical and genomic analysis', he added. And then the final impact will be lives saved through better prevention of CVD.

CVD is the number one cause of death globally. An estimated 17.5 million people died from CVD in 2005, representing 30 % of all deaths, according to the World Health Organisation (WHO). Of these deaths, 7.6 million were due to heart attacks and 5.7 million were due to stroke. By comparison, diabetes is responsible for the deaths of 1 million people.

CVD is caused by disorders of the heart and blood vessels, and includes coronary heart disease (heart attacks), cerebrovascular disease (stroke), raised blood pressure (hypertension), peripheral artery disease, rheumatic heart disease, congenital heart disease and heart failure. The major causes of CVD are tobacco use, physical inactivity and an unhealthy diet, WHO says.

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http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/89850

Fighting cholesterol with olive mill waste water

During the milling process, some of the olive's natural antioxidants perish in the waste water. Pioneering research has uncovered a way to retrieve these highly valuable substances from the waste stream.

Mediterranean cuisine has gained popularity as society has become increasingly health conscious. The merits of olive oil, an essential component of the Mediterranean diet, are well known.

This led a group of universities to investigate the potential health benefits of waste water derived from olive oil mills. Supported by the 'INCO 2' programme, the NewtechOMW project sought to isolate natural antioxidants that accumulate in olive mill waste water (OMW) during the milling process.

Biotechnologists from Tunisia performed multiple laboratory experiments which culminated in the definition of an effective solvent-based procedure for the extraction of hydroxytyrosol and other phenolic compounds. Yields on the order of 85 % are possible and the process can easily be expanded to large-scale production.

Sensitivity analysis of a number of different storage and other parameters revealed increased output when the OMW is stored in cool, low-light conditions. Tests of the antioxidising power of the recovered compounds indicated superior performance characteristics for hydroxytyrosol and 3,4-dihydroxyphenyl acetic acid.

Finally, the NewtechOMW partners gauged the capacity of hydroxytyrosol and OMW to fight cholesterol in rats sustained on a high-fat diet. The results were encouraging as several key indicators, such as serum total cholesterol (TC) and low-density lipoprotein cholesterol (LDL-C), showed significant improvement. It is hoped that this research will provide insight into the mechanisms through which hydroxytyrosol and its phenolic relatives reduce cholesterol.

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 > 4230

Tracing the fate of plasma fatty acids

Nutritionists are becoming increasingly aware of the importance of the production of short-chain fatty acids (SCFAs) from dietary starch. A new refined means for their detection in plasma has been developed.

SCFAs are produced as a result of microbial digestion of fibre and resistant starch. Recent research suggests that these may be very important in the metabolism of the liver and other organs. To gain insight into their production and metabolic fate *in vivo*, an ideal method is to use radioactive tracers.

Scientists at the Human Nutrition Research Centre in Nantes, France, under the umbrella of the 13C-Starch project, have developed a refined method of gas chromatography/mass spectrometry (GC/MS) to detect SCFAs. This has the advantage of reducing the need to use a high level of 13C tracer in studies.

Gas chromatography-combustion-isotope ratio mass spectrometry (GC-C-IRMS) was refined using solid phase micro-extraction (SPME). Plasma proteins were removed and the SPME fibre was held in the liquid when the acetate was desorbed.

When tested against an internal standard, good linearity was obtained for the fatty acids. For example, acetate gave repeatable linear results from concentrations between 0 and 400 micromoles. Accuracy was also confirmed. When tested on healthy and overweight subjects during lactulose fermentation, concentrations of acetate were consistent whether using low or high concentrations of radioactive tracer.

This refined method of tracking carbon-based metabolites has increased sensitivity. Furthermore, it holds potential for the elucidation of metabolic pathways important in the prevention of chronic diseases such as type II diabetes and atherosclerosis.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4281

Protein profile of ageing T cells

Partners in the EU-funded T-CIA project have investigated the identities of the proteins produced during the senescence of T cells in the immune system. Biomarkers associated with cell ageing were then identified according to the changing profile.

T cells are pivotal, not only in the immune system as the main source of adaptive immunity, but to cell function generally. They are involved in senescence of the immune system and the cellular dysfunction apparent as ageing progresses.

T-CIA investigated immunity and changes during ageing of the immune system in the cell chemistry of young and old, healthy and not-so-healthy donors. As a part of this study, scientists at Unilever in the United Kingdom profiled the protein changes produced by early and senescent T cells. In this way, biomarkers of senescence could then be identified.

To obtain a protein profile as cells aged *in vitro*, advanced biomolecular analysis techniques were used. These included the latest, most appropriate versions of affinity chromatography, mass spectrometry and peptide mass fingerprinting. Biomarker analysis with software designed specifically for biosystems was then used to identify differential protein expression.

A consistent pattern of protein profile changes was obtained and important proteins were identified. Several candidate proteins were isolated that are integral for basic cell processes such as lipid metabolism and calcium signalling. One of the most significant indicators was that involving the proteins for the assembly and disassembly of actin. Actin is one of the structural proteins involved in the cellular skeleton and is involved in cell division, contraction in muscle cells and signalling. Cytoskeletal remodelling thus may well be a feature of the ageing cell.

The differences in protein expression in ageing cells may well be highly important indicators of changes brought about by senescence. Identification of these could pave the way to the development of anti-ageing interventions on a biochemical level.

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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Maximising the benefits of goat's cheese

Cheese is a tasty, versatile, functional food. Scientists have investigated how to maximise the food's health-promoting conjugated linoleic acid (CLA) content without compromising its texture and sensory qualities.

Manufactured from milk, cheese has always been regarded as a compact supply of the major nutrients together with many of the required vitamins and minerals. Its worth, however, has been promoted to an even higher position on the 'good for you' ladder. Presence of members of the CLA family in cheese has boosted its status as a functional food. There is increasing evidence that CLAs prevent cancer and have antioxidant properties, with the added bonus of acting as a fat burner.

Partners with the EU-funded Biocla project aimed to increase the CLA content of milk-based foods through specially developed feeding and husbandry strategies. Their work covered cattle, sheep and goats, but project members from the Clermont-Theix Research Centre in France focused on goat's cheese in particular.

To do this, they ran three studies where different diets were fed to goats. These varied in terms of concentration of forage or grazed plant material. Supplements of linseed oil, sunflower oil and vitamin E were then added. Resulting levels of CLA in the cheeses were assessed. Panels of experts then rated the cheeses in sensory and flavour tests. Sensory tests gave a grade for odour, flavour and texture. A total of 60 French consumers gave a global appreciation mark which ranged from 1 (indicating a bad cheese) to 7 (very good). In particular, a low mark was scored for a goaty or a yeasty flavour.

Overall, the cheeses were rated favourably by the French consumers. Lipid supplement from the two oils resulted in a very high CLA content. However, this was sometimes marred by defects in flavour, particularly from linseed oil. Addition of vitamin E resulted in lower undesirable fat oxidation levels, expected because of its antioxidant properties.

The results of this study are undeniably comprehensive. Goat's cheese and other products can be manufactured from CLA-enriched milk. For the cheese industry, therefore, they have shown that cheese can be marketed as a functional food with no significant loss of taste or other important sensory properties. The medical, pharmaceutical and food industries also stand to benefit from this research.

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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Making yogurt even healthier

Fermentation to produce a range of foods carries the risk of histamine production. Members of the Decarboxylate project have researched into its production in yogurt.

Histamine is a bioorganic amine which, when ingested, has undesirable effects such as dilation of arteries, a decrease in heart rate and constriction of the bronchioles. Lactic acid bacteria (LAB) play an important role in its production from the amino acid histidine in protein-rich foods.

Unfortunately, the food commonly associated with a healthy diet, yogurt, is a candidate for this unwelcome reaction. Produced from milk, it is a high-protein food and LAB are utilised to change lactose into lactic acid. The acid then helps to preserve the product and thicken it.

Project partners at Chr. Hansen A/S in Denmark, a company renowned for industrial production of healthy food using natural ingredients, manufactured yogurt using various culture combinations. Culture bacteria under trial included *Lactobacillus bulgaricus*, a very commonly used bacterium, and other fermenters such as *Streptococcus thermophilus*. The team was also interested in whether the histamine production occurred during the production process or later, during storage in refrigerator conditions. Samples were taken at day one of fermentation and then during storage at 4 °C on days 20 and 50. These were then subjected to histamine assays using high-performance liquid chromatography (HPLC).

Histamine was found in yogurt samples produced by *L. bulgaricus* together with histamine-positive strains of *S. thermophilus*. However, when histamine-negative strains of *S. thermophilus* were used, no histamine was detected. It is most likely that *L. bulgaricus* produces histidine in the first place. The *Streptococci* then produce the histamine from the precursor. However, if a histamine-positive *S. thermophilus* strain is used, restriction of the amino acid histidine is a strategy that is likely to curb the formation of histamine.

The results of this investigation indicate that histamine-negative bacterial strains can be used without the undesirable production of the biogenic amine. All commercial yogurt cultures supplied by Chr. Hansen are indeed histamine negative. Also important for consumers is that most of the histamine was found to be produced during fermentation itself and not during the storage phase.

Yogurt is a natural food that has many acclaimed health effects. Data from this trial can help to ensure that its beneficial effects can continue to be enjoyed.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4147

Pollution affecting frog reproductive system

Monitoring pollutant levels is a key step towards predicting potential toxicity to humans and other mammals.

The EU-funded Easyring project set out to identify novel biomarkers that would reveal pollutant levels in aquatic species, with particular focus on endocrine disruptors (EDs). Researchers aimed to pinpoint new sets of biomarkers that can be used to reveal information regarding ED levels in the mucus membranes of aquatic species such as frogs.

Project partners at the Berlin-based Institute of Freshwater Ecology and Inland Fisheries studied the effects of a series of EDs on *Xenopus laevis*, the African clawed frog. More specifically the impact of EDs was assessed in reference to the hypothalamus-pituitary-gonad axis regulating reproduction.

The exposure studies were carried over a period of four weeks involving male and female adult members of the species. The EDs that were used represented both (anti)oestrogenic and (anti)androgenic modes of action and included tamoxifen and flutamide. Water from the Lambro river was also used as a control in the studies.

The results indicated that gonadotropin mRNA expression is differentially regulated by (anti)oestrogenic and (anti)androgenic EDs, which could be of pivotal importance in toxicity studies. These data imply a clear link between EDs and reproductive system dysfunctions in these amphibians and under the particular testing conditions.

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 > 4176

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Chloramphenicol resistance in south-east Asian aquaculture products

South-east Asia is now a major producer of farmed fish and shellfish. The Asiaresist project has studied the possibility of transferable antibiotic resistance genes in the region's aquaculture environment.

Asiaresist investigated antimicrobial resistance in bacteria in aquaculture products sourced from south-east Asia and imported into Europe. Antimicrobials are widely used in south-east Asian fish farms, leading to concerns that this may result in the development of antimicrobial-resistant bacteria. This could compromise public health and threaten productivity and the local economy. Therefore, it was crucial that the proper hazard control measures were adopted for efficient management of the ecosystem.

The Asiaresist project undertook to reliably identify bacteria resistant to the antimicrobial chloramphenicol (CHL) by initially using repetitive chromosomal element polymerase chain reaction (repPCR) analysis. According to the profiles obtained, possible duplicates were identified and put to one side. The remaining samples were subject to gas-liquid chromatographic analysis of cellular fatty acid methyl esters (FAMEs). The FAME profiles for unknown samples were compared with the general trypticase soy broth agar (TSBA) database in an attempt to classify them, at least to the bacterial family level. This enabled the first comprehensive account to be drawn up for CHL-resistant bacteria in south-east Asian aquaculture.

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 > 4196

Antimicrobial resistance: online project information exchange tool

Antimicrobial resistance is emerging as an extremely serious threat for the well-being of citizens the world over. Minimising this risk is currently the subject of intense research across a number of EU-funded projects.

The EU-funded Asiaresist project focused on the use of antibiotics in the south-east Asian aquaculture industry. The introduction of these antibiotics to the ecosystem could result in the emergence of bacterial species with resistance to the commonly prescribed antibiotic compounds.

Developing ways to monitor the effect of antibiotic usage and assessing the likelihood of the emergence of specific antimicrobial-resistant genes among south-east Asian fish farms were the aims of Asiaresist. In order to realise these aims and enhance the communication of information, the project launched a website (http://www.medinfo.dist.unige.it/asiaresist) in the first months.

The website, essentially a dissemination tool, comprises two parts, one freely accessible and one restricted to project partners only. The aim was to provide a platform through which information could be exchanged in a two-way direction. Furthermore, the project's website hosts a database as a knowledge repository for all the technical and research information that emerges from partner laboratories.

It is thought that the online platform has enhanced partner communication within the consortium, and it is likely to have improved communication with the general public as well.

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 > 4125

See also page 12 (offer 4191)

Genetic information on microsporidian pathogens

The use of bumblebee species as pollination tools is widespread across numerous farming communities. Protecting these species from infection is therefore vital not only to the ecosystem, but also to the economic viability of these communities.

The EU-funded 'Pollinator parasites' project studied the interactions between bumblebees and the microsporidian parasites that can infect them. Different aspects of the life cycle and virulence of Microsporidia were examined especially in conjunction with their impact on the bumblebee's health status. The overall aim would be to create polymerase chain reaction (PCR) tools to detect infection and at a later stage control disease spread.

Researchers set out to create genetic libraries of the microsporidian species that infect bumblebee populations. However, these efforts were hampered due to the nature of the infection mechanism. More specifically, the Microsporidia are characterised by their intracellular parasitic nature, making the extraction of contaminant-free DNA almost impossible.

The project partners managed to rid Microsporidia DNA from host DNA contamination using enzyme DNAase treatment. This technique yielded genomic libraries of microsporidian species and gained information on microsatellite loci. It is interesting to note that unlike other infectious agents, the loci that were isolated appeared to be monomorphic in nature and not polymorphic.

This essentially means that this type of analysis may not be best suited for this type of pathogen. Further research will allow scientists insight into the genetic profile of microsporidian species.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4141

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Understanding the impact of pesticides

Understanding the impact of pesticides and related compounds on the environment and on the health of various species is of crucial importance, and related to their overall safety and use.

The EU-funded Demetra project aimed to develop software tools that could aid in the prediction of pesticide-induced toxicity. The modelling and the overall data collection were based on five organisms in total, in order to monitor the effect of pesticide ingestion in the short and long term.

Researchers at the Mario Negri Institute for Pharmacological Research in Italy focused on the production of a series of datasets relating to the honeybee (*Apis mellifera*). These datasets formed the basis for the quantitative structure-activity relationship (QSAR) models used in the prediction of acute contact toxicity in the honeybee. A total of 85 compounds were tested and, most importantly, the studies that were carried out resulted in the accurate description of these compounds at three different levels.

In other words, compounds were studied from a toxicological, chemical and mathematical viewpoint in order to arrive at a complete description. The information that was generated was mostly targeted towards scientists and researchers active in the field of pesticide development.

It is anticipated that these datasets on the honeybee and other organisms will allow the scientific community to examine the effects of pesticide use on the environment and thus develop innovative solutions aimed at pest control.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4000

Solving the genetics of nematode resistance in sheep

The safety and quality of food products is a priority for European officials across all Member States. New research efforts are trying to guarantee that quality and good health can be ensured pre- as well as post-natally for the animals.

The EU-funded Genesheepsafety project went beyond the traditional animal husbandry techniques to improve the quality of products from the sheep food chain. Project partners sought ways to genetically enhance specific breeds by selecting individuals with a 'favourable' genetic profile (genotype).

The genetic characteristics that researchers looked for affected a variety of traits ranging from milk production to infection resistance. More specifically, part of the project consortium focused on the innate trait that some sheep appear to demonstrate, namely resistance to nematode infection. The nematode parasitic worm can have deleterious effects on the animal host, with further implications on the resultant food products and their suitability for consumption.

The Institut national de la recherche agronomique (INRA), a project partner, studied members of the Sarda and Lacaune families in Sardinia. Following specific indicators, researchers managed to discern specific linkages between genetic loci on the sheep genome and resistance to nematode infections. These loci termed quantitative trait loci are considered to play a role in the animal's ability to resist infection from nematode worms.

Further research into this area can yield extremely valuable results for application in the field of animal breeding and for the food industry in general.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4118

Direct plating method for detecting microbial resistance

The Antres project investigated resistance to antimicrobials in healthy children from rural and urban communities in Bolivia and Peru. Researchers developed a method for rapid screening of antimicrobial resistance in bacteria in the human gut.

The conventional method for detecting resistant strains of *Escherichia coli* directly on plates of McConkey agar lacks proper standardisation. This led the Antres project to produce a direct plating method (DPM) for detecting antimicrobial resistance of *E. coli* in healthy children. The two different methods were then compared. Rectal swabs or swabs from the fresh stools of healthy children were used as a source for faecal material. The children were between the ages of six months and six years and came from both rural and urban communities.

A microbiological analysis was carried out at the same time using the conventional and DPM methods. The DPM turned out to be a rapid, highly sensitive and specific method for analysing drug-resistant *E. coli* from faecal samples. Furthermore, DPM was 10 times cheaper than the conventional technique.

The DPM, therefore, represents a valuable tool for undertaking resistance surveillance on a large scale. This enables cost-effective resistance control programmes to be undertaken, especially by countries with limited resources.

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

Collaboration sought: financial support.

http://cordis.europa.eu/marketplace > search > offers > 4191

See also page 10 (offers 4196 and 4125)

Improving wheat plant health and maximising consumer benefits

Fusarium ***infection in wheat plants can prove detrimental for the entire food production chain, and ultimately for consumer health.***

The EU-funded Fucomyr project set out to use molecular and genetic tools to identify the genes that could confer resistance to *Fusarium* fungal infection in wheat. The mycotoxins produced by *Fusarium* species can be extremely pathogenic to humans. It is therefore of great importance to develop methodologies that can protect wheat populations as well as consumer health.

By developing appropriate selection tools, project partners aimed to isolate plants that are naturally resistant to infection and, based on their genetic characteristics, develop *Fusarium*-resistant wheat varieties. The Institute of Applied Genetics and Cell Biology in Austria, a project partner, focused on the creation of DNA libraries and plasmids carrying resistance genes.

The availability of the resistance plasmids in sufficient quantities was a crucial aspect of the project since the plasmids were required for the transformation of wheat plants. The transformation process would ensure that the resistance trait could be passed from generation to generation, essentially establishing a new *Fusarium*-resistant wheat variety.

The stability and 'longevity' of the transformation process is very much dependent on the plasmid composition, and therefore further studies need to be conducted before it can be thoroughly established. These protocols could provide tools for plant biotechnology in numerous aspects.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4037

Under pressure to keep food fresher

With major technical and engineering hurdles having been overcome within the 'Safe ice' project, the full benefits of high-pressure processing of frozen food may be delivered to consumers in the near future.

Non-thermal food processing techniques are presently regarded with an unprecedented interest by the European food industry. Among them, high-pressure processing is gaining popularity because of its unique capability to preserve food while inactivating pathogenic microorganisms. Besides promising almost complete retention of the nutritional content of fresh foods without sacrificing their shelf-life, other advantages include significantly reduced process times when compared to traditional thermal processing.

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Within the 'Safe ice' project, researchers from various fields combined their expertise to establish a sound scientific and technical basis to further improve high-pressure, low-temperature processes. Critical process parameters along with experimental data regarding the quality and safety of food products were accumulated with a view to developing and transferring equipment concepts to real food systems.

To allow semi-continuous freezing and thawing of fish blocks, a new approach was adopted by project partners at the Polish Academy of Sciences while designing a pilot high-pressure facility. Theoretical modelling of various inner geometries for the high-pressure chamber revealed that only a circular autoclave could fulfil the industrial requirements of fatigue strength. On the other hand, the thermal conductivity and low temperature stability of materials used were evaluated in a systematic way to develop the high-pressure reactor to its full potential.

