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results supplement

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EDITORIAL

Back to nature

Nature is stronger than us — which is why scientists turn back to nature in awe and admiration. Nature is the major source of their inspiration. The EU is funding researchers who do not only invest time and energy in finding ways to preserve the Earth's precious ecosystems, but also those who know how to harness, in a sensible way, what nature offers.



Remember the marine red algae for instance, cultivated along the coasts of Africa and Europe? Researchers from the Algisorb[®] project in Germany are pioneers in using this plant for orthopaedic

applications, such as bone tissue rebuilding, and thereby lessen the human body's dependency on synthetic materials. We offer this as a starter for this issue's biology and medicine section.

The Sun, the star at the centre of the Solar System, is the master of our moods — especially during warm summer nights. Sunlight is the Earth's primary source of energy. The Topsicle project partners, writing up their achievements in the lead article of the energy section, worked on increasing the efficiency in photovoltaic wafers to allow photovoltaic installation on a large scale. This represents an important step towards securing energy independence for Europe.

Now we might want to lean back and take a nice deep breath of fresh air. But the scientific team from the Miracles project in the city of Winchester, United Kingdom, reminds us how we pollute the environment with our cars. Automobiles, including those used in businesses, are the major source of air pollution today. So the city of Winchester hosted an innovative scheme which encouraged local businesses to try out vehicles running on alternative fuels. You can read more about Miracles in the section dedicated to environment.

The pages on IT and telecommunications lead us into the world of nanoelectronics. Scientists from the 'DNA based nanowires' project in Israel have discovered ways of using biological DNA molecules as a manufacturing tool to design nanowires. This could enable a reduction in size of current microelectronic devices by a thousand times.

The EU admits that growing mobility has an undesirable impact on safety, congestion and the environment. Many initiatives are underway to remedy this situation. One of them is described in this issue's industrial technologies section: the 'Sourdine II' project, led by researchers in Spain. It gets the ball rolling for new aircraft approach and departure procedures, to reduce noise and emissions for the good of all communities surrounding Europe's airports.

Rounding up our news on research and development (R & D), the events section presents a choice of forthcoming events for you to flag in your agenda.

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The editorial team

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EVENTS

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From ocean to human body

Pioneering the use of materials made from natural marine algae in orthopaedic applications, the Algisorb project partners worked on ensuring the materials' consistent quality by accurately determining their crystal structure.

Where the rebuilding of bone tissue needed to repair a defect and continued structural support is not a limiting factor, exploiting the body's own self-healing mechanisms is most desirable. The natural process of bone tissue regeneration can be enhanced by filling the defect with various bone substitute materials as well as bone-forming materials.

Conventional synthetic materials such as polylactides and polyglycocides that display mechanical properties analogous to those of bone tissue are highly sensitive to temperature and moisture. On the other hand, polymeric materials degrade *in situ* and are replaced by newly formed bone, a necessary step in the healing process.



An attractive alternative to synthetic materials is Algisorb[®], a natural material derived from marine red algae that is cultivated along the coasts of Africa and Europe. More specifically, the Algisorb project partners were able to synthesise it from their calcite skeleton which, besides hydroxylapatite (HA), also contains tricalciumphosphate (TCP).

The amount of TCP contained in this granulated material can be regulated and may be raised up to 95 % in order to increase the rate of resorption of the bone implant. Moreover, it is biocompatible and conducts new bone formation around the implant but also within its micropores of 10 to 30 microns.

All the materials used to compose Algisorb[®] were products of biomimetic syntheses, where natural biological structures get transformed chemically and their crystal structure modified. As they retain their microstructural properties, each compound could be identified with the use of X-ray powder diffraction.

Among the methods used to analyse the X-ray powder diffraction data collected at Röntgenlabor Dr. Ermrich in Germany, the Rietveld method allowed determination of the phase composition of the raw materials. The results were nearly as accurate as those obtained with single crystal diffraction techniques, opening the way for the manufacture of biomaterials with reproducible quality.

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

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Shedding growth factors and light to forestall fish maturation

Early maturation of farm-based fish correlates directly to production inefficiencies. The EU-funded Pubertiming project looked into the genetic, environmental, hormonal and even nutritional sources that might trigger precocious maturity.

Whilst these factors were understood to stimulate early maturity, their exact determinants remained unclear. Pubertiming set out to establish and identify these and in so doing, found a potential correlation between light intensity and photoperiod, adiposity, body size and maturity. For example, it was found that among individual salmon at different sites, the larger fish with high condition factors were more likely to reach maturity than their smaller siblings at the time of the winter solstice.

Yet, restrictive feeding had less of an impact on fish maturity than expected, and the combined

results may therefore indicate that other factors are present. It was also shown during the experiment that most males and many females matured at the grilse stage. This would seem to suggest that environmental factors outside of fish farms have a bearing on maturity. However, it was shown that even the less robust specimens can play catch-up, commencing with rapid gonadal development and full spermatogenesis or vitellogenesis when offered surplus feed.

Overall, the project achieved several milestones before its completion, namely that it was able to identify the roles of selected com-



ponents in developing the brain-pituitarygonad (BPG) axis. It was also able to identify in what manner photoperiod, nutrition and genetic factors influenced maturation either in a suppressive or initiative manner. Perhaps, more importantly, it was able to determine photoperiodic protocols to effectively forestall puberty for commercial reasons.

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

Collaboration sought: further research or development support; other.

http://cordis.europa.eu/marketplace > search > offers > 4804

Frequent acronyms

ERA	European research area	ICT	information and communication technologies
FP5/6/7	Fifth/Sixth/Seventh Framework Programme of the	IST	
110,0,7	European Community for research, technological development and demonstration activities	R & D SMEs	research and development small and medium-sized enterprises

Using light to control puberty in farmed fish

Sensitivity to light of different intensities and spectral variations was studied in two species of fish in vivo and in vitro in an effort to alleviate the problem of early puberty in farmed fish.

Early puberty in farmed fish has posed significant limitations in the efficiency of aquaculture resulting in millions of euros in losses in the salmonid and sea bass industries. A wide range of factors can influence puberty such as genetic, environmental, nutritional, hormonal and developmental. However, the precise causal factors are uncertain.

Furthermore, timing of puberty may be affected by artificial light, nutrition and genetic background. In view of this, the Pubertiming project conducted a study which combined determinant possibilities in order to arrive at groups with major differences regarding timing of puberty. The groups are thus capable of characterising key constituents of the brain-pituitary-gonad (BPG) axis such as reproductive hormones and their receptors, which control puberty.

Since controlling photoperiod (perceived day length) can be an effective way to prevent early sexual maturation, protocols for this type of control were developed in commercially farmed European fish species. This involved a heightened knowledge on the mechanisms of activating the BPG axis and a better understanding of the importance of variations in light intensity and spectral quality.

The particular species of fish used to examine light perception and spectral sensitivity included

Tracing the Atlantic cod by its bacteria

European researchers have discovered how to trace cod by analysing the communities of bacteria that inhabit their epidermal mucous.

The Codtrace project investigated a variety of new techniques to determine the spawning and harvesting locations of Atlantic cod (*Gadus morhua*). The work involved seven partners from six EU Member States and was coordinated by University College Dublin in Ireland.

Attention was focused on bacteria that attach themselves to the cod, where they feed on nutrients found in the epidermal mucous of the fish. Samples collected during Codtrace were subjected to phylogenetic analysis. More specifically, terminal-restriction fragment length polymorphism (T-RFLP) was applied to 16S rDNA sequences to identify different strains of bacteria.

The results revealed that the composition of bacterial populations does indeed vary depending on the body of water the cod were harvested from. The mucous was dominated by γ -proteobacteria and Cytophaga-flavobacter-bacteroides (CFB) bacteria, which salmon and sea bass. The process involved exposing *in vitro* incubations of pineals (small endocrine glands) to various light intensities and then assessing the production of melatonin. The light varied in intensity (such as day and night) as well as spectral composition, comparable to that of narrow bandwidth light-emitting diodes (LEDs) in small seawater tanks.