Furthermore, a tubular high-pressure reactor was proposed with a modular structure that permitted its length to be freely adjusted according to the results of feasibility studies. Taking into account the optimum freezing and thawing paths, the influence of high-pressure processes on enzymes responsible for food spoilage as well as cell viability and injury were analysed. The evaluation of high-pressure process concepts in the 'Safe ice' industrial scale facilities has offered a sound basis for future improvements in the quality of processed food products.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4155

Disease-detecting lab in the palm of your hand

Detecting food-borne diseases such as* Campylobacter *and* Salmonella *long before they enter the food chain would help ensure that the dinner on your table is safe to eat.

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There is no quick and simple way to detect infectious bacteria on farms, or even in food processing and distribution plants. Samples have to be sent to labs for testing, a process that can take hours or days.

But what if tests for *Campylobacter* and *Salmonella* could be run on the spot in as little as half an hour? The result, say European researchers, would undoubtedly be a dramatic improvement in food safety. *Campylobacter* and *Salmonella* are particularly nasty bacteria that are responsible for most cases of food poisoning around the world.

The idea of a lab-on-a-chip, a device small enough for someone to carry around but able to perform many of the tests normally carried out in a full-sized laboratory, has been around ever since microelectromechanical systems (MEMS) technology made it possible to put sensors, fluid channels and optical components into a small space. However, the costs of producing such a system and the failure of many developers to incorporate a means of preparing samples on the spot have meant that few have gone into commercial use.

A team of European researchers has addressed those problems, creating one of only two prototype systems in the world that prepare samples and perform DNA tests on bacteria in a portable, easy-to-use and cost-effective chip.

Their work, carried out in the EU-funded OptoLabCard project, will lead to the development of portable devices that can detect bacteria in the food chain and diseases as diverse as cancer, hepatitis, AIDS and flu in humans. Their work could also be used to develop portable devices that can identify pathogens and pollution in water supplies. 'The uses for these devices are almost endless … and the market is huge,' explains Dr Jesús M. Ruano López, coordinator of the OptoLabCard project at Ikerlan-IK4 in Spain.

What sets the OptoLabCard prototype apart from previous devices is the material used to manufacture the components of the chip, and the way in which samples are prepared prior to testing. Using a single material for most components — a negative thick photoresist — makes the chips simpler and cheaper to produce.

The chip itself is disposable, while a reader or base unit contains all the electronics and optics. Meanwhile, incorporating sample preparation into the chip means that users can effectively replicate laboratory processes out in the field. 'Sample preparation is perhaps the most crucial part, but it was abandoned by earlier developers,' Dr Ruano López notes. 'After all, in order to detect the presence of bacteria, it is essential to have a reliable sample.'

Rubbing a swab across a chicken carcass, for example, might produce a sample containing as few as 10 bacteria, an amount that could go undetected once transferred into the device. That inability to provide a representative sample could lead to the bird or the entire batch being deemed clean, when in reality the meat may be covered with dangerous pathogens.

To get around the problem and to improve detection accuracy, the team incorporated a method of concentrating the sample before testing. They used magnetophoresis and the polymerase chain reaction (PCR) technique. PCR is a well-established method of replicating DNA to create higher concentrations. 'By using PCR for sample preparation, we can create more concentrated bacteria samples, and because it works with DNA it means that the same device can be used to detect many different types of bacteria and diseases,' Dr Ruano López says.

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So far the device has been used experimentally to detect *Salmonella* in faecal samples taken from hospitals, and will soon be used in Denmark to test for *Campylobacter* on chicken farms. Testing for *Campylobacter* is a particularly practical use for this technology because of the bacteria's high prevalence in poultry, explains Dr Dang Duong Bang, a senior researcher at the Danish Institute for Food and Veterinary Research, which will conduct the trial. 'If the device works as promised and leads to commercial products, it will offer major benefits for farmers, processors and especially consumers,' he says.

Dr Doung Bang points to studies that suggest the cost of treating gastrointestinal infections caused by *Campylobacter* amount to the equivalent of EUR 600 million in the United States and about EUR 200 million in the United Kingdom alone each year.

Faster and more effective testing would undoubtedly reduce the number of infected animals reaching the market. Dr Ruano López says a product based on the OptoLabCard prototype could be ready for use commercially within three years, but the project team are not stopping the development of the device.

A spin-off company called microLiquid has been set up to commercialise components built with SU-8, while several of the project partners have recently launched a new project, called LabOnFoil, in which they will seek to create sample processing and detection chips on foils instead of traditional silicon wafers. This work would not only bring down the cost per test by a factor of 10, to between EUR 0.50 and 1.50, but it could also lead to skin patches able to detect and monitor disease, contamination and drug abuse, Dr Ruano López says. The patches would be able to be read by a smart card. Such developments would certainly turn tiny, portable laboratories into a ubiquitous technology, able to detect disease and ensure the safety of food anywhere at any time.

OptoLabCard received funding from FP6, while LabOnFoil is being funded by FP7.

Promoted throught the ICT Results service.

http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/89827

Use of DNA microarrays for studying soil microbes

DNA microarrays were developed for investigating links between cell physiology and the breakdown of organic substances. These DNA arrays were used to study communities of microorganisms in soils polluted by herbicides.

The Access project designed and implemented DNA microarrays for studying the links between cell physiology and given biodegradation pathways. Biodegradation is the breakdown of organic substances by enzymes produced by living organisms.

This work was part of a major study into the ecoengineering of sites polluted by atrazine, 2,4-dichlorophenoxy acetic acid (2,4-D) and similar herbicides. Detailed metabolic information was used to create molecular biology tools to help scientists understand the degradation processes of complex communities of microorganisms. This provided insights into how these communities adapt to stress conditions.

The first array was designed to see how cells react in the presence of different effector molecules of the selected pathway and its response on mRNA levels. The second microarray involved the genes used in catabolic pathways for aromatic compounds which break molecules down into smaller units, releasing energy. The third designed system was a DNA array for studying the population diversity and dynamics of microorganisms in complex ecosystems, including soil.

One advantage of this method was the potential for producing reference DNA or probes without previous sequence knowledge or a need for evolving sequence databases. A series of hybridisation probes featuring progressively higher resolution levels can be used as tools to analyse the individual members of a given microbial community.

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

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

http://cordis.europa.eu/marketplace > search > offers > 4142

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Understanding DNA replication

The molecular armoury of cells includes a host of enzymatic tools which, apart from their true function, could also find application in a host of biotechnological uses.

The EU-funded Repbiotech project focused on the investigation of the DNA replication process and the potential biotechnological applications that stem from it. Project partners investigated all aspects of DNA replication including the enzymatic machinery that makes the entire process possible.

The overall goals of the project had been to define new applications for these enzymes, potentially in an industrial setting or to herald the onset of new DNA inhibitor-based medicines. One of the microorganisms that formed the focus of the study is the hyperthermophilic archaeon *Sulfolobus solfataricus*. Due to its specific traits and affinity for high temperatures, its DNA replication system holds specific interest.

The enzymes involved in the *Sulfolobus* DNA replication process can withstand temperatures that would lead to the denaturation of DNA and the deactivation of all protein function. Therefore *Sulfolobus* enzymes are particularly suited for applications that require increased temperatures, and these can range from industrial uses to the polymerase chain reaction (PCR).

Within the Repbiotech framework, scientists managed to gain significant information regarding the chromosomal organisation of the *Sulfolobus solfataricus* DNA replication system. Further investigation would allow insight into the entire process and open new avenues for exploitation.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4164

Measuring cavitation in white poplars

The Establish project studied stress resistance in white poplar trees with a view to reforesting eroded and saline soils. As part of its investigation into stress-tolerant tree species, the project measured the extent of cavitation in small tree organs.

Cavitation is when a bubble in a liquid rapidly collapses, causing a shockwave. Such an event can occur in the vascular tissues of trees like *Populus alba*, commonly known as the white poplar. However, measuring cavitation and possible blockages in secondary roots, small twigs and leaf stalks was not possible using the traditional method of taking hydraulic conductivity measurements.

Therefore, the Establish project developed a new protocol for measuring cavitation. The first step required that the part of the plant being studied was placed in a pressure chamber. Once target pressure had been achieved, the sample was rapidly frozen in liquid nitrogen. The number of empty vessels in a cross section of these organs was then counted using a variable pressure electron microscope.

This technique proved extremely effective and was calibrated against the conventional method. The new protocol has been used to investigate how vulnerable the organs of various poplar species are to the phenomenon of cavitation.

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

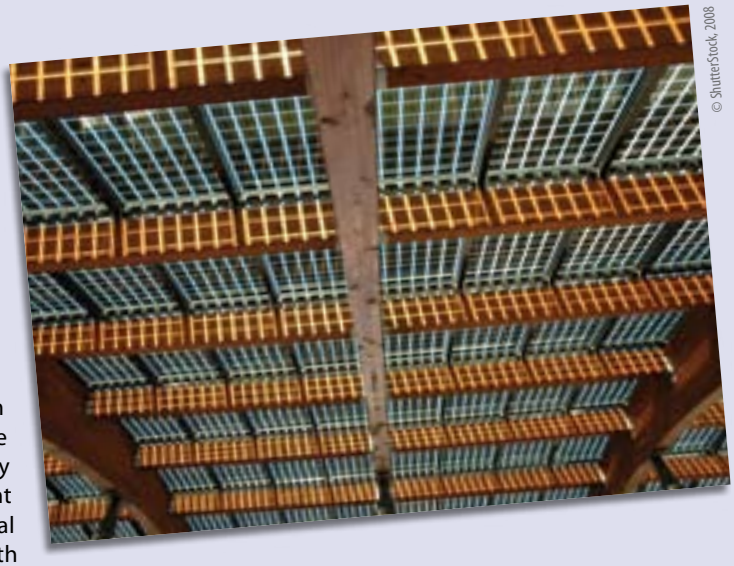
Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4175

See also pages 22 (offer 4194) and 23 (offers 4103 and 3867)

Increasing solar cell efficiency with silicon nitride

Some of Europe's top engineers worked together to convert more of the sun's energy into electricity by constructing better solar cells.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The solar cell industry has experienced significant growth in recent years. Looking to provide an advantage to European producers, the EESD programme supported a three-year R & D project aimed at increasing cell efficiency.

The Institut für Solarenergie Forschung (ISFH), a German partner in the INDHI project, was called upon to determine the robustness of silicon nitride (SiN_x) layers. Laboratory measurements of the INDHI prototype revealed excellent results for the bulk lifetime parameter. In addition, optimal surface passivation was achieved during contact firing with the aid of floating zone silicon (FZSi).

The next phase of the research involved extending the new SiN_x technology from a prototype to industrial-scale production. The ISFH collaborated with fellow INDHI partners EniTecnologie and the Italian National Agency for New Technologies, Energy and the Environment to produce a batch of 24 wafers. The result was an efficiency rating of 15.1 %. A second production run was performed with the Universität Konstanz, which introduced a short circuit current that helped boost the efficiency to 15.9 %.

The ISFH subsequently subjected the new SiN_x wafers to significant doses of ultraviolet radiation to ensure reliability in the field. Further tests revealed that surface passivation and other critical wafer properties were preserved during the move from the laboratory to an industrial production set-up. The ISFH and its INDHI partners are following up on these promising results.

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 > 4150

Bringing recycling to the solar cell industry

Valuable insight has been gained from a life cycle analysis (LCA) of three different kinds of solar cells, which included an assessment of the possible benefits of recycling.

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Silicon (Si) is a primary ingredient in solar cells, which capture the sun's energy and convert it into clean electricity. Limited supplies of Si and other raw materials necessitate the development of a sustainable approach to solar cell production.

A complete LCA of three different types of solar cells was performed in the context of an RTD project entitled SENSE. The types assessed include amorphous silicon (a-Si), copper-indium selenide (CIS) and cadmium telluride (CdTe).

The SENSE project coordinator, Universität Stuttgart, defined the various components of the LCA, such as the scope, inventory analysis, impact assessment and optimisation phase. Emphasis was placed on calculating the consumption of raw materials and energy resources as well as determining additional environmental impacts.

A key feature of the SENSE LCA was the fact that it was based on data from actual working production lines, rather than simulations. Another innovative element was the research on the potential role that recycling could play in terms of reducing material and energy requirements. These findings will help drive the decision-making process regarding the choice of solar cell technologies for the future.

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 > 4253

What is a technology offer?

All research results uploaded on the Technology Marketplace are assessed by CORDIS to reveal their exploitation potential. The top ones are selected and rewritten as technology offers in a journalistic style. Online, each offer is linked to the related result.

Tempted by a technology presented in this issue?

All of the projects presented in the supplement are seeking cooperation partners in specific areas, and interest in their work is welcomed. Please contact their coordinators directly if you would like to know more about them.

Distribution of electrical power and fault isolation

A study was undertaken into the monitoring and control of electrical power networks and the isolation of faults.

The CRISP project studied how the latest ICT research could be used to bring about reliable, cost-effective monitoring and management of power networks. Software was developed for creating interactive intelligent distribution networks. Tests were carried out in the laboratory and the field tests undertaken in a range of countries. The work resulted in a series of recommendations for using intelligent ICTs in power networks involving a high degree of distributed generation. Benefits included improved regional control and monitoring within an integrated EU distribution network.

The elementary electric power system (EPS) cell was selected for experiments involving the fault diagnosis application. Because of their interoperability and ease of reuse, interface files were used to facilitate exchanges between the PCs and the programs. The programs were applied to a range of EPS configurations and ICT structures. The real-time closed loop was tested. With full cable installation, a faulty section could be isolated in under 10 seconds, dramatically reducing the interruption in the distribution EPS.

A series of case studies reflected the views of partners regarding the possible merging of ICT networks and EPSs in the future. Particular focus was placed on the distribution network, on the expected structure of the system and on combining different infrastructures. The work indicated that there is great interest in developing modular communication boxes and programs.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 4126

Sea, the energy of the future

Ocean wave energy has huge potential for massive power generation. Experts believe that this technology could be producing electricity at a commercial level as soon as 2010, yet for this to become a reality, research must continue.

Researchers based at the Centre for Renewable Energy Resources in Rafina, Greece, have turned their attention to the problems of wave energy conversion to electricity and hydrogen. They have tested the problems with production, storage and use in order to improve upon the techniques currently available.

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They concluded that in the long term, hydrogen along with electricity will be one of the most important energy carriers, and widely applicable. This research is part of the Marineco project which sought to find environmentally benign fuel components to be used by the metal and chemical sectors. It aimed to develop a structure for a power-industrial system designed for the Arctic, based on renewable resources. This has led to the technological development and tests of the pilot module of an offshore float wave electric power station (FWEPS) as a device for energy conversion.

The centre's tests concluded that the hydrogen seawater electrolysis production and FWEPS seemed to be an inter-supplemental technology for supporting decentralised energy supply systems. Furthermore the researchers considered that the components of the power system under development are promising candidates for the future power production-consumption market. This is due to the fact that, for many regions, the use of sea-wave energy is preferable and profitable for electricity generation. Furthermore, they suggest that hydrogen production by seawater electrolysis is superior to other means.

The project overall contributes to the medium- to long-term research which sets as its objective to develop new components of power engineering structures based on the use of renewable energy sources. It also incorporates new energy carriers such as hydrogen which are both affordable and clean and which can be well integrated into a future sustainable energy supply both for stationary and transport applications.

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 > 4063

Novel diagnostic techniques for negative ion sources

Although the acceleration of particle beams is understood by accelerator physicists, the source of the primary particles is often cloaked in mystery. The 'HP NIS' project attempted to shed light on the operation of negative ion sources commonly used in accelerators.

The development of negative hydrogen (H^-) ion sources with performances exceeding those achieved today is a key requirement for the next generation of high-power proton accelerators. Although widely used in accelerators for charge-exchange injection from linear to circular machines, negative ions have a variety of applications beyond high-energy physics. Negative hydrogen ion sources are a key element in the formation of intense beams of energetic neutrals for fusion plasma heating.

In general, negative hydrogen ions are produced in low-pressure hydrogen plasmas, but the demands on the source differ substantially. The ultimate aim of the 'HP NIS' network was to assemble all the competence within the EU to respond to this technological challenge. To promote the optimisation of existing negative ion sources in European research institutes, a better understanding of the source operation was sought.

The Plasma Research Laboratory at Dublin City University was the project partner most involved in plasma modelling. The complexity of this task was addressed with the simultaneous development of several codes. A two-dimensional particle-in-cell code with Monte Carlo collisions calculations

continued on page 17

Refineries for bioethanol and power production

A novel and cost-effective system has been developed for the sustainable co-production of biofuel and power. The integrated biomass utilisation system (IBUS) uses biological material with a high lignocellulose content to produce bioethanol, while generating a surplus of electricity.

In the future, IBUS will provide the main basis for refineries producing biofuels. The 'Co-production biofuels' project developed the system to produce bioethanol through the integrated conversion of conventional sugar and starch with straw or whole crop grain feedstocks. The by-products of this process comprise animal feed for cattle and fish and a solid biofuel low in alkali chlorides.

The project integrated the production of biofuel with a combined heat and power plant (CHP). This enabled the exploitation of large amounts of low-temperature thermal energy resulting from the production of electricity. It also allowed maximum generation of power from the solid biofuel by co-firing in the power plant's boiler. The benefits of the IBUS system are considerable, including the ability to produce bioethanol without the use of fossil fuels. Carbon dioxide (CO_2) emissions are negative overall because the greenhouse gas is condensed following fermentation and the liquid CO_2 used for enhanced oil recovery.

The process was fully sustainable. It returned plant nutrients to the soil through animal feed and produced bioethanol without generating waste water or volatile organic compounds such as dioxin. IBUS also used household waste in a very efficient manner. The recyclable material was first removed before the biodegradable fraction was converted to bioethanol.

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

Collaboration sought: joint venture agreement.

http://cordis.europa.eu/marketplace > search > offers > 4254

Producing bioethanol with thermophilic enzymes

A cost-effective and sustainable method was developed for the production of ethanol using lignocellulosic waste or dedicated crops. New technologies focused on pre-treatment and enzymes responsible for hydrolysis.

The TIME project focused on improving the efficiency of converting lignocellulosics, plant material comprising cellulose and lignin, to ethanol. New techniques were developed for the pre-treatment and hydrolysis by enzymes. These stages were responsible for up to 50 % of current production costs. Therefore, TIME aimed to increase the ethanol yield while reducing the amount of energy consumed during the production process. This was achieved through high-consistency hydrolysis and fermentation technology, and the use of heat-tolerant yeast strains. The TIME project developed integrated high-temperature conversion technology which used thermophilic (heat-loving) enzymes and improved accessibility of substrates. The first step required prehydrolysis, or liquefaction, at a high temperature followed by complete hydrolysis at a lower temperature. The enzymes required for both stages were identified and evaluated.

Results indicated that a separate high-temperature stage for liquefaction of material at the beginning of the process was realistic. For best results, a complete set of heat-loving enzymes was used at the pre-hydrolysis stage. This made it possible to replace the conventional commercial mixture in the initial 24-hour stage of a two-step process. The mixture was replaced with an artificial mixture of cellulase proteins, which delivered a high hydrolysis yield without a corresponding increase in overall protein dosage.

The project's results provided a basis for the development of improved enzyme products which could remain stable at high temperatures in the range of 55 to 60 °C. Those enzymes currently available to industry are stable at 45 to 50 °C. Such an improvement means less protein is needed for the hydrolysis of the lignocellulosics substrate. This, in turn, helps to save time and money.

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

Collaboration sought: further research or development support.