Furthermore, light transmission of different wavelengths in the skull was measured resulting in a model for light sensitivity in terms of melatonin production in sea bass and salmon. This was applied in the development and testing of narrow bandwidth lamps at a commercial scale using salmon trials in sea cages.

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

Collaboration sought: further research or development support; other.

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University College Dublin and its partners used to classify the origin of samples.

The success rate of the classification scheme was a remarkable 78.3 % when averaged over the different Codtrace sites and seasons. The findings also provided additional proof regarding the important role cod play in hosting bacteria in regions of the ocean otherwise unable to support such organisms. Further to the encouraging Codtrace results, the bacterial classification scheme has been designated for further R & D.

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

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Intelligent waste management for aquaculture

A fish waste processor spawned during the Zafira project represents a more intelligent approach to waste management for aquaculture.

The aim of the project was to combine western and eastern know-how to deliver a zero discharge solution for aquaculture. Waste management is a serious issue for the rapidly growing aquaculture industry.

The Institut für Meereskunde at the University of Kiel (IFM-Geomar), a German member of the Zafira consortium, performed a number of small-scale tests in the laboratory based on recirculating aquaculture system (RAS) technology. They selected the European sea bass, *Dicentrarchus labrax*, as a model fish.

Solid fish waste was eliminated from the tank by a combination of a swirl separator and foam fractionation, which removed

large and small particles respectively. Ozone treatment was also applied to further improve water quality. Care was taken to minimise the energy and water replenishment requirements of the system without compromising the health of the fish.

The trials, which lasted well over one year, were carried out in collaboration with a German small and medium-sized enterprise (SME), Erwin Sander Elektroapparatebau GmbH in Eltze. Close monitoring of total suspended solids and other parameters provided IFM-Geomar with the information necessary to design a detrivorous reactor to handle the RAS waste products. Chemical analysis of the waste stream provided insight



into its potential use as a nutrient-rich feed for other organisms.

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

Collaboration sought: information exchange/training.

Effect of protein supplements on dairy cows

The use of protein-rich concentrates was investigated on dairy cattle fed with silage made from grass or maize. Scientists studied the effect on rumen-buffering, glucose supply, the provision of essential amino acids and the impact on feed intake and milk production.

The Novazote project undertook two sets of experiments which investigated the effect of protein supplements on dairy cows. The first studied the protein level and acidogenicity value (AV) of concentrates on milk producing cows fed silage from grass and maize. The second experiment analysed the effect of dietary protein content and the amino acids from metabolised proteins on milk produced from cows fed with maize silage.

The maize/grass silage mixtures used remained the same throughout the study. Despite the differences in the ingredients of the concentrates, the nutritional characteristics were similar except for designed differences in crude protein (CP) concentration. CP includes true protein, which comprises amino acids and non-protein nitrogen and which can be converted into protein by micro-organisms in the cows' rumen.



Differences in feed intake and milk production in the diets offered were minor. The concentrate included a buffer which reduced forage dry matter intake and reduced milk fat concentration. The fatty acids in the milk were also affected by the treatments, especially whether it originated from morning or afternoon milking. According to the results, increasing the CP concentration did not affect the com-

Evolution of scrapie resistance in French sheep flocks

Scientists used a genotype programme to monitor the reduction of the incidence of scrapie in flocks of sheep. Two groups of sheep were used to demonstrate the effect of using rams possessing the ARR/ARR genotype for scrapie resistance.

Researchers from the Scrapiefreesheep project selected two groups that comprised a total of 25 Manech red-faced dairy sheep flocks. The sheep were chosen according to the willingness of breeders to take part in the monitoring process over several years. The groups also needed to be involved in milk recording which allowed for the collection of data about the sheep, including their pedigree, date of birth, mode of rearing and dates of lambing. If the sheep was bought from another flock, the date of purchase was also recorded.