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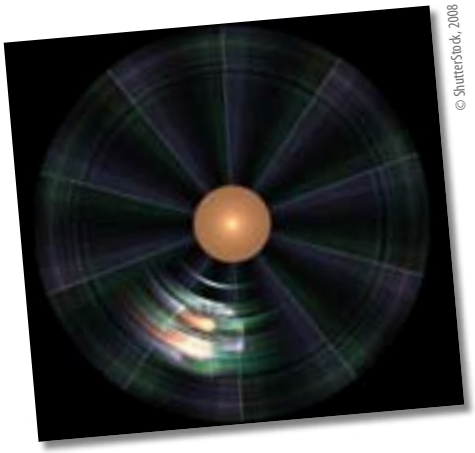
continued from page 16 **'Novel diagnostic techniques for negative ion sources'**



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provided a solution to the non-linear plasma kinetics. By carefully linking the code with global chemistry models, scientists drew on their strengths in one area to address the weaknesses of the other.

To test the validity of the new numerical scheme coupling the two models, expected behavioural trends such as increased ion density at lower pressures were compared with experimental data. For this purpose, a novel alternative to cavity ring down spectroscopy was introduced which had not yet been applied to high-power, caesium-seeded negative ion sources. This laser-based absorption spectroscopy technique was applied to measure the negative hydrogen ion density of dilute or weakly absorbing species. Scaling laws were derived from the analytical models, which would be difficult to derive from experiments and could be applied to reference ion sources for the ITER fusion project.

Funded under the FP5 programme 'Human potential' (Improving the human research potential and the socioeconomic knowledge base).

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4216

Modelling greenhouse gas emissions from dairy farms

Scientists involved in the Midair research project used the computer model FarmGHG to accurately establish the contribution of dairy farming to global warming.

The dairy farming industry emits significant amounts of greenhouse gases (GHGs) to the atmosphere. The primary culprits are methane (CH_4) and nitrous oxide (N_2O), both of which are GHGs addressed by the Kyoto protocol. The CH_4 and N_2O emissions originate from the cows as well as from the manure they produce.

The Midair project brought together 15 research institutes to shed light on the exact magnitude of dairy farming's impact on climate change. In order to fill the gap in knowledge concerning emissions, measurement data were collected from 15 model farms. Both conventional and organic farms were selected from five distinct European regions: Atlantic, Boreal, Continental, Mediterranean and Pre-Alpine.

These data were supplemented with output from FarmGHG, a computer model developed at the Danish Institute of Agricultural Sciences, a member of the Midair consortium. FarmGHG simulates carbon and nitrogen cycling at dairy farms incorporating the entire supply chain. It enables the estimation of each farm's net emissions of CH_4, N_2O and other GHGs from both direct and indirect sources.

During Midair, FarmGHG was applied to the model farms to identify regional variation as well as variation between conventional and organic dairy farming. It was also used to determine the effectiveness of various proposals to reduce GHG emissions. The model was also extended to analyse other environmental problems associated with large-scale farming, such as eutrophication.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 4184

See also pages 22 (offers 4127 and 4194), 23 (offer 3867) and 40 (offers 3965, 3914 and 4009)

Sustainability and technology

Current models which deal with the issue of sustainability do not go far enough to understand the long-run consequences of economic activity. Research conducted in the framework of the Transust project sets new parameters for these models and delineates the most important contributing factors.

The scientists prepared a set of working papers and a questionnaire exploring a range of issues. On the subject of technical progress, the questions focused on the long-run effects of technological innovation and its effect on economic welfare, climate change and emissions. With regards to revenue recycling and the labour market, research examined taxes and charges and the impact of various tax recycling regimes being applied. The role of energy prices on economic activity was also assessed, as were the costs of climate policies, technologies for carbon capture and storage and the need for these to be integrated into current models.

The main aim of this research was to gain a better understanding of the kind of technological change that is considered compatible with sustainability. It approached this aim by identifying the key elements for improving the capabilities of current models that address the concept of sustainability. Therefore, rather than focusing solely on factors negatively affecting progress towards sustainable infrastructures, it shifted the attention to modelling the type and causes for technological change. This factor is placed centre stage because it is understood that the transition to sustainable economic structures requires investment activities. It is this activity which causes the kind of technological change which is considered to be compatible with sustainability.

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The main conclusions that were made regarding the models concerned the need to redefine the concept of welfare generating services and to investigate the drivers that determine the relationship between the stock and flow variables. The researchers suggest that measures of welfare need to be adjusted so that they do not base results solely on flow variables (i.e. gross domestic product or consumption), but also include relevant stocks. Evidence of this is provided by the results following extreme events such as flooding. A measurement of welfare using only flow variables misses a considerable loss of capital. Also, it is recognised that the services generated by stocks and flows provide indicators relevant for measuring economic welfare. The model-by-model results of the questionnaire are laid out in a related paper and are available on the project website: http://www.transust.org

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 > 4156

Global measurements of carbon dioxide

Comparison of carbon dioxide (CO_2) data coming from satellite instruments against* in situ *measurements and model simulation results has contributed to the establishment of a global CO_2 monitoring system.

Monitoring CO_2 fluxes provides a better insight into the changes in the global carbon cycle related to natural sources and man-made emissions. Until recently, atmospheric CO_2 concentrations were mainly monitored through sparse earth-based observation systems, for example oceanic stations. Unfortunately, there are only approximately 100 stations that gather data on a regular basis. Moreover, very few of them are tall enough to cover vertical CO_2 profiles with increased accuracy.

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Advancements in satellite infrastructure offered space-borne measurements of CO_2 concentrations that can complement observations from earth-based monitoring systems. Moving one step ahead, the COCO project focused on exploiting space missions for retrieving detailed estimations of CO_2 column integrals. Using new methodologies, the project's research work aimed at employing satellite data for the estimation of CO_2 vertical column abundances in the atmosphere. With the aid of suitable models of atmospheric transport, these estimations can further be employed for the calculation of surface fluxes.

Project research work took advantage of the spectral characteristics of existing systems that measure the atmospheric infrared radiation for retrieving CO_2 column integrals. Such systems included the atmospheric infrared sounder (AIRS) and the television infrared observation satellite (TIROS) operational vertical sounder (TOVS). The Max-Planck Institute for Biogeochemistry conducted detailed comparisons of the retrieved CO_2 column integrals against those gathered from *in situ* aircraft measurements and model simulations.

It was shown that the upper troposphere CO_2 concentration patterns revealed by both systems were in good accordance with those derived from model simulations and *in situ* aircraft measurements. Particularly, the AIRS retrievals were in better agreement with earth-borne data than the TOVS ones. For further information on the project, please visite: http://www.bgc-jena.mpg.de/bgc-systems/projects/Coco

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 4045

See also pages 22 (offers 4127 and 4194), 23 (offer 3867) and 40 (offers 3965, 3914 and 4009)

Welfare and consumption — the road to sustainability

Sustainable development has a growing role to play in developing policy in the EU. The social and institutional dimension is reflected by those modelling the transition process.

The Brundtland Report (World Commission on Environment and Development, 1987) defines sustainable development as 'development which meets the needs of the present without compromising the ability of future generations to meet their own needs'. This definition has two direct links to welfare economics. The first lies in the intergenerational allocation problem, the second refers to the definition of 'needs' that can be considered using the microeconomic theory of utility maximisation.

Two concepts of sustainability have been established in the literature; these are 'weak' versus 'strong', both of which are directly linked to the question of welfare measurement. The main difference between the two concepts is the existence of a binding resource constraint. This in turn has an impact with regard to modelling the influence of the state of the environment on welfare.

The Transust project aimed to build a network of excellence for researchers interested in sustainability models. Specifically, researchers at the Austrian Institute for Economics Research studied the input of welfare and consumption. The paper begins by noting that most existing models are grouped into three broad categories, each with different ideas regarding welfare measures. The three groups include aggregated neoclassical growth models, disaggregated computable general equilibrium (CGE) models and disaggregated macroeconometric models. These three groups of models are described in a literature overview.

A further section uses this broad classification to analyse the treatment of welfare in seven main Transust models. The analysis highlights both strengths and weaknesses in order to provide a satisfactory description of sustainable development.

This can be demonstrated by extending the analysis to the expected welfare implications of policies representing successful sustainable strategies in the different models. A successful sustainable strategy could include a policy of introducing prices for emissions or environmental use through taxation.

One example is road pricing. This might be combined with the recycling of tax revenues in order to introduce new technologies. This would augment capital and lead to greater investment, such as for the public transport system.

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

Collaboration sought: further research or development support.

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A new approach for safer drinking water

A methodology has been developed to help provide safer drinking water in periurban areas of Latin America.

As society becomes more urban and population density increases, access to safe drinking water declines dramatically. In this context, the struggles for land and water often go hand in hand. In light of this, the Negowat project has organised, expanded and assessed a methodology which merges an agent-based modelling approach with role game playing. The result is a liaising tool for assisting negotiations of land and water management in urban upstream structures in Latin America.

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Taken as an example, Bolivia is one of the Latin American countries in which significant accomplishments have been achieved for the design and implementation of community management for rural water supply. However, there is still much room for improvement when it comes to assisting periurban committees. Periurban areas, which immediately border an urban area, differ from rural and urban systems in terms of complexity, budget size and challenges encountered.

Hence, tools to raise awareness and training to broaden communication regarding such issues were put into effect in order to seek improved solutions. One of these came in the form of a role-playing game named SosteniCAP, for sustainability of drinking water committees. Behind the methodology was the idea of raising awareness, targeting women and youth as well as strengthening the management team and the representatives. This was applied to 500 committees supplying water to 500 000 dwellers in the urban vicinity of Cochabamba and in periurban areas of Andean countries.

Distribution of the methodology involved a book which compared various means of supporting community-based drinking water committees in rural, urban and periurban areas. There was also a series of booklets for managers and local leaders of the areas. These efforts have contributed to increasing awareness of the significance of self-organised drinking water committees at national level, serving as a valuable alternative.

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 > 4214

Role playing for environmental success

A role-playing-based game structured to assist the decision-making process for environmental policies has been introduced by the Negowat project. In an effort to improve dialogue and to harness greater understanding between all involved parties, the role-playing game offers a unique opportunity for insight into the issues involved.

Formulating effective environmental policy between stakeholders is a complex matter, not solely because of the unpredictable behaviour patterns of nature, but also due to the complexity of human interaction. In many cases, negotiations may stumble and even break down between interest groups due to a simple misunderstanding.

In order to integrate complex environmental policies, dialogue is needed. That dialogue must be based on an effective comprehension of the issues involved, not only for one's own interests, but for all the interests at the table. Since, for example, water catchment areas may be the concern of two or more nations, having a unified policy to best preserve the area is of paramount importance.

Such uniformity is often harder to achieve than one might realise, but fortunately role playing provides a remedy. A number of vital elements are introduced that promote effective interaction and dialogue and, more importantly, a learning curve.

The game is structured on five basic principals, each having a very specific goal to achieve. For example, there is the role of mayor whose primary goal is to provide his constituents with fresh, clean water. There is the second interest of farmers who require water for irrigation, a third acts as a manager of a water company, a fourth is a delegate from industry, personalising the industries' demand for water. The fifth is the water management department that has to guarantee fresh, clean water for all.

Using specific mechanisms such as production objectives, pumping processes and effluent treatments and processes, the game is given shape. The game's mechanisms, such as the hydrological functioning included, are based on real-life modelling and data. This ensures that the role-playing provides a high degree of realism by which the relationships and their dynamics between components can be understood and maximised.

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Additional results of the research can be seen in the various improved learning curves of the participants. More specifically, learning about integrated water management and its rural aspects has the additional success of filtering its way into educational systems.

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 > 4192

Better tools for water use management

Effective water management strategies are needed to optimise the use of this scarce resource. Ensuring that resources are effectively used was the purpose of the Daywater project, which addressed three major areas of study.

Properly managed water resources are vital to any urban environment in which water is limited. An effective management strategy requires a multi-directional study that involves all interested parties, but also covers new areas of concern which previous studies may not have addressed.

Water use patterns, strategies and even philosophies differ greatly from region to region. They are further dependent on such considerations as topography, annual rainfall, spatial topology and even urban catchments. Even urban expansion and land-use management have direct impacts on water use, and making the best of it requires effective simulation modelling with dynamic assessment tools.

For example, in the Netherlands, there is an exceptionally high level of water management integration, requiring every activity having an impact on water to be registered and controlled. By comparison, in France, there is no urban run-off policy at the national level.

Whatever the modelling requirements, the decision-making process is part and parcel of the procedure, and herein the project identified three framework areas to best suit the end-user. The three perspectives, legal framework, stakeholders and phasing, place a great deal of emphasis on adaptive water management.

The legal framework helps determine who is responsible for water use and who gets to pay for it. The process then supports the stakeholders by providing them with the constraints and resources present. The phasing stage determines what action is necessary and when it will be needed. It is important to note that the adaptive decision support system encourages a non-linear approach to water management with a variety of tools such as simulation models, assessment tools, databases, guidance documents and road maps.

While each region could implement its own strategies on water management using the adaptive decision support system, it could implement more effective water retention on a global scale. The developers are looking for further research and development support.

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

Collaboration sought: further research or development support.

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Synthesising river basin management planning

An overview and synthesis of recorded experiences and background studies has been created regarding public participation in river basin management planning across Europe.

The Harmonicop project has increased the understanding of participatory river basin management in Europe and supported the implementation of the Water Framework Directive on this matter. The research focused on crucial and scientifically challenging aspects of river basin management through in-depth case studies in nine countries. Such aspects included scale issues, the role of information and information tools, and the cultural, political and geographical influences.

The research resulted in a handbook on public participation methodologies for use in the implementation of the Water Framework Directive. Following this, an analysis and synthesis report was created which identifies historical trends, common features and cultural differences concerning public participation in river basin management planning.

It is likely that the findings disseminated in the report can be utilised in assisting with the case studies. They can also offer significant points to be provided in the project's guidance handbook. In the long run, it is hoped that the gathered knowledge and experience will result in improved participatory river basin management.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 3844

Simulation models support flood forecasting

A flood forecasting application has been designed using simulation models and post-processing tools to assist users with the operation of sequence simulations and various respective functions for flood crisis support.

The Crossgrid project has developed user-friendly grid components for interactive, data-intensive applications such as simulation and visualisation. These can be used in case of a flood crisis and can also be combined with weather forecasting. The grid can be used in 11 European countries and is furnished with components which can monitor application performance, distribute data and manage resources.

One such example is the flood forecasting application framework which can assist users. For example, it can browse the results of simulations, register results into the replica management service and applicable metadata into the metadata catalogue for later search and retrieval. Moreover, the application consists of several simulation models, including meteorological, hydrological and hydraulic models, which are connected to form a workflow. Thus, the meteorological model forecasts precipitation; the hydrological model computes this for river discharge and finally the hydraulics model uses that computation to determine a possible flood. The binary output data each model produces are used to create pictures which can help evaluate the situation.

The flood forecasting application has two user interfaces which assist in providing a more user-friendly interaction. One is applied as a web portal which can be accessed through a standard web browser. The second is applied as a plug-in for 'Migrating desktop', an environment helping users work with the grids that have been developed.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4027

See also pages 28 (offer 4198) and 29 (offer 4012)

Using mortar to restore Europe's historical buildings

A novel mortar system has been created for the application of nitrate-reducing bacteria to stone, comprising a bioremediation effort to restore European cultural heritage buildings.

Urban pollution is known to cause many problems. Among them is damage to cultural heritage buildings. In light of this, the Biobrush project has examined the viability of using bioremediation to restore stone buildings in cities across Europe. Bioremediation involves the use of microorganisms to reinstate the natural environment altered by contaminants in its original condition.

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Through a vast collaboration between scientific partners, end-user conservators and industries, various treatment combinations were tested in laboratories and then on buildings. Performance and risk were assessed within different climatic conditions in northern and southern Europe.

In the course of this process, a new mortar was developed to act as a delivery agent for bioremediation using denitrifying (nitrate-reducing) bacteria. The cement developed required a shorter time period for permeation. The use of alginate served to trap denitrifying bacteria in the mortar, protecting it from alkaline pH, dryness and mechanical strain and guaranteeing homogenous dispersion of bacteria throughout the material.

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 > 4151

Monitoring on-road vehicle emissions

As Europe continues to tighten its air quality legislation, the need for effective monitoring systems is growing. A new spectrometer from the University of Manchester has the potential to capture a significant share of this market.

Emissions of carbon dioxide (CO_2) by cars, industry and other sources have taken on new significance in a world threatened by climate change. Efforts to monitor CO_2 and other pollutants in real time have been hampered by the capabilities and response times of the equipment currently available on the market.

A multimillion euro research project was funded by the Growth programme to promote the use of tuneable laser diodes in such applications. The University of Manchester (UMIST), a participant in the Assyst project, led the development of a prototype spectrometer based on a laser diode. It focuses on the near infrared (NIR) portion of the electromagnetic spectrum where CO_2 and other pollutants, such as carbon monoxide (CO), absorb radiation.

The major advantage of the Assyst spectrometer is the rapid response time of the laser diode. This enabled vehicle emission monitoring at high speeds on road networks, providing a more accurate picture of actual vehicle emissions during normal operating conditions. The equipment was also used on a traditional test bench in a laboratory environment to evaluate how emissions vary with engine load.

Another attractive characteristic of the system is its capacity to be easily expanded to monitor a wide range of air pollutants. UMIST and its Assyst partners have developed all the necessary software and electronics to make this possible.

In addition to vehicle monitoring, the consortium also demonstrated the suitability of the system for fenceline monitoring and other open-path applications. Further to the success of the project, UMIST is seeking patent protection for the new spectrometer. Future development activities will target the inclusion of additional pollutants, in particular nitric oxide and hydrocarbons.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4127

See also pages 18 (offer 4184), 19 (offer 4045) and 40 (offers 3965, 3914 and 4009)

Effect of elevated CO_2 levels on poplar stomata

Stomata can provide valuable information by acting as bio-indicators of environmental change. They were studied in a tree plantation in order to better understand the impact of increased levels of carbon dioxide (CO_2) on such ecosystems.

Tree plantations have great potential for alleviating CO_2 levels and helping to reduce Europe's carbon emissions. Multidisciplinary studies were conducted into the role of poplar plantations in capturing CO_2, supporting Europe's commitment to the Kyoto protocol. The work carried out by the Euroface project involved quantifying the uptake of elevated levels of atmospheric CO_2 under present and future climate conditions. The results provided data for policy-makers regarding the long-term exposure of trees to elevated CO_2 and its effect on carbon fixation in woody plants.

The study of stomata was important to the project. This is because these tiny pores on the undersides of leaves regulate the exchange of gases and water vapour with the atmosphere. In the past, studies have been undertaken to measure the response of stomata to increasing levels of CO_2. The Euroface project, however, was the first to have carried out long-term studies, extending over several years, into the effect on stomata of elevated levels of CO_2. Understanding the stomatal response was important, because it can affect levels of photosynthesis, transpiration and the efficient use of water within the leaves.

continued on page 23

Reforestation solutions in arid areas

Reclaiming land through reforestation, especially under arid climatic conditions, is a challenging exercise. New advances in molecular ecophysiology appear to be overcoming the hurdles, however, and can provide solutions.

The EU-funded Establish project sought to select those plant species that could thrive under highly stressful conditions, characterised by lack of humidity and often high salinity. Project partners envisaged a reforestation plan whereby these areas could be used for multipurpose forests, with application in the area of wood production.

Poplar species that can survive and grow in such conditions would therefore be best suited for these reforestation projects. Establish partners used a combination of skills to molecularly pinpoint the types of poplar trees that could be used to recultivate such areas. Furthermore, the techniques developed within the project could potentially be used in other biotechnology breeding programmes across Europe.