The first group comprised 15 flocks involved in official milk recording, with an average flock size of 350 ewes, a full and long scrapie history and a high incidence of the disease. The second group comprised 10 flocks, 5 involved in official milk recording and 5 in simplified milk recording, with an average of 320 ewes in a flock. The second group possessed a short scrapie history and a medium to high incidence of the disease. Groups I

and II were divided up further into two subgroups, in order to take into account French TSE legislation.

Researchers took blood samples from all the sheep and the DNA present was purified and then analysed for four alleles involved in resistance and susceptibility to scrapie. There were two key periods for each of the scrapie-affected flocks involved in the moni-

toring programme: the first was the year of the first outbreak of the disease in the flock; the second was the first year of introducing homozygous ARR/ARR scrapie-resistant rams.

Since the scrapie history differed between flocks, the results were expressed in relative age of the sheep within a flock. The year 0 position of milk protein and had minimal effect on milk yields.

The second experiment used four concentrates which differed in CP concentration, ether extract and sugar concentrations. The metabolisable energy, which is the energy available from feed eaten by the cow, was similar between the concentrates. The results indicated that diets with lower CP concentration reduced dry matter intake and milk production. However, they increased the efficiency of the conversion of dietary nitrogen into milk nitrogen, thereby causing nitrogen pollution to be reduced. Researchers found that concentrates based on maize by-products increased milk production and reduced milk protein and fat concentrations.

A reduction in milk protein concentration may be the result of a major imbalance of amino acids in the absorbed protein. The reduction in milk fat concentration could be due to synthesis of fatty acids in the cows' mammary glands and to bacteria in the rumen inhibited by lipid supplementation.

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

Collaboration sought: information exchange/training.

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corresponded to the first year of using rams which possessed the gene for scrapie resistance. Increased artificial insemination using ARR/ARR rams resulted in greater resistance to scrapie.

The sheep breeders in group I began using resistant rams before breeders in group II. Therefore, the cohorts of lambs born using ARR/ARR rams appeared more resistant in group I than group II. The result was continuous improvement in the genetic makeup for ewes born after using resistant rams.

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





From botany to bones: marine algae develop bone implants

The Algisorb project set out to develop a tested biodegradable bone-forming material based on cultivated marine red algae, which contains substances that stimulate bone growth.

Bone defects can be caused by fractures, the removal of bone cysts, traumatic bone loss or inborn bone defects. Orthopaedic constructive surgery aims to alleviate some of the physical and social debilitation caused by the resulting defects. In many cases however, even following surgery, the patient is left with permanent problems.

The aim of the Algisorb project was to develop bone-forming material. The key features of such a material would be that it enhances bone growth, can be completely reabsorbed and lead to complete restitution of the injured bone. A form of hydroxyapatite, which is chemically similar to the mineral component of bones, was derived from marine algae. The chemical nature of the material means that it lends itself to substitution and can integrate in bone structures and support bone regrowth without breaking down or dissolving.

As part of the project, scientists set to work on developing a series of materials containing defined tricalcium phosphate/hydroxyapatite ratios of naturally grown red algae. They developed these new materials which were then tested in terms of crystallographic composition, trace elements, ultra structure, porosity and absorptive capacity. It was dis-

Healing bones all by ourselves

Improved scaffolds which can be used in reconstructive craniofacial surgery have been developed by scientists working on the EU-funded Intelliscaf project. The new intelligent scaffold material supports bone, skin and cartilage regeneration.

Advances in reconstructive surgery have now made it a plausible reality that bone, skin and cartilage can regenerate faster using medically engineered techniques. The objectives of the Intelliscaf project were to



produce innovative scaffold materials which could regenerate the damaged skin, bone or cartilage upon implantation, therefore speeding up the healing process in a way not possible before.

An 'intelligent' material was designed for this purpose; to initially fill the defect, it provides an equivalent function by 'acting' in the same way. Thereafter there is support for the natural healing process *in vivo*. The material works using cell adhesion factors, molecular factors and progenitor cells.