Scientists from the University of Helsinki used microarray technology to identify poplar genes controlled by various abiotic stress conditions, including salt, drought and ozone. This constituted one of the first studies on the genetic markers setting specific poplar species apart from others based on their behaviour under particular climatic conditions.

The results could form the basis for a series of breeding and reforestation programmes bringing new potential for growth in arid areas.

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

Collaboration sought: information exchange/training.

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Monitoring poplar response to drought

The 'Life quality' programme funded the Establish project consortium to investigate the suitability of poplar trees for reforestation projects in arid regions. One of the objectives was to assess the response of* Populus euphratica *to drought conditions.

Regions that receive reasonable amounts of rain today could turn arid in the coming decades as climate change redistributes rainfall patterns. This could have serious repercussions for the local ecosystems as well as for agriculture.

Reforestation efforts in these regions must take this threat into account. Seven agricultural and forest research institutes teamed up during Establish to identify species of trees with high resistance to stress. Scientists with the Institut national de la recherche agronomique (INRA) studied *Populus euphratica*, a poplar tree common to the subtropical regions of Africa and Asia.

Specifically, INRA subjected cuttings of *P. euphratica* to drought-like conditions and observed the results. Unfortunately, the French researchers discovered that cavitation and embolism reduced conductivity and severely limited water retention. In fact, *P. euphratica* fared worst among the various species of poplar tested.

The results of limited water availability were readily apparent in the trees themselves as stomatal closure was detected and growth was stunted. *P. euphratica* was, however, able to recover quickly when watered. INRA hypothesised that this attribute enables it to survive in arid climates where it can rejuvenate itself by tapping into underground water resources. Additional insight into methods of propagation in such conditions was also gained.

The findings of INRA suggest that *P. euphratica* may not be the best choice for replanting in arid regions. The significant water resources needed to keep it alive until the underground root system has developed sufficiently render it cost-ineffective.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 3867

continued from page 22 **'Effect of elevated CO_2 levels on poplar stomata'**

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Results indicated that, in younger trees, raised levels of CO_2 caused a reduction in stomata, whereas older trees, exposed over a longer period, showed no significant reduction. Although the mechanism controlling the response of stomata to CO_2 is not completely understood, it is clear that sensitivity is not due to internal leaf tissues. It appears that it is controlled at the guard cell which surrounds the stomata regulating the opening, or the cuticle, which is the waxy covering of the leaves.

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 > 4194

See also pages 14 (offer 4175), 18 (offer 4184), 19 (offer 4045) and 40 (offers 3965, 3914 and 4009)

Managing wetlands with Ecotools

An impressive collection of modelling tools created by European and African experts enables the accurate simulation of the myriad of complex processes occurring in wetland ecosystems.

Lake Victoria, the largest lake in Africa, was the subject of intense research during the Ecotools project. One of the objectives was to derive a comprehensive set of modelling tools to facilitate decision-making aimed at sustainable development of the wetland areas surrounding the lake.

The Centre for Colloid and Surface Science's unit at the University of Siena in Italy coordinated a team of universities, research institutes and governmental ministries during Ecotools. Environmental and socio-economic data were collected and analysed. Subsequently, a set of complementary modelling tools was developed based on a common framework.

The elements addressed by the models include the effects of retention of phosphorus, nitrogen and other nutrients, subsequent changes in phytoplankton populations, cause-effect relationships between wetland use and the wetland ecosystems and, finally, a full account of the economic implications with an emphasis on fisheries management.

During Ecotools, the models were successfully tested on the case of Lake Victoria. They can now be extended to other wetland ecosystems. The models as well as full documentation have been made available on the Internet.

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 > 4109

Promoting sustainable management of Lake Victoria

East African wetlands provide key resources for local populations while providing valuable services for the regional population. By developing workable strategies for the sustainable use of natural ecosystem products, the Ecotools project supports the integrated management of these services.

The transboundary waters of the African Great Lakes are nearly all shared by two or more African states. In support of the policy objectives formulated in the millennium development goals, the Ecotools research project examined two multi-use wetland ecosystems near Lake Victoria. This region is under pressure to provide fundamental resources, contribute to alleviating poverty and provide key services. The project outcomes are directed largely at east African decision-makers to allow them to understand the links between water, poverty and sustainable development and to help them to promote more integrated policy actions.

Researchers focused on determining the role of the wetland and inshore waters in the Lake Victoria basin ecosystem. To do this, they tested methodologies for the study of material fluxes that enter and are released from the ecosystem.

The project was made up of partner research institutions with extensive experience in ecosystem research and sustainable management. The research generated information that formed the basis for the development of databases used to analyse and model the lake's productivity. These databases included satellite-based geographical water quality information and data on how the wetland impacts on water quality properties. The partners also developed new methods for the study of inshore water quality and of spatial and temporal trends in the water quality.

As well as examining the quality of the receiving water body, the researchers created and tested methodologies for the study of material fluxes that enter and are released from the ecosystem. In particular, they considered the nutrient retention of disturbed wetlands, carbon dynamics and evapotranspiration.

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

Collaboration sought: further research or development support.

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Studying wetlands in Africa

North Africa is home to several important wetland sites that support a variety of wildlife and vegetation. An international consortium was funded by the 'INCO 2' programme to examine the evolution of these unique bodies of water over time.

The National Authority for Remote Sensing and Space Sciences (NARSS) in Egypt applied its expertise in remote sensing during the Melmarina project. Landsat thermal mapper images were collected for three wetland sites: Lake Manzala in Egypt, Merja Zerga in Morocco and Ghar el Melh in Tunisia.

The NARSS used ground control points (GCPs) and polynomial transformations to correct the images. Next, spectral analysis of the corrected images led to the definition of several distinct ecological zones. Following corroboration with field surveys, the data were used to investigate the spatial variation of vegetation between the three sites.

A central focus of the Melmarina research was to quantify changes in the expanse of the three wetland sites, in the distribution of vegetation and in major features (e.g. sea outlets and reclamation). In order to accomplish this task, NARSS substituted Aster and Spot images as well as aerial photos when historical Landsat images were not available.

Finally, the 'System for hydrology using land observation for model calibration' (Shyloc) software package was employed to provide information about water levels. The method was calibrated against field measurements of channel width on the Utique Plain in Tunisia.

The knowledge obtained during Melmarina will be used to formulate sustainable wetland management practices in the region.

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 > 4211

A healthy future for the Gulf of Aqaba

A report from the University of Jordan summarises the findings of a case study on the Gulf of Aqaba. It includes proposals designed to ensure a sustainable future for this valuable body of water.

The SMART project was funded through the 'INCO 2' programme in an effort to strengthen collaboration between countries bordering the Mediterranean Sea. The goal was to establish and share policies aimed at promoting sustainable use of the limited resources in coastal regions.

One of the SMART case studies addressed the Gulf of Aqaba, an important waterway bordered by four countries: Egypt, Israel, Jordan and Saudi Arabia. Both shipping and tourism feature heavily in the region, which is home to several busy ports as well as popular vacation spots. Therein lies the challenge put to the organisations involved in SMART: how to stimulate economic development without sacrificing environmental quality.

Hydrologists with the University of Jordan investigated the multitude of threats the Gulf of Aqaba is facing. The extent and depth of the gulf are such that any pollution released into its waters is likely to remain there for a long time, allowing negative effects to accumulate. Sources of pollution include local industry and agriculture, water traffic, waste treatment as well as thermal pollution from a power station.

The University of Jordan and its SMART partners have put forward a number of recommendations based on the findings of the case study. A relevant summary report is available.

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 > 4108

Sustainability issues of Mediterranean coastal zones

The SMART project provided a comprehensive analysis of the problematic issues as identified in five case study zones investigated. This part of the project's work yielded a comparative analysis of all zones, particularly focusing on water demand concerns and the socioeconomic demands of the region.

The Mediterranean has seen rapid development in the past decade and, as such, the demands made of its natural resources are growing and in many cases conflicting. This has led to often irreversible damage, which has highlighted long-term policy considerations.

The project looked at five case studies (Egypt, Jordan, Lebanon, Tunisia and Turkey). One of the reports that were produced focused on preparing a comparative analysis of these case studies. This was divided into two parts. The first part put forward a legal and administrative framework of each of the countries represented. Based upon national water scarcity indicators, the analysis went on to highlight the most extreme situations. The second part elucidated the theoretical model developed for the comparative analysis. This model has been shown to be fully operational, even in those cases where only limited data are available. The conceptual framework as well as the multi-criteria analysis adopted demonstrated an operational approach able to bridge scientific modelling and policy.

One of the successes of this project has been the participatory nature of the research. For example, the result of the scenario analyses has been disseminated to the local stakeholders. This has created an awareness of modern scientific planning methodology amongst these actors, through their continuing participation in various phases of the project and in local meetings.

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

Collaboration sought: further research or development support.

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Developing management tools for aquatic resources in north Africa

The north African lagoon is a delicate and important ecosystem, which this research looked to support by promoting the sustainable development of the region. Investigation results from coastal lagoons collated by the Melmarina project have been put into a database to help researchers continue this important work.

The Melmarina research project has looked at the creation of management tools for aquatic resources in north Africa by monitoring and modelling coastal lagoons. Six research partners were involved in the venture, each with their own specialisation and focus.

Surveys and monitoring programmes were set up to examine the themes of hydrology, water, sediment quality and aquatic ecology. In order to evaluate the longer-term changes that have occurred, extant ground data and satellite remote sensing techniques were used. A hydraulic two-dimensional finite element model and an eutrophication model were applied to each key geographical site. This was done in order to evaluate the impact of future changes occurring as a result of rising sea level.

All this information has now been compiled into a comprehensive database, put together by researchers at University College London. The data were incorporated within a geographic information system (GIS) and time series database. The historical data for each of the primary sites were presented per country. Secondary data, cartographic maps, aerial photographs, relevant scientific publications, vegetation and fish surveys were also incorporated. The databases were used for visualising spatial data and preparing data for inclusion within the modelling and remote sensing work.

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 > 4171

Mapping the course of life

Innovative software tools have been introduced within the Tigress project to explore alternative approaches to the visualisation of datasets derived for large numbers of individuals over the course of their lifetime.

The geographical movement of individuals over their lifetime is among the most easily visualised of all social processes, but belongs to a special case of very complex time-based visualisation problems. Involving more than an individual and a two-dimensional space, it includes time as a third dimension, which is not always easily represented. Moreover, the geographical environments in which individuals interact in models are often completely aspatial worlds, such as markets.

The Tigress system (TiGS) provides the analysis facilities, integrated within a state-of-the-art software environment, to use empirical and simulation data over a wide range of spatial and temporal scales. It provides the essential means for investigating the 'time-geographical' dynamics of each subject area, and could also pave the way towards better regional policy formulation, particularly with respect to sustainability. 'Time-geography' methods support the exploration of the effects of spatial and temporal constraints on the behaviour of individuals and of the ways in which socioeconomic structures emerge at higher scales.

TiGS has already been successfully used within the framework of the Tigress project to explore and visualise the migration path changes of plovers. The multi-dimensional scaling tool allowed the interpolation of user-selected 'time-geographical' information and its representation as maps of differentiated spatial resolution. The analysis of potential emergent characteristics which were not apparent at the underlying resolution of the original 'time-geographical' dataset was thus facilitated.

The 'time-geographical' information representation is further enhanced by the real-time update of the maps, and the ability to use multiple and irregularly shaped lenses to observe the interactions of different phenomena. Furthermore, TiGS has been made available for download at http://tvk.sourceforge.net as open-source software under the general public license. The accompanying documentation and online help facilities aim to assist interested users in developing familiarity both with the data analysis and, importantly, the key concepts of time-geography.

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

Collaboration sought: available for consultancy.

http://cordis.europa.eu/marketplace > search > offers > 4010

Assessing landslide risk with the help of a GIS

Vienna Consulting Engineers (VCE) constructed a model that incorporates the benefits of a geographic information system (GIS) to assess risk in regions susceptible to landslides.

Landslides have claimed lives and caused considerable property damage in the mountainous regions of Europe. The EESD programme funded research aiming to improve management of these and other natural disasters.

EESD funding enabled VCE to gather a team of dedicated scientists from nine organisations to form the OASYS project consortium. The group applied its collective expertise and experience to the task of landslide risk management.

Technology proved an important enabler as a GIS was used as a platform for the display and analysis of data from different sources. Determination of landslide risk relies on a statistical model that takes a number of different factors into account. This allows the characterisation of slopes for which no historical landslide data are available.

VCE and its OASYS partners further enhanced the model by including details about landslide generation mechanisms. This facilitated the identification of the parameters that have the greatest predictive power for new landslides. In conclusion, the OASYS prototype represents a significant step forward in landslide risk management.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 3979

Geo-mapping the snow

Radar and satellite mapping of the snow-covered areas of Europe is an extremely useful tool for monitoring climate changes. Elaborate software codes have been developed to exploit a wide range of sensors for snow mapping and facilitate operational applications in real time.

Accurate snow maps that provide information on a number of snow parameters like snow cover area, snow water equivalent, snow wetness and snow surface temperature are indispensable for a number of scientific fields. The fields of meteorology, hydrology and geology all use snow data. Moreover, snow maps are expected to considerably aid in environmental protection. The Envisnow project has developed a software suite that integrates snow parameter retrieval algorithms and process data accumulated from multiple sensors.

Automated snow mapping is now feasible for both imaging radar and optical sensors. Software data processing enables classification of snow-covered areas utilising either backscattering information stemming from radar observations or multi-spectral reflectance signatures from optical sensors. The collected data may be projected in many different ways, resulting in a number of respective maps.

The developed software facilitates snow mapping from specific absorption rate (SAR) measurements. SAR sensors are capable of observing the earth's surface without being affected by clouds or daylight, but enable detection only for melting snow. Their data have numerous applications in hydrology and water management. The snow classification tool developed by the Envisnow partners was successfully tested for SAR sensors onboard a number of European satellites.

Snow cover maps were also produced from both medium- and high-resolution optical sensors. Once again, application and testing of the software tool was successful.

Different observation geometries, sensor resolution and sensitivity to snow parameters between radar and optical equipment result in systematic differences of the respective maps produced. The developed tool can account for these systematic differences and eliminate them, enabling consistent mapping.

The snow parameter retrieval algorithm integrates the complementary characteristics of optic and radar sensors. The resulting automated snow mapping is utilised in hydrological modes allowing better prediction accuracy.

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 > 3923

Goodbye to faulty software?

Will it ever be possible to buy software guaranteed to be free from bugs? A team of European researchers thinks so. Their work on the mathematical foundations of programming could one day revolutionise the software industry.

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We have become used to the idea that software will not work properly. While we would take a faulty car back to the dealer and demand they put it right, we are remarkably tolerant of software that goes wrong.

The software we buy usually comes with no guarantee and disclaimers are notoriously all-encompassing. We no longer expect everything to work correctly 'out of the box'. More to the point, neither does the manufacturer. Indeed, software houses seem to rely on their customers to find faults, which they can then 'patch' in a so-called 'upgrade' of the product.

'The software industry is still very immature compared to other branches of engineering,' says Dr Bengt Nordström, a computer scientist at Chalmers University in Göteborg. 'We want to see programming as an engineering discipline, but it's not there yet. It's not based on good theory and we don't have good design methods to make sure that at each step we produce something that's correct.'

Dr Nordström believes that the whole approach to software design needs to be rethought. The usual approach is to validate a program via a lengthy testing process. Instead, he would like to see a design philosophy that guarantees from first principles that a program will do what it says on the box.

The key lies in an esoteric reformulation of mathematics called 'type theory' based on the notion of computation. In this approach, the specification for a computational task is stated as a mathematical theorem. The program that performs the computation is equivalent to the proof of the theorem. By proving the theorem, the program is guaranteed to be correct.

It is not that simple, of course, but so promising is type theory that since 1989 the EU has been funding a string of projects to develop it under the 'Future and emerging technologies' programme.

Dr Nordström was coordinator of one of the projects, TYPES, which fosters cooperation on the topic among researchers at 15 European universities and research institutes, along with those at 19 associated academic and industrial organisations.

The TYPES partners are also releasing open-source software packages that anyone can download, use and modify. These packages include several 'proof editors' that, in type theory, are the key to guaranteeing the correctness of programs.

Can such an abstract research area really lead to reliable, bug-free software?

'European research in this field is the strongest in the world,' Dr Nordström points out. 'Many computer programs are going wrong, they don't work properly, and in the long run this research will help. This is a very slow process; it takes many years to get ideas from the universities into industry, but I think it's slowly taking place.'

The open-source principle, Dr Nordström says, is fundamental to what they are trying to achieve. 'It's important that anyone can evaluate the code and check if it is correct, so it's inherent in this project that what we are doing should be open so that it can be discussed by everybody.'

Results from type theory are already finding their way into other projects. The EU-funded Mobius project is developing methods, known as 'proof-carrying code', for downloaded programs to be certified as bug-free. Meanwhile, a France-based company is using ideas from type theory to design secure embedded computer systems such as those used for smart cards. Further research is also under way in Japan. Researchers have also demonstrated the power of type theory by proving the classic 'four colour' theorem with one of the proof editors used in TYPES. Type theory is also finding application in the analysis of human language.

Dr Nordström does not see type theory as being necessary for all programs, but there is a clear need for guarantees in critical systems in banking, for example. But type theory could also be important in the transport, defence and health care sectors, where mistakes can cost lives.

TYPES received funding from FP6 as a 'coordination action', which describes projects that aim to oil the wheels of cooperation rather than directly develop a new technology. TYPES interweaves both basic and applied research. 'That's one thing I find very, very interesting compared to other sciences,' Dr Nordström notes. 'We are maybe 150 people working in this project and it's a mixture of very practical persons and very theoretical persons and there is a lot of exchange between them. I think that's very rare compared to other sciences.'

He hopes that the work done under TYPES will ultimately allow programming to mature into a genuine engineering discipline with the same high standards and quality assurance now expected elsewhere in the engineering profession.

'A lot of effort is now spent on testing software,' he says. 'Very often programs are written quite quickly and then they are tested and changed and tested again, and so on. It's very unsystematic. This is not how we build bridges and highways. That style of working is going to change so that we spend more effort on actually writing programs than testing them.'

Promoted through the ICT Results service.

http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/89864

Testing computer grid infrastructure

The Crossgrid project set up an international cross-border computer grid that spans nine European countries. A total of 16 test bed sites enabled the running of applications in real grid environments.

A computer grid resembles a computer network in many respects. However, the size of a grid is much larger in the sense that it involves many more geographically dispersed computer units. The Crossgrid project has achieved the difficult task of constructing a grid involving 9 European countries and 16 different institutions.

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The computing capabilities of a grid of this size enable the handling of enormous amounts of data. Immediate applications in a number of scientific fields are expected. High-quality visualisation can be applied in medical procedures, and distributed data analysis is a very efficient tool in high-energy physics. Furthermore, elaborate grid-based decision support systems may substantially aid crisis teams.

For the Crossgrid project, the development of an international test bed has been a major achievement. The test bed facilitates the running of applications in real grid environments and offers the possibility of accurately evaluating the grids' performance. Specifically, the international grid computing infrastructure, the Crossgrid test bed, provided a distributed resource facility. Different work packages developed have been tested on the grid framework. The test bed has supported the construction of sites at the national level of the various project partners, while at the same time it has greatly facilitated the integration of all national facilities involved in the project.

With the aid of the test bed, software developed by project partners within the course of the project has also been integrated. Furthermore, the developed test bed is exceptionally user-friendly and capable of collaborating with other developed grids.