Such advances were only made possible through the concerted efforts of the project's research teams. One of the teams focused its research on the preparation of the bone and cartilage scaffolds. They prepared several bone and cartilage regeneration scaf-



covered that the biphasic materials possess a fascinating and potentially useful microporous interconnecting structure. The presence of this type of structure provides the precondition for the resorption of bioactive ceramic material and hence, allows for the ingrowth of bone cells into and through the pores of the inorganic matrix.

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

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folds with controlled 3D architecture, composition and microstructure. Various techniques were used in order to change the porosity, interconnectivity, mechanical strength and surface chemistry of the proposed material.

Amongst the scaffolds developed were the following. First, polymer scaffold for cartilage regeneration, which was generated using compression moulding and 3D fibre deposition of various compositions of copolymer blocks. Also, titanium and calcium-phosphates made up some of the base materials which led to the production of scaffolds for bone repair. These scaffolds showed improved features in comparison to existing scaffolds.

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

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

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Plasma-treated polymers for tissue regeneration

The choice of polymers for various biomedical applications depends on their surface properties that subsequently influence their interaction with living tissue cells. Plasma treatment of polymers can change their surface characteristics to optimise their performance when in contact with the human body.

Surface properties of polymers, such as the morphology, surface free energy and their hydrophilic or hydrophobic behaviour, can be modified to meet the requirements of specific biomedical applications. Scaffolds of treated polymers, as well as composite materials based on calcium phosphate (CaP) and bioresorbable polymers can be developed for bone, cartilage and skin tissue regeneration.

The Intelliscaf project aimed to develop blocks of synthetic materials so small they

can be implanted into injured areas of the human body and support its own tissue rebuilding process. Since in general all polymers do not possess the surface properties needed, gas plasma treatment offered a unique route for the modification of their surface.

The use of plasma gases such as oxygen, hydrogen, argon and helium was shown to be highly efficient in enhancing the wet-

continued on page 9

Renal development gene mutations traced to their origin

The inheritance of a particular gene associated with renal hypodysplasia (RHD) was investigated in a pan-European study.

The RET proto-oncogene, a gene on chromosome 10 in humans, encodes for a receptor tyrosine kinase that acts as a receptor for certain neurotrophic factors. As such, it is essential for the normal development in a range of systems including the enteric nervous system and early kidney development. Partners in the EU-funded Escape_trial project focused on this oncogene and its mutations to determine its effect on renal development.

Previous research has shown that RET deficiency in a mouse model caused RHD. However, up to this study, there had been no characterisation of RET mutation phenotypes for abnormalities in renal development. In order to rectify this, almost 100 children with RHD from 12 European countries were screened for variations in three associated genes including RET, a gene responsible for its activation and a co-receptor.

The scientists found seven patients in total with mutations in the RET gene. One par-

ticular mutation (RETV791F) in six of the patients showed a limited geographical distribution in central Europe, being present only in Germany, Poland and Serbia. Within one family, two mutations in the activator and coreceptor genes were found as well as the RET mutation suggesting oligogenic inheritance.

Haplotype analyses revealed an interesting origin for this RET mutation which has also been reported to predispose humans to medullary thyroid carcinoma (MTC). The RETV791F mutation was found to have originated from a common ancestor living some 26 generations ago. Significant was the low penetrance of the mutation with little or no evidence in the phenotype in the majority of carrier relatives.

The clinical implications of mutations in the RET gene are far-reaching in that the study suggests that they can predispose individuals to both RHD and MTC. Moreover, the results from the Escape_trial study suggest

Left ventricular hypertrophy and kidney disease

Researchers studied left ventricular hypertrophy (LVH) in children suffering from chronic kidney disease.

LVH is the most important independent marker for indicating risk to the cardiovascular system in adults suffering from chronic kidney disease. Poor cardiovascular health appears increased even in children suffering from chronic renal insufficiency (CRI), which is a progressive loss of renal function. However, the age and stage of CRI when changes to the heart become apparent was unknown.

The Escape_trial project investigated the prevalence and contributing factors to abnormalities in the left ventricles of children.