Facilitating thorough evaluation of grid performance and resolving organisational and security issues, the Crossgrid test bed is the framework for a new category of applications in medicine, environmental control and physics.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4198

See also page 21 (offer 4027)

From single-user to multi-user communications

The initial impulse responsible for attracting the attention of a wide research community toward multi-user systems aided by multiple antennas has not been of a theoretical nature. Instead, significant engineering advances could follow the study of the convergence of wireless systems conducted within the FLOWS project.

The last decade has witnessed an immense increase of wireless communication services to keep pace with the ever-increasing demand for higher data transfer rates combined with higher mobility. Several techniques were proposed to satisfy this demand for reliability in long-distance communications, among which are multiple antenna technologies which have advanced significantly.

However, when comparing their potential capacities with their achieved throughputs, large gaps are noticed. FLOWS project partners sought to understand more fully the effects of the presence of multiple users of the multiple-antenna transmission channel. Moreover, the assets of 'joint transmission' were explored with a view to minimising the computational complex signal processing.

Deploying multiple antennas at the transmitter and at the receiver, independent streams can be transmitted simultaneously from all the antennas. The capacity of the designed multiple-input multiple-output (MIMO) channel grows at least linearly with the number of antennas at both ends without bandwidth expansion or increase in transmission power.

Scientists at the laboratories of Siemens in Germany came up with a series of theoretical results concerning the capacity of the designated MIMO system. Their research was then focused on the flexibility of the 'joint transmission' scheme, which is inherently compatible across a wide variety of standards.

This 'multi-standard' friendliness should maximise the opportunity to reduce the complexity through reusing hardware across multiple standards, from the universal mobile telecommunications system (UMTS) to Hiperlan/2 and GSM. On the other hand, such simplified mobile terminals would offer the opportunity of a more unified approach to signal processing at the base station and across different air interfaces for each user.

The attainable performance of utilising a transmission scheme that requires channel knowledge at the transmitter side was evaluated for realistic scenarios. 'Joint transmission' takes advantage of the fact that the channel responses between the mobile terminal and a base station are equal for the uplink and the downlink. Therefore, only simple linear filtering of the received signal at each mobile terminal is needed, offering a dramatic reduction in the channel estimation efforts.

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

Collaboration sought: licence agreement.

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Interactive grid computing aids particle physics

Almost two decades ago physicists at CERN, overwhelmed by the amount of experimental data in need of processing, first developed the web technologies. For forthcoming larger-scale experiments, the novel grid computing environment provides the necessary resources for data analysis.

CERN, near Geneva, is the European laboratory for particle physics. There, high-energy experiments are conducted with the use of large accelerators, devices that accelerate elementary particles like protons to speeds close to that of light. Collisions between these particles provide crucial information for the fundamental questions in physics.

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A new accelerator, the large hadron collider (LHC) where two beams of protons accelerated inside a tunnel of 27 km in circumference will collide head on, was recently completed. With these speeds and energies, the conditions a fraction of a second after the Big Bang are recreated. Questions regarding the origin of matter, for example, may well find some rational explanation.

It is no surprise that conducting such high-magnitude energy experiments will produce an unprecedented amount of data requiring handling, processing and thorough analysis. Exceptional in both quantity and sophistication, computational resourses can handle such an amount of data. The Crossgrid project has developed a large interactive grid framework armed with elaborate data mining techniques that is capable of the aforementioned magnitude of data analysis.

The collision of the two beams gives rise to a wealth of physical phenomena. Elaborate detectors gather the relevant information which then is stored in distributed databases. The developed data mining techniques use online filtering and neural networks to distinguish the important events (signal) from the background. The distributed techniques have reduced the time required for these analyses from hours to minutes. Moreover, the Crossgrid project partners have developed the user-friendly 'Migrating desktop' integrated with both application and tools and equipped with the virtual network computing (VNC) client for interactive applications. More information along with tutorials can be found at: http://www.crossgrid.org

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4012

See also page 21 (offer 4027)

3G wireless communications and beyond

For reliable third-generation (3G) wireless communications within multi-user mobile systems employing time-variant multipath channels, advanced signal processing techniques have been introduced within the FLOWS project.

Among the major factors limiting the performance of mobile wireless communication systems, fading of the signal coupled with the interference from transmitters using the same channel degrades the receiver's performance. However, significant improvements in the receiver's performance can be achieved by exploiting the channels' diversity, so as to effectively transmit the signal over multiple independently fading channels.

Within the FLOWS project, dedicated techniques for the joint exploitation of spatial, multipath and Doppler diversity were proposed for wideband code division multiple access (WCDMA) systems. WCDMA, the accepted technology for the next generation of cellular networks, provides intrinsic protection against the multipath effects of the channel in highly loaded cells.

On the other hand, multiple-input and multiple-output (MIMO) techniques provide an additional source of spatial diversity by creating, in the ideal case, independently fading channels between transmitter and receiver. Doppler spread caused by the rapidly time-varying channel with the fast motion of the mobile terminal was further regarded as an additional source of temporal diversity.

Joint multipath-Doppler chip equalisation was proposed by project partners at the University of York as a means of optimally exploiting multipath and Doppler diversity for suppressing multi-access interference. The receiver designed with chip-level equalisation integrates two-dimensional matched filtering for combining the signal energy dispersed in the multipath delay and Doppler spread.

The ultimate aim of this new processing technique was to reduce the transmission bit error rate (BER) sufficiently to allow a coding scheme to work more efficiently. Moreover, emphasis was laid on ensuring an implementation of the receiver technique with realisable complexity on existing devices. Its performance was evaluated over a wide range of channel models and more importantly, its compatibility with orthogonal frequency-division multiplexing (OFDM)-based standards.

Besides providing high detection performance even in fully loaded multi-user scenarios, a simple implementation of a universal mobile telecommunications system (UMTS) receiver is expected.

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

Collaboration sought: further research or development support.

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New logic: the attraction of magnetic computation

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European researchers are the first to demonstrate functional components that exploit the magnetic properties of electrons to perform logic operations. Compatible with existing microtechnology, the new approach heralds the next era of faster, smaller and more efficient electronics.

In the 1960s, Henry Moore observed that it took around 18 months for silicon chip manufacturers to shrink their technology and fit twice as many transistors into the same area of silicon. But Moore's Law is beginning to lose its hold. According to the international technology roadmap for semiconductors (ITRS), devices based on silicon-only technology will soon reach the limits of miniaturisation and power efficiency.

Chip designers and manufacturers are looking for new materials and techniques that will drive forward a new era of electronic devices and applications. An EU-funded project called Maglog has demonstrated for the first time the possibility of producing processors from ferromagnetic materials that are faster, smaller and more efficient than conventional silicon chips.

More than 150 years ago, Lord Kelvin found that the electrical resistance of iron changed when it was in an external magnet field, and that the change depended on the direction of the field. This magnetoresistance effect was very small, but in 1988 Peter Grünberg and Albert Fert — joint Nobel Prize for Physics winners in 2007 — independently developed materials which exhibited much larger magnetoresistance.

Their work spawned a new field of science, magnetoelectronics, or spintronics, which promises significant advances in IT and computing. Magnetoelectronics exploit the magnetic properties or spin of electrons as well as their charge. In the presence of a magnetic field, the electrons may point 'left' or 'right', which can represent bits of data, such as the binary digits 0 and 1.

Funded under FP6, Maglog brought together leaders in the field of magnetoelectronics to adapt the technology not just for data storage and memory, but also for computation. The project partners describe it as 'memory that can think'. The input signals at each magnetic logic gate change the magnetisation of physical structures within the cell. The magnetic field affects the electrical resistance of the structures which can be measured with a read-out of 'true' or 'false', or in binary a 1 or 0.

'The main goal of Maglog was to show that magnetic logic gates could be produced on a conventional complementary metal-oxide semiconductor (CMOS) platform,' says Professor Guenter Reiss, the project coordinator. 'For successful commercialisation, it is critical that this novel method of data processing can be integrated into conventional chip technologies.'

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One production approach uses lithography to etch structures within the ferromagnetic material to produce zones where the magnetic orientation of the material 'flips'.

This switching between two states depends on input signals and thereby enables logical operations to be performed. Cells fabricated in this way use no silicon and require no multilayer processing — they can be manufactured at very low cost on flexible materials.

Another successful production approach for magnetic logic gates remains confined to high-performance computing applications that require low power consumption, for instance battery-operated devices such as mobile phones.

This form of magnetic logic gate uses structures called magnetic tunnelling junctions. Each junction is manufactured from alternating layers of ferromagnetic materials and insulators. This type of gate is programmable — it is possible to change the operator within the logic gate, for example switching an 'and' gate to an 'or' function.

'The industry is crying out for reconfigurable computing to make microprocessors more efficient,' Professor Reiss says. 'We have one of the best demonstrations of reprogramming logic gates "on the fly" and could enhance the performance of a central processing unit by a factor of 10 to 100.'

Magnetic logic has other advantages over conventional microprocessors. First, such processors are 'non-volatile', meaning that they retain their output state even when the

continued on page 31

Low-cost home surveillance

Thanks to the Wirenet project, the introduction of powerline technology is set to bring down the cost of home surveillance systems.

Technology has transformed the workplace and is now making its way into our homes. The current trend is toward intelligent homes with advanced entertainment, security and energy-saving features. However, wiring new homes is costly, while retrofitting existing homes can be prohibitively expensive.

Recently, the technology to transport high volumes of data over power lines has matured. For this reason, the Growth programme funded a team of 10 organisations to investigate the potential of power lines for the purposes of home automation.

The Italian firm Microtelecom s.r.l. led the development of a home surveillance system. They applied ultra-wide-band (UWB) technology to enable power lines to carry high-quality audio and video signals. Consequently, the Italian engineers were able to demonstrate the system's capabilities for tasks such as entry control.

The major advantage of the solution is its low cost in comparison to conventional home alarm systems. Microtelecom and its Wirenet partners have targeted entry into the low-end sector of the relevant market.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4128

The wonder of metadata acquisition for the web

There is a vast overlap concerning the function which a web service offers and its underlying implementation. Thus the Wonderweb project has proposed to construct domain ontologies by analysing application programming interfaces (APIs).

The semantic web presents a new era of the World Wide Web offering data content which can be processed by machines as well as a broad spectrum of intelligent services. This has been made possible through the development of ontologies which specify shared domain theories, thereby allowing more effective communication for people and machines. Ontologies thus have a major role in allowing content-based access, interoperability and communication throughout the web, offering improved service.

Semantic web service descriptions, employed in various application domains, depend upon generic description language like OWL-S for the specification of main elements of the service such as inputs and outputs. They also rely on an ontology which bears knowledge in the type and function of service offered. Domain ontology quality has an impact upon the reasoning tasks which the semantic descriptors perform. For a majority of tasks, it is best if web services are described according to the same domain ontology. Consequently, the domain ontology used needs to be somewhat generic and thus more adaptable. Furthermore, domain ontologies portray complex relationships existing between the domain concepts, allowing them to perform complex reasoning tasks. It is thereby evident that constructing quality domain ontologies, meaning those that are both generic and rich, is equally important as creating a generic web service description language.

Wonderweb inquired whether it was conceivable and useful to construct a domain ontology from software APIs. Additionally, it examined whether part of a domain ontology can be semi-automatically derived from APIs. Two different domains were used to verify the hypothesis. One was the domain of ontology stores based the resource description framework (RDF). The other consisted of bioinformatics services. Results proved very positive with both domains.

This method may thus well be a crucial innovation in the field of semantic web services by supporting domain engineers in their task of building adequate high-quality domain ontologies.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4116

continued from page 30 **'New logic: the attraction of magnetic computation'**

current is switched off. 'When you switch it on again, you are exactly where you were when the power went off,' Professor Reiss says. 'This could greatly reduce or avoid the need for booting up, which can take a long time, especially with small devices that have to load a lot of information from memory.'

Magnetoelectronic components generally consume less power than their conventional counterparts, but the non-volatility can help chips cut their consumption to the bare minimum by temporarily shutting down zones that are not in use.

The project was originally funded for three years to build a very simple demonstrator. The team received a six-month extension for further research into the manufacture of working logic gates integrated on a CMOS wafer. Although Maglog has now ended, the partners continue to work together to bring about the birth of this next-generation microprocessor technology.

Ingenia Technology, a spin-off company from project partner Imperial College, is investigating applications for domain wall structures, such as intelligent smart cards. The cards would be able to perform a degree of data processing within the smart card's chip. This in-built 'intelligence' provides the card with an additional layer of security.

The partners also hope to enter the market for the application-specific integrated circuits (ASICs) typically found in mobile phones. These are chips designed for a specific application and often customised for individual customers, making them expensive.

The programmability of magnetic tunnelling junction logic gates could also allow chip designers to manufacture generic chips that are then customised through logic gate programming.

'From a generic ASIC chip you could configure it with its unique identity,' Professor Reiss says. 'We know of a project in Japan and IBM are working on this, but this is a market with huge potential. There's a tremendous need for smaller chip dimensions and less power consumption, and we think that chips with magnetic logic are the answer.'

Promoted through the ICT Results service.

http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/89840

Meet Robo habilis

A European research project has brought the dream of human-like robots closer to reality by creating a human-like arm and hand controlled by an electronic 'brain' modelled on the human cerebellum.

'Hollywood did a bad job for us,' says Dr Patrick van der Smagt, the coordinator of Sensopac, an EU-funded project whose goal is to create a robotic arm, hand and brain with human-like physical and cognitive capabilities. While the movies have convinced many people that humanoid robots such as C-3PO or WALL-E are realistic, Dr van der Smagt knows all too well how difficult it is to build robots with even basic human abilities.

Yet robots that could function flexibly and safely alongside people in everyday environments could revolutionise daily life. Existing robots, such as those that help assemble cars or computers, can perform repetitive actions quickly and precisely. However, Dr van der Smagt says, 'they are not very intelligent or flexible and they don't do very much sensing.'

The international team of neuroscientists and roboticists that he leads decided that the best way to make a robot that is intelligent, flexible and sensitive is to model it on the human body and brain. This approach, called biomimetics, is inspired by the realisation that evolution has provided the human body and brain with an astonishing range of abilities. 'We can run for hours, yet also perform very high precision tasks,' Dr van der Smagt says. 'If you compare that to any robot system, it's oceans apart.'

After two-and-a-half years of research, and EUR 6.5 million of FP6 funding, Sensopac scientists have designed and tested a human-like arm with a dextrous and sensitive hand, controlled by a computer program inspired by the human cerebellum. Every step towards this accomplishment required groundbreaking research by the 11 partners in the consortium.

To develop robotic skin as sensitive as human skin, the researchers started by studying how human skin senses not just pressure and position, but features such as the direction pressure is coming from.

To mimic the skin's sensing capabilities, researchers at the German Aerospace Centre (DLR), guided by physiology results from Umeå University, in Sweden, created a thin flexible material filled with a form of carbon whose resistance changes with pressure. This approach let them combine information from sensors in different parts of the skin in order to minimise the number of information-carrying wires.

'We can soon integrate hundreds of detector elements and get the information out with just five wires,' Dr van der Smagt says. 'And we have the ability to distinguish between shape, the amount of force, and the direction of force.'

The human arm and hand can generate and control a remarkable range of force, from the delicate touch of a watchmaker to the power of a javelin thrower. Much of this range of force and finesse comes from the pairs of opposing muscles that control each joint.

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Researchers at DLR took the same approach. The artificial arm they built and are now experimenting with uses a total of 58 motors in opposing pairs, coupled with non-linear springs, to control the arm. The hand they have built is closely modelled on the human hand. It can snap its fingers, pick up an egg or carry a cup of coffee. Its fingers are moved by 38 opposing motors.

Again, the researchers had to go back to basics, for example making detailed magnetic resonance imaging (MRI) studies of human hands in hundreds of different positions. 'Surprisingly enough, this doesn't exist anywhere else,' Dr van der Smagt says.

From the start, the group knew that sensitivity, dexterity and strength were not enough. They had to provide the biomimetic arm with a high degree of intelligence. Their ultimate goal is to create a microchip that will allow the arm to carry out tasks requiring human-level skills in a real-world setting. Dr van der Smagt envisions an arm that could 'decide' to pick up a cup, sense important properties of what it contains, for example water versus flour, and move it from place to place. 'It's not that the system needs to know that there's water in the cup,' Dr van der Smagt says, 'but how to handle whatever is in it appropriately.'

Scientists at the University of Edinburgh, in Scotland, and at Lund University, in Sweden, decided that the best approach was to model the human cerebellum. The cerebellum is a fist-sized organ at the base of the brain that coordinates sensation and movement. The researchers are currently using software to simulate important aspects of how the cerebellum processes and integrates information. 'It's the first neural-network-based controller that can control the dynamics of a robotic system in its full operational range,' Dr van der Smagt says. In the next six months, they will be seeing how well this system can learn to control the arm.

Although he is excited by the group's progress towards a robotic arm and hand with human-like capabilities, Dr van der Smagt remains impressed by what nature has already done. 'It makes one realise that we are still light-years away from achieving what biology has accomplished,' he says. 'We are definitely not there yet, but we are getting much closer.'

Promoted through the ICT Results service.

http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/89906

Interactive tactile interface for visually impaired computer users

The Itacti project developed a state-of-the art interactive tactile interface to improve access to modern computer and Internet applications for the visually impaired.

Advances in information technology have helped to break down the barriers which prevent people who are visually impaired from accessing computers and their applications. One of the last challenges to be met has been that of three-dimensional graphics.

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The technology employed was based on the novel application of smart materials. These were then used to produce an array of 'dots', which was simple to construct and manipulate using interactive touch-sensitive feedback. Images and text were placed in a format suitable for tactile display. Software tools were created that enabled software control of the tactile interface. The program highlighted the active windows, the contents of which were mainly text and displayed in Braille. Contour lines were used to represent graphic structures, while areas of colour were indicated by different patterns of dots.

Simple pictures were displayed by showing individually ascribed parts, which were coloured or shaded. For instance a map, which initially showed everything, then with frontiers, followed by features in the landscape, cities, roads and railway lines and so on. The program was designed to be used under Windows 2000 and has been adapted to XP.

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

Collaboration sought: marketing agreement.

http://cordis.europa.eu/marketplace > search > offers > 4112

From perception to action

The Cyberhand project aimed to develop a cybernetic prosthetic hand. It is hoped that this anthropomorphic device will be able to recreate the 'lifelike' perception of the human hand, and thus increase its acceptability.

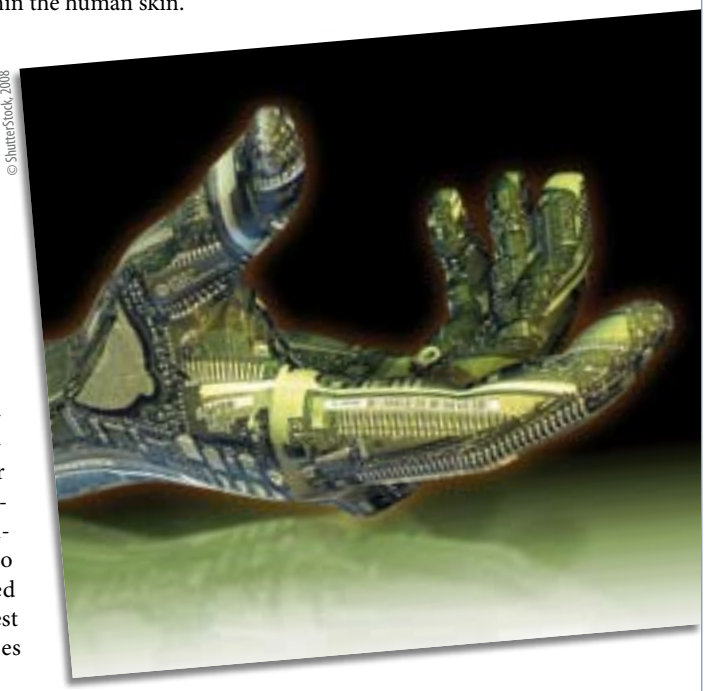
Strong motivation for the development of this innovative prosthetic hand device was provided by the task-oriented interest of the user community. Patients frequently express the need to replace their missing limb with a functional hand replacement that will enable them to perform the activities of daily living autonomously.

The cybernetic hand is by definition connected by neural interfaces to a human and thus makes it possible to exploit sensory and motor coordination mechanisms for controlling grasping forces, because it does not just mimic the human musculoskeletal structure. Neural signals that used to arrive at the original hand's muscles are interpreted to correlate with the joint movements.

While the ultimate aim was to connect the Cyberhand through neural interfaces implanted in peripheral nerves, its modular design allows the exploitation and, even more importantly, the validation of different neural interfaces. Research at the Fraunhofer Institut für Biomedizinische Technik moved towards the development of implantable telemetry systems for the recording of electroneurographic signals and stimulation of peripheral nerves.

The Cyberhand's sensory system included sensors intended to functionally emulate touch sensors in the human skin and produce information about the interaction between the hand and the object reached. Biological touch sensors represent physical properties of the environment in contact with the skin and are found in several distinct structures within the human skin.

Responses of sensory neurons to mechanical stimulation, such as touching and tissue compression, were investigated with a pneumatic stimulator. The ultrasonic sensor incorporated in the stimulation tip provided the essential contact information. The modular design of the Cyberhand makes it comparatively easy to exploit its advanced technologies and test scientific hypotheses for the functional role of biological sensors during manipulation tasks.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Undoubtedly, implementations of arrays of flexible sensors assembled as an external 'skin' can be expected in the future with mechanical properties similar to those of natural skin.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4162

Saving lives with a 10-kilo phone network

A 10-kilo GSM mobile phone network developed by European researchers will allow rescue workers to set up communications just hours, or even minutes, after a man-made or natural catastrophe. It will mean more lives saved.

When disaster strikes, communications are often one of the first infrastructures to go down. But this is exactly when effective communications are most desperately needed.

That problem may be a thing of the past thanks to achievements in the 'Wireless infrastructure over satellite for emergency communications' (Wisecom) project. The team behind the project has developed hardware and software allowing rescue workers to respond faster in the wake of a catastrophe. 'We developed lightweight, portable (or transportable) systems that allow rescue workers to set up voice and data networks in a very short time,' says Dr Matteo Berioli, Wisecom's coordinator.

The hardware can then link up to satellites to connect with the world mobile and landline networks, Dr Berioli says. 'The system works anywhere there is satellite coverage, which is to say almost everywhere in the world,' he adds.

The system comes in two versions, which exploit two different satellite technologies: Inmarsat BGAN and DVB-RCS. BGAN, a satellite telephony standard, is smaller with lower performance, while DVB-RCS is a satellite broadcast standard and has much better performance, but is much larger.

The version working with BGAN is portable, the size of a small suitcase, and weighs just 10 kg. It can be carried on a standard flight and delivered to the disaster zone, where non-technical rescue workers can set it up in minutes. The DVB-RCS version is larger and heavier, weighing 60 kg — about the size of two fairly large suitcases. 'Most of the volume in the DVB-RCS version is taken up by a satellite dish,' Dr Berioli reveals.

Both systems come with an integrated GSM network and wifi connection. The BGAN version integrates a GSM pico-cell — a tiny mobile phone cell using the Internet to connect to the public phone service — and offers coverage of over 300 m radius for voice and data, while the DVB-RCS version integrates a GSM micro-cell which can cover several kilometres and benefits from a larger bandwidth on the satellite connection.

The BGAN version is for immediate deployment during the initial emergency response, while the DVB-RCS one has longer deploying times, mainly because the 1.2 m satellite antenna has to be carefully pointed. It is intended to help reconstruction efforts in the days and weeks after a disaster.

In addition to the hardware, Wisecom developed useful software to maximise the impact of the system. Location-based services (LBSs) allow emergency chiefs to track rescue workers as they seek out disaster victims. 'It is fundamental with triage, [helping to determine] which cases require the highest priority,' Dr Berioli offers as an example.

'We only discovered the importance of this service when we talked to end-users.'

Indeed, one novelty of the Wisecom project is that user suggestions are a vital part of its work plan. 'Engineers can create perfect technology, but often in the past it did not always correspond to real needs. We included end-users as part of the consortium to make sure we were developing relevant systems.'

The LBS for triage is a case in point. Coding triage victims by colour — black, red, yellow or green — is an internationally recognised system. Black denotes a fatality; red someone who is near death, yellow is serious but not life-threatening, while green signals an injury.

'If a victim is red, the rescue worker notes that and the LBS software immediately, via Wisecom, tells the command centre where to find the victim. Then command can alert other rescue workers and establish voice communication [with] specific people to speed up the rescue, ' Dr Berioli explains.

All this — voice and data, GSM and wifi — runs over Wisecom and the satellite. So the command centre could even be on the other side of the world, thanks to the satellite link-up.

LBS and this system of electronic triage are just one example of the extra functionality the team built into the system. Tetra is another example. 'Tetra is the new communication standard that serves the needs of emergency response and public safety,' Dr Berioli says. 'There is currently a very big push for this standard in Europe,' he notes.

Tetra was not part of Wisecom's original brief, but the team developed a solution within their system for this standard. 'We did not produce a full demonstrator, but we proved the functionality in the lab. It could be easily scaled up for real-world use. We did not have to do it, but it was very rele-

continued on page 35

Aerial systems aid in fire detection

A fire detection and localisation system consisting of hardware and software components has been designed for fire detection using single unmanned aerial vehicles (UAVs) flying at low altitudes.

The Comets project has developed technologies and tools for real-time coordination and control of multiple heterogeneous UAVs. It has tapped into the ways in which various aerial systems such as helicopters and airships complement each other in terms of reciprocal data retrieval. The benefit of this method is that it increases fault tolerance and flexibility.

The development process involved the creation of a new control system and technique as well as the integration of distributed sensing techniques and real-time image processing capacities. As a way to test and prove the system and techniques, the system was demonstrated in real-time forest fire detection, localisation and monitoring.

The system's hardware components include visual and infrared cameras and electronic components such as a video server and sensors for vehicle positioning. Fire alarms are detected from the visual and infrared images. The software is able to join information sources so that the occurrence of false alarms is reduced.

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Furthermore the software can run on a laptop or onboard provided the vehicle is one which can operate a processor.

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

Collaboration sought: further research or development support.

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When surgery enters the world of virtual reality

With the ultimate aim of providing a unique virtual reality environment for preoperative planning of hip replacements, the Multisense project started by integrating the haptic modality into a multimodal environment.

Despite the obvious importance of tactile cues in everyday life, tactile sensing and display for tele-manipulators, virtual reality and, more generally, human-computer interfaces (HCIs) may still continue to elude researchers. The fusion of sensory data including sound, touch and even smell could form an advanced, realistic and intuitive user interface. Nevertheless, current systems have relied heavily on vision feedback.

The Multisense project aimed to combine different sensory devices in a unique virtual reality environment for orthopaedic surgery. For the haptic modality in particular, hardware and software were developed at the University of Salford to provide effective touch feedback that could enhance the growth of innovative medical applications. The medical user-selected scenarios, in which haptic feedback helps to position and orient artificial implants, would be of the greatest benefit. The haptic requirements of this specific application were also defined.

More specifically, research work sought to address one of the limitations to the realisation of a portable tactile display, which lies in the size and weight of current actuators. Although electrostatic and piezoelectric actuators allow for compact designs, they lack the force output needed to generate a realistic haptic sensation and, more importantly, require heavy and complicated power supply. Sixteen miniature, direct-current motors were therefore used to provide pulling forces up to 4.73 N to the spring-loaded pins of the tactile display in the form of a pin array.

Forces from the motors are transmitted to the pins by means of nylon tendons encased in Teflon cables, allowing for a small tactile display component to be attached at the fingertip. The motors within the drive pack are powered by a battery stack that adds a mass of 100 g to the portable, wearable device's total weight, which does not exceed 275 g. Initial test results have indicated that all pins in the array can be displaced over 2.5 mm. The bandwidth of this displacement is greater than 12 Hz, which is suitable for texture simulations.

This haptic device was realised to suit the workspace of a multimodal application framework and the interaction requirements of medical procedures, where surgeons would use a range of sensory cues.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4069

See also page 5 (offer 4049)

continued from page 34 **'Saving lives with a 10-kilo phone network'**

vant to our system, so we were keen to do the work,' Dr Berioli adds.

Once all these elements were complete, the Wisecom team tested the entire system in a live demonstration. 'I was impressed by how many people were involved. There were over 150 people and 25 vehicles: fire trucks, ambulances, everything. We gave the rescue workers some training, but they did everything on the day, setting up the Wisecom system and going through an emergency drill. It worked very well,' the coordinator confirms.

Now the system is ready for commercialisation, and some of the partners are actively pursing opportunities — though, in part, that will depend on public services. 'These types of systems are generally purchased by governments, or civil security forces,' Dr Berioli notes.

Wisecom, which was funded by FP6, had another unexpected impact. 'It has put satellites on the map for emergency communications. There are not many people working in this area, and it has suddenly become a hot topic, because people have understood the potential of satellites in emergency situations, when terrestrial infrastructures are not reliable or [no longer] available. For this reason, I assume, I was invited to chair the satellite workgroup on the EU's Public Safety Communications Forum,' Dr Berioli concludes.

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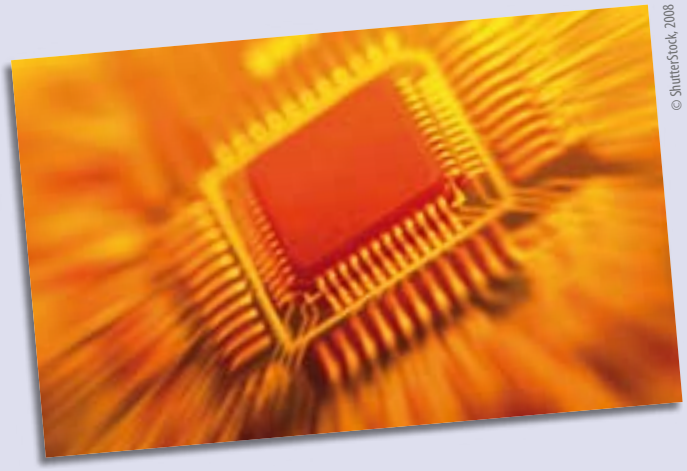
http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/89887

Ultra-low-power integrated circuits

Both low- and high-threshold voltage metal-oxide semiconductor field effect transistors (Mosfets) combined with reverse biased diodes result in a novel family of integrated circuits. These patented circuits consume minimal amounts of energy.



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A field effect transistor is a semiconductor device through which the current is carried by majority carriers only; it is a unipolar device. This current flows through a narrow channel, the gate, from the source to the drain. The voltage applied at the gate controls the width of the channel and consequently the transistor's conductivity.

In the course of the ATHIS project, it was shown that ultra-low-power (ULP) circuits can be built with multi-threshold Mosfets and ULP reverse biased diodes. For ULP diodes, reverse current is for all practical reasons zero. It is this region of ultra-low leakage and a negative impedance characteristic in reverse mode that are currently more scientifically interesting.

The ATHIS project developed these ULP circuits by biasing the n-MOS transistor in static operation at a gate-to-source voltage lower than zero. This way the leakage current was reduced to almost zero, offering much lower static power dissipation. On the basis of the ULP diode principle, a memory cell and a voltage doubler have also been developed and experimentally tested. Their ability to function well at high temperatures must be especially noted.

These innovative circuits have already been patented and their immediate widespread application in digital circuits is expected.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4038

Smart testing at high temperatures

An innovative system integrates test and failure detection methodologies for system-on-chip (SoC) technology used in high-temperature applications.

The ATHIS project focused on developing new methods for innovative, integrated, miniaturised and distributed electronic systems with reliable operation under high-temperature conditions (above 200 °C). The high-temperature electronic components and systems are aimed for further deployment in critical situations found within the automotive, aerospace, avionics, ship and oil extraction industries.

Part of the project work involved the development of a testing scheme for a range of subcircuits realised on SoC technology at temperatures around 250–300 °C. The so-called 'Built off-chip self-test' (BOST) has been included in a tester/oven interface. It provides suitable strategies for testing embedded memories in SoCs. A few examples of these memories include static random access memory (SRAM), dual-ported random access memory (DPRAM) and electrically erasable programmable read-only memory (EEPROM).

With the aid of programmable function blocks, the test scheme features increased flexibility to test stimuli and high adaptability to accommodate changes in test algorithms. The key test algorithm used is the industrially known MARCH test that is capable of detecting various types of faults. Such faults include all address, stuck-at, transition and coupling faults under varied complexity of the memory array architecture. Moreover, the algorithm has the potential to test word-oriented memories (WOMs) through substitution of the bit read/write commands by word operations.

Other possible system capabilities include circuitry fault detection in cases where common voltage test methods fail to describe properly. The system can find useful applications in a wide range of test scenarios, including failure mode analysis and reliability testing. Its increased flexibility and low-cost design make this system suitable for use by companies involved with the manufacture or use of high-temperature electronic devices and systems.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4019

Power applications of high-temperature superconductivity

The use of high-temperature superconductors for electrical power transmission cables was among the first large-scale applications that were envisaged after the discovery of high-temperature superconductivity. Within the Big-powa project, critical steps have been taken towards the realisation of this vision.

With current densities exceeding the admissible densities of standard metal conductor currents by up to two orders of magnitude, superconducting cables bring unique opportunities for the power supply of the metropolis. Copper overhead lines of existing electric power distribution networks could be replaced in the near future by underground superconducting cables, carrying electricity more efficiently and in an environmentally friendly way.

The Bi-2223 conductor has the most advanced manufacturing technology for the moment, and it will in all probability be used in the first large-scale power applications of high-temperature superconductors. The behaviour of new superconducting Bi-2223 elements manufactured within the Big-powa project under over-currents above the critical current has been analysed extensively by means of numerical simulations.

As any electrical device may experience over-currents, the response of superconducting

continued on page 37

An innovative approach for the lock industry

A novel means to produce cost-efficient, complex-shaped engineering components has made its way into the lock industry.

Industrial sectors continue to search for ways to minimise manufacturing costs by lessening the surplus of raw materials. One process capable of this is powder metallurgy (PM), a forming and fabrication technique which uses sintering (the heating of raw material to produce various parts out of metal powder). However, when it comes to complex-shaped engineering components, PM falls short unless the parts are machined after sintering. This can be expensive, because the hardness of the heat-treated materials requires more care in machining.

In light of this, the PM-Mach project has created efficient methods for machining powder compacts prior to sintering. This encompassed novel means for powder pressing, clamping, machine procedures, tooling and lubrication. One such development involved new material to improve locking devices. Until now the lock industry was not able to combine all the elements of drill and corrosion resistance as well as durability. Thanks to a new PM material, which combines standard stainless steel with stainless tool steel, such features are now possible. As an end result, the lock industry may just have an innovative and efficient approach at hand.

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

Collaboration sought: information exchange/training.

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Novel semiconductor materials

In the late 19th century, silicon carbide was mainly used for cutting tools, grinding wheels and sandpapers. Nowadays, it is recognised as one of the fundamentals for semiconductor industry materials.

Silicon carbide is dark to light green in colour and has the chemical formula SiC. It is usually produced in an electric arc furnace and has been extensively used as an abrasive and structural material. It is also a wide band-gap semiconductor currently under active development for high-power, temperature and frequency device applications.

The interest in this material stems from its high electron mobility in relation to a phenomenon called polytypism. SiC crystals exhibit many structures depending on the stacking sequence of Si-C tetrahedra. The main SiC polytypes that have been explored have either the cubic (3C) or the hexagonal (4H or 6H) structures. It is the 3C structure that has the highest electron mobility and the smaller band-gap, and it is therefore exceptionally suited for medium-power applications (300–1 200 V, 10–100 A). However, interest has concentrated on the hexagonal polytypes because of the commercial availability of substrates cut from bulk crystals. The Solsic project has rectified this problem by developing bulk cubic SiC crystals and wafers while at the same time cubic SiC properties were scrutinised.

Several types of rectifiers like Schottky barrier diodes and various types of transistors like metal-oxide semiconductor field-effect transistors (Mosfets) were developed based on 3C-SiC. A processing line for the fabrication of these devices has been established. Processing includes epitaxial growth of n- and p-doped layers, ion implantation and post-implantation annealing, lithography, dry etching, silicon dioxide and silicon nitride deposition as well as thermal oxidation.

The devices thus fabricated match the corresponding state-of-the-art hexagonal SiC devices in performance. Crystal defects that initially inhibited performance from reaching the expected values were greatly reduced. In conclusion, it was demonstrated that for medium-power applications (300–600 Volts), devices fabricated from cubic silicon carbide perform exceptionally well.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 4051

continued from page 36 **'Power applications of high-temperature superconductivity'**

Bi-2223 cables constitutes a key point for any large commercial application. For the thermal and electrical analysis of superconducting Bi-2223 tapes and cables composed of multiple layers of tapes, dedicated numerical models were developed at Centre national de la recherche scientifique (CNRS).

These models have been used in finite element method (FEM) simulations of monofilamentary and multifilamentary Bi-2223 superconductors of different geometries. If a single tape could withstand very high over-currents, superconducting cables with several non-cooled layers are expected to be more sensitive to over-currents. The temperature predictions of FEM simulations were validated by means of comparison with the measurements of temperature sensors from experimental tests.

Further modelling attempts for the evaluation of superconducting Bi-2223 cables' performance and continuous improvements in their design geometries are required before full utilisation of their potential.

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

Collaboration sought: information exchange/training.

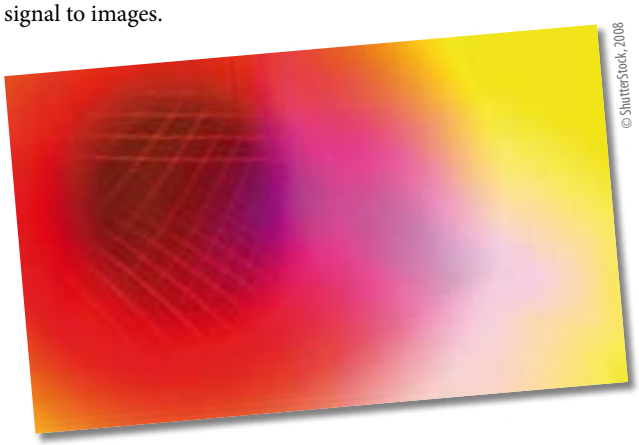
http://cordis.europa.eu/marketplace > search > offers > 4100

Arrays of thermal imaging sensors

Series of miniature thermal sensors are capable of accurate motion detection through infrared imaging. High sensitivity and fast response characterise these innovative sensors.

Thermal imaging is a well-known, well-established method for really looking and seeing in the dark. All materials emit electromagnetic radiation that depends almost solely on the temperature of the emitting body. This radiation can not be detected by the human eye and consists of wavelengths in the infrared region. Sensors collect this infrared radiation and transform the input signal to images.

A variety of industrial processes exploits the benefits of infrared imaging. Numerous small and medium-sized enterprises ranging from those manufacturing electrical equipment to environmental protection and information processing companies will revolutionise their processes with the aid of a new generation of infared sensors. The sensors have been developed by the partners in the Tech-tir project.



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The whole Tech-tir project has focused on developing sensor technologies that will greatly facilitate the application of thermal infrared devices for detection and imaging. The technological approach followed by the project partners has already yielded tangible results. Namely, a two-dimensional array of thermal sensors has been developed. The electronic circuit required for driving and controlling the sensor has also been manufactured and thoroughly tested. The circuit is a complementary metal-oxide semiconductor (CMOS) integrated circuit.