Researchers used echocardiograms, ambulatory blood pressure (BP) monitoring and biochemical profiles to study 156 children aged between 3 to 18 years. The children suffered from chronic kidney disease stages 2 to 4. The results were compared with a control group of 133 healthy children of similar age and gender and showed that LVH is more common in boys. The likelihood of the condition also increased with standardised body mass index.

Independent correlates of left ventricle mass index included low haemoglobin levels, low



that it may be a commonly occurring genetic abnormality in children with central European ancestry.

Low penetrance of the mutation combined with its clinical significance indicated that the RET mutations could usefully be included in genetic screening programmes within the European population.

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

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

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glomerular filtration rate (GFR), young age and high body mass index. The relative thickness of the left ventricle was linked with serum albumin. The probability of a left ventricle abnormality increased with the C-reactive protein. The results showed that significant changes to the heart can be present at a young age and in the early stages of CRI in children. There appeared to be a link between LVH and male gender, anaemia and weight, but not BP. Additional effects of volume and inflammation on the shape of the heart were also apparent.

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

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

http://cordis.europa.eu/marketplace > search > offers > 4787

continued from page 8 'Plasma-treated polymers for tissue regeneration'

tability of the materials' surface and subsequently, cell adhesion. The presence of concavities and more importantly, of micropores by which the surface area of the materials was increased, had an essential role to play in the induced tissue formation. Furthermore, plasma generated in a vacuum environment has sufficiently high energy to break weak bonds within the polymers and replace them with highly reactive components, including antibiotics. Despite the fact that these materials demonstrated satisfying skin-, cartilage- and bone-forming capacities, surface sterility remained critical for avoiding inflammatory responses. Low-pressure gas plasma was therefore used to remove organic contaminants such as air pollutants, oxide layers and other surface additives at the molecular level. The choice of gas used depended on the nature of the contaminant and of the substrate. It promoted the inactivation of micro-organisms, while minimising damage to the treated materials.

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

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

Playing for keeps — computerised play helps elderly stay sharp

European researchers have built a computerised play platform for elderly people. Field testing shows that the system keeps elderly players mentally sharp, stimulates socialisation, and can alert caregivers to developing problems.

Three years ago, researchers with the EUfunded ElderGames project set out to create a high-tech play platform specifically for the elderly — the first one designed to provide cognitive and social stimulation, and to allow early detection of cognitive decline.

The researchers knew that play can help ageing people stay cognitively fit and stimulate much-needed social interaction. What they hoped was that they could design and build a computer-enhanced play platform that elderly people could use easily, would enjoy, and that would enhance quality of life.

'Play is good in itself,' says Malena Fabregat, ElderGames coordinator, 'but the challenge was to allow the users to train what the experts told us were the most important cognitive abilities in this period of life'.

Ms Fabregat and her colleagues were aware that many elderly people are afraid of new technologies and tend to avoid them. They were surprised by how quickly elderly participants overcame their technological fears. 'Even with the first prototype, which had lots of cables and cameras, after five or ten minutes they had absolutely forgotten about the technology,' says the project coordinator.

Extensive trials allowed the researchers to perfect an inviting, interactive play table and display, and develop a set of computerdriven games that exercise and track important cognitive skills, stimulate social give and take, and are fun.

'This is very simple, but very important at this time of life,' says Ms Fabregat. 'Elderly people need to feel useful, to feel capable, and to feel that they have things that are interesting to do.

The ElderGames play platform and suite of games meet all of those objectives. And they provide an opportunity just to have a good time, she says.

The ElderGames project, which received funding from the Sixth Framework Programme (FP6), had several goals. The researchers wanted to create an attractive, easy-to-use play platform that could support a wide variety of computer-driven games, and that would allow caregivers to assess the cognitive skills of individual players over time. To accomplish those goals, the researchers needed to be able to identify individual players accurately, and to track each person's play on a moment-to-moment basis.