With low-cost and well-established processes, sensor fabrication issues have been completely resolved. The sensors do not need cooling and have very small thermal conductance as well as thermal capacitance. Both characteristics are essential for the required high sensitivity and rapid response.

Demonstrator prototypes are available, and Tech-tir project partners are currently seeking further financial support in the form of either a joint venture agreement or spin-off funding.

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

Collaboration sought: joint venture agreement, manufacturing agreement, financial support, venture capital/spin-off funding.

http://cordis.europa.eu/marketplace > search > offers > 4135

Exploiting nanotechnology to spot the right smell

Recent advances in signal transduction technology have opened the way to elaborating a miniature biosensor, mimicking the olfactory system of mammals. As a promising alternative to conventional analytical techniques, such a biosensor could provide food companies with a means of homing in on precise smells, according to product and consumer requirements.

Coupling biomolecules to non-biological electronic transducers, molecular bioelectronic systems could one day support a wide variety of applications, amongst which are biosensors. Aiming to achieve the performance of natural olfactory biosensors, such a nanobiosensor array has been developed within the Spot-nosed project, which exploits the electrical properties of single olfactory receptors.

When an odour molecule binds to the olfactory receptor, the induced conformational change and modifications to the impedancemetric properties of the protein can be recorded by means of nano-electrodes. To develop a bioelectronic nose capable of identifying a wide range of odours, immobilised biological sensitive material was integrated with transducers, converting biological signals into quantitatively measurable electrical signals.

More specifically, the nanobiosensor array integrates a set of elementary nanotransducers, each of which consists of noble metal nano-electrodes with a single olfactory receptor in between. Noble metal substrates of platinum (Pt), gold (Au) and silver (Ag) were chosen as the most suitable, since they are relatively easy to functionalise. The nano-electrode devices were fabricated at the Centro National de Microelectrónica (CNM) in Barcelona, using standard microelectronic processes such as nanolithography and electron beam lithography.

Both individual nano-electrodes and nano-electrode arrays were fabricated with a diameter ranging from about 1 micron to less than 500 nm. The electrochemical cell for localised impedance measurements was a three-electrode cell with a volume of 5 ml, with the counter-electrode made of a platinum plate. The polarisation of the working silver electrode was fixed against a saturated calomel reference electrode (SCE).

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Extensive laboratory tests have shown that this novel olfactory nanobiosensor will respond to a few odour molecules with a high degree of accuracy that surpassed even the researchers' initial expectations. The partners in the Spot-nosed project are planning to continue their research and develop suitable electronic instrumentation that could be adapted to an atomic force microscope for performing measurements at the nanoscale level.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4106

Innovative electronics for controlling multiple nanosensors

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Nanometre-scale silicon cantilevers are capable of performing highly accurate mass measurements. Arrays of these novel mass sensors have been developed along with the necessary circuitry for controlling them.

A beam supported at one of its ends is the picture we all have of a cantilever. What is astonishing, though, is the fact that with modern fabrication technologies we can create cantilevers at really miniature sizes, of the order of nanometres. Moreover, these minute cantilevers are capable of mass measurements and therefore serve as mass sensors. With their aid, the 'Nanomass II' project has monitored a multitude of both chemical and physical processes.

For the wide range of applications these innovative mass sensors will have, the project partners developed not just one prototype, but went on and produced arrays of cantilevers. Using polysilicon, arrays of four and eight cantilevers have been fabricated. The cantilevers have been inscribed at a single nano-area with an electrode connecting them to an outside electronic signal detection and read-out circuit. Cantilevers have also been defined on different nano-areas with a metal line connection between them and the controlling circuit.

An integrated electronic circuit comprised of a complementary metal-oxide semiconductor (CMOS) processor serves as the read-out and controlling circuit. It has been chosen in such a way as to minimise the noise from the parasitic capacitance. This capacitance occurs as a result of the polarisation of the nano-cantilevers on the nano-area. The use of an insensitive transimpedance configuration to this noise also results in smaller distances between the cantilevers forming the array.

Another exciting and extremely useful result from the 'Nanomass II' project research is that with the aid of an array, differential detection can be achieved. It is possible to functionalise only some of the cantilevers that form the array. Consequently, keeping one inert and exciting the rest of the cantilevers results in optimum detection performance.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 4098

Complementary to CMOS nanosensors

Mechanical mass sensors are indispensable in a variety of physical and chemical processes. A combination of complementary metal-oxide semiconductor (CMOS) circuitry with an array of nanometre-scale silicon cantilevers is capable of high-resolution mass detection.

The possibility of combining the well-known and well-established CMOS circuitry with nanotechnology processes has been explored and confirmed during the 'Nanomass I' project. Namely, it was shown that novel nanolithographic techniques could be combined with standard CMOS technology. Additionally, a mass detector based on an array of nanometre-scale silicon cantilevers was fabricated. Such a compact and sensitive environmental or biochemical sensor was further optimised in terms of fabrication, performance and functionality under the auspices of the 'Nanomass II' project.

Of critical importance to the functionality of such sensors is the electromechanical behaviour of the resonating cantilever excited electrostatically by a parallel driver electrode. Elaborate software codes were developed to model this behaviour. Four different approaches aimed to describe the capacitive current signal provided by the cantilever-driver system. This current signal is the result of the cantilever's oscillation from an AC voltage excitation and a DC voltage application to the driver-cantilever system.

In the simplest approach, the complex underlying system can be modelled with just a resonating equivalent resistor inductor capacitor (RLC) circuit in parallel with a capacitor. The model is valid for stiff cantilevers that consequently oscillate with small amplitudes.

The non-linear real curved cantilever deflection and parallel plate approximation models are suitable for descriptions of capacitive current signals of soft cantilevers and large amplitudes of oscillation. These two approaches, along with the non-linear/linear cantilever deflection approximation model, can also provide information on mechanical magnitudes as in cantilever deflection. The above three models are also capable of simulating the behaviour of the parallel driver electrode, i.e. the driver-cantilever transducer, when coupled with an electronic circuitry.

More functionality tests will be performed, bringing mass sensors with a mass resolution of 10^{-19} gr in vacuum and a spatial sensitivity of less than 100 nm closer to industrial applications. For more information, please visit: http://einstein.uab.es/_c_nanomass

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

Collaboration sought: information exchange/training.

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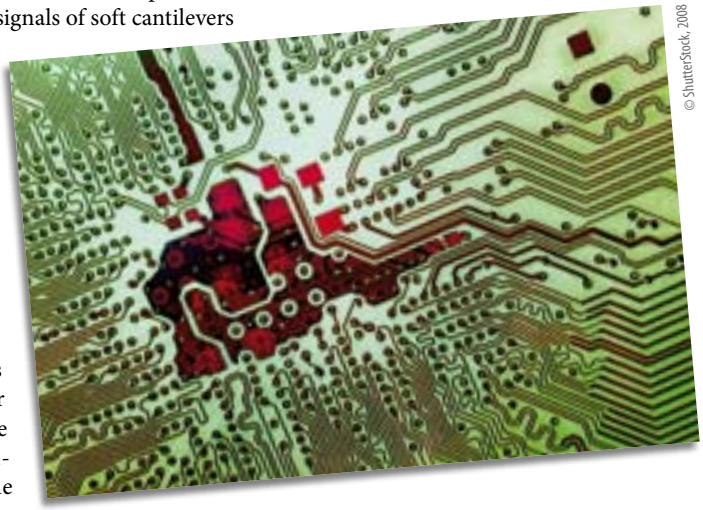
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Experimental data for diesel engine research

The Chalmers University of Technology has constructed a comprehensive database with temperature, flame and flow field data from a diesel engine in order to facilitate model validation.

Numerical models are an important tool used by engineers in engine development. However, models are imperfect and must be continuously verified against experimental data.

The Minnox project aimed to reduce nitrogen oxide (NO_x) emissions from internal combustion engines. The research relied heavily upon modelling techniques, thus it was imperative that actual engine data were available for comparison.

The Chalmers University of Technology, a Minnox partner from Sweden, performed a number of different experiments and assembled the results into a single database.

A two-litre, single-cylinder, direct injection diesel engine was used as a test bench.

Two different thermo-pistons were employed to provide highly resolved temperature measurements on the surface of the piston and at the cylinder head. At the same time, the concentration of NO_x and other pollutants was analysed in the exhaust stream. Cylinder pressure and other parameters were also monitored in order to estimate total heat loss.

In a second phase, an endoscope was added to perform flame imaging. It was necessary to allow the engine to warm up prior to recording so as to avoid interference from soot build-up. Pyrometry theory was subsequently used to calculate sooting flame temperature and soot concentration.

For the final series of experiments, additional modifications were made to the engine to incorporate optical instrumentation. Specifically, information about the flow field within the combustion chamber was gathered with laser Doppler anemometry.

Data from the three experimental phases were inserted into a central database that was made available to the other members of the Minnox consortium for model verification purposes.

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 > 3965

Measuring heat flux in internal combustion engines

Reducing pollutant emissions from cars requires detailed knowledge about what is happening inside the engine. The Universität Stuttgart devised a unique experimental methodology to measure the temperature field in the combustion chamber.

Nitrogen oxides (NO_x) produced inside vehicle engines are subsequently released to the atmosphere where they negatively impact human health. The pressure on automobile manufacturers is increasing as tighter vehicle emission standards are set to come into force.

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NO_x formation in the combustion chamber is highly dependent on temperature. Therefore, attempts to re-engineer the internal combustion engine to reduce NO_x emissions must be driven by knowledge of the temperature field. Unfortunately, detailed data for the various stages of the combustion cycle are lacking.

Working under the auspices of the Minnox project, the Universität Stuttgart constructed an innovative experimental set-up using special surface thermocouples. Using over 100 such sensors, the German engineers were able to obtain simultaneous measurements of the heat flux throughout the entire combustion chamber. This represents a quantum leap forward from past research efforts.

The flexibility of the experimental apparatus facilitated the investigation of different intake geometries, flow field conditions and flame propagation. In addition, the low mass of the thermocouples enabled the collection of high-resolution data, on the order of one degree of crank angle.

In the context of the Minnox project, the results of the Universität Stuttgart's research were used to calibrate three-dimensional engine simulation tools. Such tools will help vehicle manufacturers, such as those taking part in the project, advance engine technology more rapidly than previously possible. Finally, it should be noted that the experimental methodology can be applied to other engine components, such as fuel injectors.

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 > 3914

See also pages 18 (offer 4184), 19 (offer 4045) and 22 (offers 4127 and 4194)

On the quest for more fuel-efficient and cleaner engines

Computational fluid dynamics and high-end visualisation software have been employed to develop computer models that would enable a more thorough understanding of fuel flow and combustion distribution in spark-ignited engines.

Among the technologies that will potentially form the basis of future highly efficient and near-zero emission automobiles, novel approaches to combustion processes like controlled auto-ignition seem to play a key role. However, the occurrence of significant cycle-to-cycle variations in different parts of a particular engine remains one of the factors limiting the full exploitation of the potential of these new combustion techniques.

To support accurate prediction of the effects of unsteady engine operation on energy conversion efficiency and resultant pollutant emissions, a novel engine design software tool has been introduced. The large eddy simulation (LES) techniques received the attention of the LessCO2 project because of their ability to filter individual and, importantly, spatially filtered cycles.

LES techniques allow a richer view at in-cylinder flow and combustion than the widely applied Reynolds averaged Navier-Stokes techniques, as they have the inherent potential to predict high-frequency unsteady effects. With the long-term objective of realising a robust

continued on page 41

Automotive safety systems get more dependable

As automotive safety systems become more complex, the risk of failure increases. But European researchers believe they have found a way to improve dependability.

Modern cars are complex beasts, with electric and electronic components that are smarter than the average desktop computer. They perform split-second calculations so they can deploy, for example, an airbag at the appropriate time.

And that is just one example. There are dozens of others, either available now or emerging from the research and development labs of Europe's automakers. The developments mean automotive safety is about to get a whole lot more complex.

But complexity is the bane of dependability. The more complex a system, the more likely it will suffer potentially catastrophic errors.

Enter integrated safety systems (ISSs), the latest paradigm in safety engineering. Such technologies allow safety components, like speed, steering or other sensors, to be available for a variety of applications.

In the past, a wheel speed sensor would be slaved to the ABS braking system, but under ISS all components are part of a network, so they are available for a host of other applications, like ensuring a car or truck is observing local speed limits.

This integration reduces development time and the costs of a new application. But ISS can also improve dependability by designing it into in-car infrastructure from the start.

That was the goal of the EASIS project, an FP6-funded research effort to build an ISS for the automotive industry as part of a much broader effort to improve car safety. It was not a simple task. 'The problem is that there are a lot of safety systems, but they are standalone, so in the future we will have to combine them,' explains Dr Vera Lauer, coordinator of EASIS. 'We had to collect requirements from the different applications and domains, and to combine them into an integrated safety system,' she adds.

Such problems included fitting software and its services to requirements, using cost-efficient hardware solutions on the engine control unit (ECU) level, and identifying the appropriate processes and tools to develop these systems. There were two specific architectures to address: software and hardware. 'The development partnership Autosar is dealing with the standardisation of software architecture for automotive applications, so we aligned ourselves to their work, concentrating on safety services,' Dr Lauer notes.

For hardware architecture, EASIS focused on cost-efficient and scalable approaches. The team's contribution to the standards process for hardware interfaces was a big step forward. Hardware interfaces are the physical connections between components. An agreed standard, which is emerging now, will save a lot of money and eliminate unnecessary complexity.

Next, the team developed a model-based application development approach, called the EASIS engineering process (EEP). The approach is tailored for complex ISSs. The research team integrated a dependability framework, which ensures applications are designed to eliminate or mitigate errors and failures. The EEP covers both hardware and software design and validation and provides common services upon which future applications can be built.

The team verified their results in two demonstrators. In one, they showed the effectiveness of a firewall they developed for telematics systems. 'A lot of emerging safety systems will involve in-car communications and telematics — either with GPS or other cars via wifi,' Dr Lauer explains. 'It is vital that the safety of the car cannot be compromised by malicious communication.'

The project also demonstrated overall system dependability using a hardware simulator, called hardware-in-loop (HIL), with an integrated retarder, or intarder. Retarders are hydraulic brakes.

Both cases demonstrated the effectiveness of the EASIS approach, and the work has attracted the interest of the European carmakers and suppliers. 'We kept in close contact with other major European car safety initiatives like Prevent, AIDE and others,' Dr Lauer says. 'It was very successful. We have made a big step towards a working ISS infrastructure for cars.'

And that means that the complex science of car safety systems just got a whole lot simpler, and more dependable.

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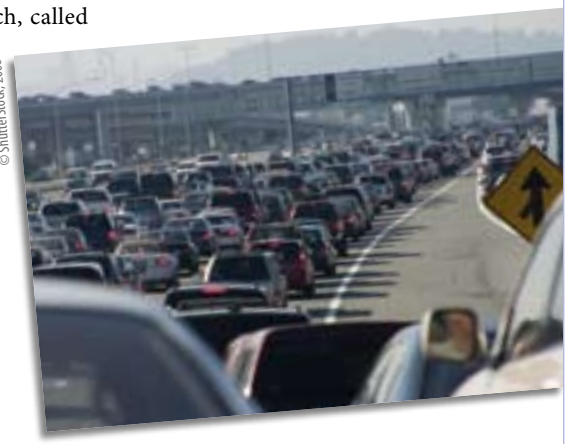
http://cordis.europa.eu/ictresults/index.cfm/section/news/tpl/article/BrowsingType/Features/ID/89735



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continued from page 40 **'On the quest for more fuel-efficient and cleaner engines'**

computational fluid dynamics tool that could predict cycle variability in internal combustion engines, the AVBP software code was updated at the Institut français du pétrole.

Research work focused on conserving the code's numerical properties when the mesh is deforming with the piston and valve movements and on mesh management using conditioned temporal interpolation. Since AVBP was primarily written for turbo-machinery, advanced numerical methods were implemented to handle moving boundaries in a computing time-efficient manner, while avoiding the occurrence of negative cell volumes.

Moreover, an automatic mesh management technique for adaptive inflow/outflow boundary conditions as well as a LES combustion model for prefixed spark-ignited combustion were developed. The first validation results demonstrated the enhanced capabilities of the new parallel LES solver of reactive multi-component compressible Navier-Stokes equations in two- and three-dimensional unstructured hybrid grids.

This highly innovative software tool, providing the essential means to address engine warm-up and its impact on fuel conversion, should open valuable perspectives for the future design of automobile engines.

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 > 4009

See also pages 18 (offer 4184), 19 (offer 4045) and 22 (offers 4127 and 4194)

Silent machines

Noise is a disturbance to the human environment that is escalating at such a high rate that it will very soon become a major threat to the quality of human lives. Reducing the noise emitted by machine tools considerably alleviates the problem.

For many of us, sound pollution has become a fact of life — a constant, unwelcome layer of background noise that can disrupt sleep, cause irritation or anxiety, and even trigger a range of stress reactions. In the past 30 years, noise in all areas, especially in urban areas, has been increasing rapidly. The acknowledgement that noise pollution has already become an environmental problem has resulted in a number of European directives aiming to regulate noise levels.

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The Noiseless project aimed to sharply reduce noise emission from machine tools through the development of innovative machines producing techniques combined with novel damping and absorbent devices. The project has already produced tangible results since a prototype noiseless punching machine has been developed. The ineffective approach of reducing noise levels by completely enclosing the machine has been abandoned. In contrast, design modifications and extra equipment integrated in the punching machine resulted in the desired noise reduction.

Linear motors for both the X and the Y axis were used. Therefore, the machine dispensed with rotary motor, belt, bearings and ballscrew. Linear motors substantially reduced the noise produced in transmission at fast speeds. The axis, driven by the linear motor, was guided by re-circulating caged balls resulting in further noise reduction. Structural noise on the other hand was minimised through the use of active dampers. The installed active mass damper has its first mode of vibration at 900 Hz, an obstacle in facilitating further noise reduction via the damper strategy.

The prototype punching machine can work at different constant speeds of the punching unit and is equipped with new tool holders.

Recent scientific health evidence suggests that workers may be falling ill due to the insidious effects of chronic noise exposure. Therefore, the development of such noiseless machines, apart from the expected economic benefits, will also reduce the incidence of physical and psychological injury among workers.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 4035

Pump up the power, not the volume

Most machinery manufacturers have no acoustic solutions to achieve the goal of reducing the noise produced when manufacturing tools are in operation. Noise pollution created by machinery is generally accepted as a problem which affects quality of life.

Noise pollution can cause physical and psychological damage. Despite EU initiatives to provide guidelines on this matter, it remains unresolved, mainly because of the lack of alternatives. Up until now manufacturers have not provided cost-effective solutions, and it has been left to the end-user to find a way out. This has resulted in the use of machine enclosures which reduce the acoustic impact; however, practically, this has proved to be an inefficient solution.

Shifting the onus of finding the solution on to the manufacturer is a better way to produce results, which has been the crux of this project. In this way, better solutions can be obtained through the development of appropriate strategies combining structural modifications with damping or absorbent devices. Even in the short term, it is expected that such developments will increase the manufacturers' competitiveness.

In the context of the Noiseless project, researchers at Cedrat Technologies in France have applied their expertise to developing an innovative tool for noise control. It is based on the use of piezoelectric actuators, which transform the input signal into motion. This device has a major advantage over others in that it emits a very low resonance frequency. The main problem is that, when used to generate higher force, the standard piezoelectric actuator ends up being very noisy because as a result, the dampers are too stiff and their resonance frequency is too high. It cannot damp low-frequency vibration and noise.