They accomplished this by using multiple cameras mounted on risers at the corners of the table and special handheld pointers that players use to indicate their moves or choices. The cameras and pointers allow the real players to interact naturally with the virtual world on the display. The result is a comfortable table with graceful bays on all sides which make it easy for players to reach anywhere on the large plasma or LCD display that makes up most of the table's surface.

The ElderGames team put a great deal of effort into identifying and developing games that seniors would find interesting, that would stimulate socialisation, and that would challenge important cognitive skills. Working with experts from a variety of

fields, the researchers homed in on a set of important mental abilities that are most affected by ageing, including the ability to maintain and direct one's attention, executive functions such as planning, problem-solving and decisionmaking, fine motor skills and memory.

They analysed hundreds of games to find ones that utilised these key mental skills, that could be played interactively, and that were challenging and enjoyable enough to entice players to play again. The result is a suite of 20 games that seniors or caregivers can select, which together exercise all of the targeted skills. In addition, the researchers developed software that tracks the functioning of each player over time, with the aim of providing caregivers with an early warning of potentially serious cognitive changes.

The researchers have now tested the suite of games and the prototype game table at centres in Norway, Spain and the United Kingdom. According to Ms Fabregat, the trials have shown that the ElderGames system benefits seniors in a variety of ways. Crucially, it promotes active, healthy ageing. 'There are many studies showing that play and leisure activities correlate to life satisfaction,' she says. 'This is one area where ElderGames has proven itself.'

In addition, caregivers and doctors have been impressed by the ability of the system to warn them when an elderly person is showing even subtle cognitive changes. 'The experts were able to get high-quality individual information from these group activities,' says Ms Fabregat. 'This multiplied their ability to monitor and assess the people they were responsible for.'

One reason for the high quality of information the system provides, Ms Fabregat says, is that even though the elderly players know that their performance is being tracked, they are relaxed and responding naturally, in contrast to their performance in anxietyprovoking clinical testing situations.

Amparo Ruiz, an occupational therapist in Galicia, Spain, who helped supervise some of the field trials is excited by the system. 'The elderly people like it when they play and feel integrated into the new technologies,' she says. 'And for me it's very important that I can get information about their attention, memory and other functions while they are playing, and then choose games that emphasise the areas where they have problems.'

Ms Fabregat and her colleagues are eager to see ElderGames reach seniors and their caregivers worldwide. Commercial game companies in Europe, North America and India have already shown interest in the system.

'We've had some very good reactions to the prototype,' says Ms Fabregat. 'We'll see what happens next.'

Promoted through the ICT Results service.



Action of retinoic acid on cancer cells elucidated

In the search for advanced cancer therapies, researchers have investigated the action of retinoic acid (RA). Its impact on cancer cells when combined with other cellular and chemical agents was also observed.

Trials have shown that retinoids exhibit both preventive and therapeutic action for certain cancers. Aiming to extend on this potential, the EU-funded project 'Anticancer retinoids' researched the anti-cancer action of RA and the possibility of combination therapy with other drugs.

Dexamethasone and hydrocortisone are steroid hormones which can be used as part of cancer therapy. Dexamethasone, for example, is given to patients undergoing chemotherapy to counteract certain side effects of the treatment and can be used as an anti-cancer drug in its own right. The project team at the National Cancer Institute in Pordenone in Italy investigated the effects of these two glucocorticoids on mantle cell lymphoma (MCL) cells.

Results were encouraging. Numbers of MCL cells were not significantly increased by

Genes and radiation

Sensitivity to radiation varies among different individuals and as of yet there is still no clear knowledge of the mechanisms behind radiation-induced carcinogenesis.

The EU-funded Telosens project focused on the genetic factors that can underlie indi-



vidual sensitivity to radiation. More specifically the role of telomeres was investigated and shedding light on the telomere role was a key project objective.

physiological concentrations of either steroid.

Furthermore, the beneficial antiprolific prop-

erties of RA in MCL cells are not affected by

either dexamethasone or hydrocortisone.