Cedrat has developed an amplified version of the device which has enough power to be useful in structural control, but has a low resonant frequency, and thus is not as loud. The active damper has a very high quality factor necessitating that it operates at frequencies at least two times higher than the resonance frequency of the actuator in order to keep the control loop stable. The performance of the developed piezo-active damper has been considerably improved by the addition of a passive damper in parallel with the piezo-element. Subsequently, the modification allows active dampers to be used near their resonance frequency.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4104

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Non-destructive testing of marine bonded structures

In shipbuilding, the use of adhesive bonding for joining lightweight materials results in a sharp reduction of production costs. Guidelines, procedures and application of non-destructive testing guarantee the exceptional quality of these bonded structures.

It is quite remarkable that instead of bolting together lightweight materials when building a ship, joining them together with adhesives is not only more efficient, but also much cheaper. The Bondship project has shown that the use of adhesives in a small superstructure like a speed craft reduces production costs by as much as 30 %. However, savings in production cost are not the only reason for using adhesives to bond marine structures. Dispensing with millions of bolts and screws, a passenger ship is much lighter and needs less fuel to operate.

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Safety and quality have been major and central concerns for the research conducted by the Bondship project. Adhesively bonded joints must, and have been, thoroughly inspected. Quality assurance was not of course limited to production only, but extensive testing has been performed on prototypes under full and usually harsh operating conditions.

An elegant and very efficient way to test materials under operating conditions is non-destructive testing. With such testing techniques, the materials are still intact after inspection. Ultrasonic testing is a widely used non-destructive method.

With the aid of current state-of-the-art ultrasonic non-destructive techniques, the Bondship project has inspected production prototypes and assessed the performance of joints. It has also characterised the properties of the adhesive materials used. Moreover, simulation tools have been developed for predicting the ultrasonic behaviour of the bonded structures, and innovative inspection methods have been deployed for large structures.

Verification and application of the ultrasonic testing techniques resulted in the establishment of a series of procedures and guidelines for quality assurance in production. Moreover, procedures and guidelines have been defined not only for the design and modelling of the joints, but also for their repair. Finally, qualification tests accompanied by the relevant acceptance criteria have also been established.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4089

See also page 46 (offers 4022 and 4085)

Along with safety, ensuring passenger comfort

Aiming to meet the requirements of a challenging international market, the design process of modern ships needs to be subject to continuous enhancements. For the passenger ship industry to be competitive, the available techniques of modelling and evaluating are being further advanced to cover passenger comfort.

As the passenger ship industry is expanding to fulfil a variety of transportation needs, the passengers' comfort has an increasing impact on the operating revenues in the short term. More importantly, market shares in the long term will be influenced by passengers' acceptance of this mode of travel over air, road and rail alternatives.

Passengers are becoming more selective about conflicting objectives, relating not only to convenience and price, but also to comfort. Factors at issue include ship motion and the ambient environmental conditions, such as excessive vibration and noise. Within the Compass project, an attempt was made to rationally define and quantify passenger comfort.

The responses of passengers on four ships, two conventional large mono-hull cruise ships and two fast catamaran ferries, were collected during 33 trips. Since comfort can be assumed to be dependent on social, physical as well as situational factors, it was assessed on the basis of subjective responses from the 3 150 questionnaires returned. Seasickness was found to be the most crucial and obvious factor contributing to the discomfort experienced by passengers aboard ships.

Moreover, in a series of experiments conducted with a ship motion simulator, 28 subjects were exposed to low-frequency sway and heave motion to evaluate comfort as a function of the magnitude of motion. The impact of ship motion on both passengers' physical and cognitive tasks was estimated through objective performance measurements. The latter were combined with the subjective ratings the passengers provided to specific questions just after each task and trial.

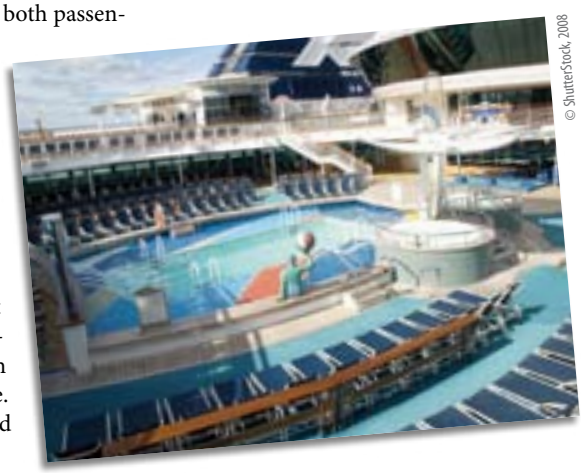
For all activities, the effort required by the passenger seemed to increase with increasing motion amplitude. The experiments in fact showed that physical tasks such as writing or walking, eating and drinking were considerably degraded.

The framework behind these assessment procedures was based on existing knowledge and methodologies by which comfort levels are evaluated. However, the factors of passenger comfort identified and quantified could assist ship designers and operators to enhance the attractiveness of modern ships under the current competitive market conditions.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4095



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Assessment of enzyme-treated wool samples

A series of tests were carried out on enzyme-treated wool samples, with analytical assessments undertaken on fibres.

The Biofelt project carried out a technical assessment on enzyme-treated wool samples and fibres. The samples' morphology was studied using a scanning electron microscope. The differences between stages in fabrication and different treatments were recorded. A reference standard cloth was compared with samples that had undergone an alkali solubility test. Single steps in fabrication were investigated using piano hammers to study tension release. The amino acid patterns of samples were examined and compared with a reference value.

Vegetable contaminants of wool, ring burrs and grass seeds, were treated with commercial cellulase, xylanases and pectinase, both separately and in combination. Measuring reducing sugars and soluble carbohydrate content of the treatment solution gave an indication of the breakdown of vegetable material. The effects of different enzymes on the weight loss of different grass seeds were also noted. Also studied were the individual and combined effects of peroxidase and laccase on ring burrs and the possible removal of lignin.

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Felted yarn and prefelted samples of material treated with protease showed an improved uptake of colour compared to untreated samples. Samples treated with protease showed deeper colouration when subjected to different dyes. Laboratory scale experiments indicated that low-temperature dyeing at 60 °C resulted in uneven colouration. Pre-felted material treated with protease and dyed at 90 °C gave a similar or marginally improved result to untreated reference material dyed at 98 °C. However, when the process using protease was carried out on a pilot scale with felted examples, severe fibre damage was observed.

The project's findings will help reduce manufacturing costs of felt and carbonising wool due to savings in energy, water and time. The competitiveness of the European felt industry will also be enhanced through updated production methods and a higher market profile for wool felts.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 4139

No longer pipe dreams — cleaning strategy for pipe organs

Organ pipes that have been constructed out of lead inevitably suffer corrosion when faced with the test of time. Research conducted by the Collapse project outlines a new method for cleaning these pipes without damaging them and is part of developing a conservation strategy which is supported by the EU.

Pipe organs are among the oldest instruments still used in European and classical music, both ecclesiastical and secular. They are often beautifully decorated and some, for example those which date back to the baroque era, display ornate carvings and cherubs on their cases. The history of this instrument dates back to Ancient Greece, where their wind supply was created with water pressure. Built for churches and concert halls, the organ pipe is an integral part of European musical and cultural heritage.

Many organ pipes were built from lead and lead-tin alloys. Over the years, the indoor atmosphere has led to corrosion of these pipes. Because of the delicate nature of the instrument, there are no effective methods and products to clean these pipes. The Collapse project aimed to develop new methods for cleaning and preventing damage and to present guidelines for a European conservation strategy.

As part of this project, researchers based in Sweden have developed a new and effective method of cleaning corroded organ pipes. They have now presented their results.

The researchers explain that cleaning the corroded pipe is done to decrease the rate of corrosion by removing salts from the surface. However, the difficulty lies in cleaning without removing the insoluble corrosion products such as the lead white.

The researchers pioneered the use of water leaching of the corroded pipes from the pipe foot area. This is a process of extraction of a solid mixture. For it to be a success, all the solute must be dissolved by the solvent, without dissolving any of the carrier material. They suggest that ultrasonic agitation be used to decrease the leaching time. The suitable leaching time depends on the extent of the corrosion damage and on the shape of the pipe foot. However, these findings stress that it is not advisable to clean the corroded pipes with water if the environment is still corrosive.

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

Collaboration sought: information exchange/training.

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RFID unlocks supply chain potential

Radio frequency identification (RFID) promises to revolutionise stock management, but few applications exist so far. Now, European researchers are perfecting a platform to unlock the potential of RFID.

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RFID promises to revolutionise retailing through advanced stock management, sophisticated promotions and supply chain optimisation. But cost-effective solutions have proved elusive because serious technical and business hurdles exist. Few efforts have addressed the problems in a consistent way.

The EU-funded SMART project is putting the finishing touches to a complete RFID application platform that addresses the technical problems and presents options for an integrated solution to the business issues.

In some ways, RFID is like an electronic bar code. It can be read at a distance using an RFID reader, which means that people do not need to scan it manually. As goods enter a warehouse, they can be logged into the inventory automatically.

RFID reduces the risk of human error, offers instant stock levels and can be tied to back-end systems, initiating orders automatically when stock starts to run low. It is a very simple principle, but the potential applications could revolutionise retailing.

For example, if a shelf needs refilling, the system can alert management automatically. If a product is reaching its sell-by date, RFID could notify retailers to discount the product. 'It means they have a better chance of selling stock, rather than dumping it, so the store runs more efficiently and more profitably,' explains Dr Katerina Pramatari, scientific coordinator of the SMART project.

Even more advanced applications can be put in place. If one product is selling well at store A, but selling badly at store B, RFID-powered inventory systems could initiate the transfer of the product from one store to another.

These are just the initial plans, and more sophisticated applications could emerge over time. For example, a reader could scan a customer's entire basket, and then present the total, vastly increasing speed and cutting costs at the checkout.

The promise of RFID is enough to make retailers drool, but serious obstacles exist. For a start, while RFID tags are relatively cheap — they can cost as little as 10 cents — putting them on every product quickly becomes very expensive. Currently, RFID tags in retailing are mainly used on pallets. There is also a question over who bears the cost. The retailer or the supplier?

The research faced a lot of technical challenges, according to Dr Pramatari. 'Getting the right RFID tag to ensure reliability and readability was an important decision. In the end, we chose generation 2 tags because they are cheaper and can be read more reliably from a greater distance,' she explains.

Given that these chips will be attached to every packet, cost and reliability are important factors, especially for smaller businesses. The SMART team also had to adapt the technology for use with meat products and in cold storage.

The RFID installation, itself, took significant research time. 'We had to ensure that we got the greatest range from the RFID readers for all the applications we wanted to test, using the fewest possible number of readers. Once we started to install the RFID tracking onsite we discovered we had to adjust our layouts to the specific conditions in each store,' Dr Pramatari explains.

'Developing back-office functions was another technical challenge, as was developing web services so that the retailer could automatically communicate stock levels, for example, to the supplier. That, of course, required discovery services, which would "discover" the appropriate retailer for a given piece of stock.'

The FP6-funded SMART project has developed solutions to many of the problems, but more will probably emerge as it goes into phase one of its testing, due to begin in October 2008.

'We are running two test scenarios in two pilot phases for RFID retail applications. The first phase of the pilots will test the back-office functions, while the second will put more emphasis on consumer aspects of the test scenarios,' Dr Pramatari reveals. The first test involves stock tracking and activity monitoring for promoted goods, in this case bath foam. The supplier is able to monitor shelf and backroom inventory for the promoted good, sales location, consumer preferences for gifts and so on, making adjustments to promotion activities while the event is still running. The second test involves an automatic discounting system for products — in this case meat — nearing their expiry date. Once the results are back from the initial pilot phase, SMART will integrate the indicated improvements in the system and then run a second pilot test in the first half of 2009.

SMART's work will make it much simpler for other projects to design a functioning system with less effort. This modest contribution could help propel RFID services into the retailing mainstream.

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Software for automatic defect detection

An innovative computer-assisted defect modelling tool can significantly improve the diagnostic processes of industrial inspection through minimisation of human error.

Non-destructive testing (NDT) is of critical importance when assessing the structural integrity of parts such as those used in aircraft. Improvement of the cost-effectiveness and reliability of NDT procedures significantly contributes to increased safety and reduced flight delay times by enhancing maintenance and extending the life time of aircraft parts.

Motivated by these considerations, the INDET project focused on realising an innovative structure for NDT processes in order to reduce costs while increasing the efficiency and reliability of the investigations. More specifically, computer and Internet technology was exploited to develop a set of advanced tools to assist NDT investigations.

A novel computer-assisted software tool allows defect extraction and modelling of non-destructive testing images. The tool offers inspectors increased ability to correlate the image with its three-dimensional (3D) computer-aided design (CAD) counterpart. With the aid of this tool, the defects detected by inspectors are first extracted in the 3D domain and then modelled using suitable automatic geometric fitting methods.

Compared against the original, a modified CAD model is derived that includes the identified defects in order to facilitate reporting. In addition to this, the tool offers a more precise defect characterisation through a number of measurement functionalities. These involve defect centre position, boundary length, surface area, defect orientation and the distance between two defects.

This NDT data processing tool supports decision-making by speeding up image data interpretation and facilitating reporting. Potential users mainly include NDT inspection companies and airframe manufacturers.

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

Collaboration sought: further research or development support.

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Remote processing of non-destructive inspection data

Non-destructive testing (NDT) plays a critical role in assuring that structural components and systems perform their function in a reliable and cost-effective fashion. A Java applet facilitates remote processing of the collected data.

NDT is a very broad, interdisciplinary field. NDT engineers define and implement tests that detect material conditions and flaws that might otherwise cause planes to crash, reactors to fail, trains to derail, pipelines to burst, and a variety of less visible, but equally troubling events. In order, for example, to locate a rail crack, a specific train inspects the two rails with ultrasonic probes, moving with a speed up to 50 km/h. Three probes observe each rail: one vertical probe for longitudinal cracks and two inclined probes for transversal cracks with privileged angle. Ultrasonic pulses are triggered at constant space distance, driven by the running speed of the train. The reflected amplitudes of ultrasonic echo are then used for failure detection.

These amplitude scans (ASCANs) present at all non-destructive tests are processed with the aid of a commercial software product, the PVWAVE. It is a visual data analysis tool that lets users interactively explore and quickly manipulate and analyse their data.

To develop affordable, robust non-destructive inspection processes and technologies has been the aim of the INDET project. Specifically, Dassault Aviation S.A., an INDET project partner from France, has developed a web virtual environment that facilitates real-time data and information processing for remote inspection training, set-up and mainly diagnosis.

With a Java applet, the Jwave 3.5, the web version of PVWAVE, an inspection engineer can now make accurate and reliable diagnoses remotely. The applet serves as a web interface between the inspectors' workstation (client) and the central server where all data and software codes are stored.

After collection of all necessary information and data from the server and effective testing parameter setting, the detected defects are published in an electronic document. The Java software has been extensively tested and is now available for demonstration.

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

Collaboration sought: further research or development support.

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See also page 43 (offer 4089)

Advanced alloy research improves aircraft efficiency

Aluminium alloys, especially the cold-finished aluminium wrought product known as alloy 2024, are extensively used in aircraft construction. Newly developed alloys offer the possibility of manufacturing safer and better aircraft.

Alloy 2024 is an aluminium alloy with a tensile strength comparable to that of steel. With such mechanical properties, this alloy is ideal for applications requiring high strength. Typical uses include aircraft fittings and structures, computer parts, gears and shafts. The IDA project has focused its research on a new generation of alloys. These specific aluminium alloys have even better mechanical properties, especially in the form of plates.

The alloys are expected to relieve the pressure on the modern aerospace industry for high-efficiency aircraft with a long service life. After careful and thorough evaluation of their mechanical properties, the recently developed alloys will greatly improve aircraft manufacturing.

In order to determine the behaviour of the investigated alloys, the IDA project partners have evaluated fatigue and crack growth. In materials science, fatigue is failure of material due to structural damages that occur when the specimen is subject to a cyclic load. All failure mechanisms originate at the microscopic level. Consequently, thorough knowledge of the microstructure of the alloys under investigation is also required.

continued on page 47

Standards set for innovative coating methods sky high

Flocking is used in the application of fine particles to adhesive coated surfaces such as on airplane cabin equipment; however, this process has distinct disadvantages. The aim of this research is to develop innovative coating methods that bypass these shortcomings.

The 'Fur- and flocking-like innovative coating' (FFLIC) project was set up to develop coating technology that does not have the disadvantages associated with flocking coating. However, the aim remained that the material should serve the same purpose: to provide high surface resistance. The disadvantages of flocking include the cost as well as the health and safety hazards associated with the fibre dispersion in the air. Other potential problems include the limitations of the design of the material and the lack of extra positive external effects of the coating.

The development of a coating technology, in this case, new multi-component paint, was undertaken by Plastal in Italy. The company has employed a team of scientists who are experts in engineering plastics. The material was considered particularly effective in the provision of protective coatings for pilot equipment found in airplane cabins.

The conditions inside the cabin have to be very controlled in order to maintain the high level of precision required by pilots in order to do their job to the best of their ability. The scientists working on the project completely redesigned and rebuilt the painting equipment. The flow of air control was used to study dust inside cabins. Temperature and humidity inside the cabin were also included in order to monitor this special software.

This research has shown that a painting spray plant could be designed out of this research. The next step for this project is making the new multi-components paint, one that could ensure better pollution control and that would be made to standards considerably higher than those set by the flocking process.

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

Collaboration sought: further research or development support.

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Corrosion-free magnesium alloys

Though light and therefore ideal for many manufacturing purposes, magnesium alloys are susceptible to corrosion. Coatings so thin that they do not prohibit functionality, yet hard enough to provide corrosion protection would revolutionise many industrial sectors.

The potential market for light alloys is practically limitless. Alloys create an opportunity to manufacture a car using metallic materials that have plasticity. Magnesium alloys in particular seem very promising and will most probably replace composites currently used in many other industrial processes. Widespread usage can be achieved provided effective corrosion protection is available.

This is not an easy materials science problem. Corrosion is a macroscopic effect of a microscopic flow of ions. To set the barrier and effectively prohibit the flow without compromising the material's functionality requires nanotechnologies. The Nanomag project has succeeded in providing corrosion protection using a plasma-enhanced chemical vapour deposition (PECVD) of a thin film. The resulting coating is compact and homogeneous. It is a few hundred nanometres in thickness and has very low porosity. Moreover, the method of applying the coating, PECVD, is a well-known and well-established deposition procedure.

The coating's protective capability is further enhanced by the absence of free silica gel groups and the organic fraction is so low that it is untraceable using Fourier transform spectroscopy. Extensive laboratory experiments measured coating resistance. Electrochemical impedance spectroscopy data confirmed high values of corrosion resistance. Coating deposition can be achieved with a conventional parallel plate low-density reactor. Equally, a high-density inductively coupled system may be used.

Coating processes developed previously were both environmentally hazardous and expensive. In contrast, the method proposed by the Nanomag project is economic and environmentally friendly.

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

Collaboration sought: information exchange/training.

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continued from page 46 **'Advanced alloy research improves aircraft efficiency'**

Once the parameters at microscopic scale that govern fatigue and crack growth are identified, the danger of material failure is greatly reduced.

The IDA project partners have developed sophisticated models to simulate and predict fatigue and crack growth behaviour. With the aid of these models, a more exact definition of the requirements for the new aluminium alloys is possible.

Development of damage-tolerant materials will substantially aid the European aerospace industry. Using the new alloys along with the in-depth knowledge of their mechanical properties, better, faster and more reliable aircraft can be produced.

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

Collaboration sought: further research or development support.

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