Previous trials had implicated the steroids

as promoting increased numbers of Epstein

Apoptosis through death receptor signal-

ling is one important phenomenon through

which cancer can be controlled. The team

focused on the TRAIL (tumour necrosis

factor alpha-related apoptosis-inducing li-

gand) death signalling pathway. The isomer

9-cis-RA was able to sensitise MCL cells to

TRAIL-dependent apoptosis but without

Moreover, 9-cis-RNA inhibits the growth-pro-

moting effect in MCL cells activated by CD40

(cluster of differentiation 40) cells with or

the involvement of TRAIL receptors.

Barr virus immortalised B lymphocytes.

The DNA-dependent protein kinase catalytic subunit (DNA-PKcs) has been known to be involved in the repair of DNA double-strand breaks. Project partners showed that impairments in the DNA-PKcs function can increase DNA amplification tendencies. Understanding how gene amplification is linked to specific genetic factors may be important in understanding responses to radiotherapy.

Assessing therapy for stroke rehabilitation

A study was conducted to compare the time allocated to therapeutic activities to that of non-therapeutic activities of physiotherapists and occupational therapists in stroke rehabilitation units in four European countries.

Therapists documented their activities in relation to stroke rehabilitation over the course of two weeks in 15-minute intervals. In these recordings, they included the activity itself as well as location and frequency, the number of stroke patients and other people's involvement. In order to compare activities between professional groups and between units, tests and models were used. The results showed that time allocation varied between physiotherapists and occupational therapists as well as between units. As a result, these differences affected the time allotted to therapeutic activities. More examination is called for in order to have a full view of work organisation effects in stroke rehabilitation units in terms of efficiency.



without interleukin-4. It seems then that RA is able to inhibit basal growth of MCL cells as well as antagonising stimulation of their proliferation by external factors such as CD40.

These research results have illuminated possibilities for the use of RA isomers both in combination therapy for cancer and exploitation of cross-talk between significant pathways involved. As such, it forms a valuable base for the fight against cancer, one of the major causes of morbidity in Europe.

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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Scientists also found evidence suggesting enzymes like ligase IV may be essential components of the recombination processes that accompany gene amplification. As a further application of the findings of the Telosens project, gaining knowledge on how tumour cells themselves react to radiotherapy and why some of these do survive is likely to be extremely beneficial. Mutations in some tumour cells may 'translate' in decreased sensitivity to radiotherapy and subsequent increased gene amplification events.

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

Collaboration sought: further research or development support.

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A scientific paper was written to highlight the results and was later published in journals and presented at conferences in Europe. For more information, please visit: http://faber.kuleuven.be/onderzoek/dep3/ neuro/cerise/index.htm

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

Collaboration sought: further research or development support.

Consumer response to grape and berry processing techniques

New processing techniques were developed to enhance the health benefits derived from grape and berry products. Research was carried out to test the perceived benefits and marketability of such products.

The Maxfun project developed a new enzymeaided processing technology to be used in the production of juice or wine. The aim was to



use this technology for grape and berry products, to increase the yield and to improve the quality of the final consumer product.

Using this newly developed technology, which consisted of enzymatic treatments combined with new physicochemical and mechanical treatments, led to the production of improved products.

The new fruit and berry products were tested. These products contained an increased concentration of polyphenol, which is an antioxidant as well as having other potential health benefits. A consumer survey was carried out in order to ascertain the perceived benefits and disadvantages or risks which consumers associate with these

Enzyme-aided extraction for bioactive components

European scientists have developed novel enzyme-aided processing technologies for berries and grapes in order to increase yield and improve the quality of juice or wine. Particular emphasis was given to resveratrol and other polyphenols in grapes and wine.

Researchers from the Maxfun consortium treated harvested grapes with different concentrations of ozone gas for periods of one, three and five hours. The result was an increase in the metabolism of phenols, especially stilbenoid biosynthesis, during storage of the grapes. One example of a stilbenoid is resveratrol, concentrations of which were identified after two days of storage. This was found to be similar to the amount induced by treatment with ultraviolet C. Similar amounts of resveratrol accumulated in grapes following treatment with ultraviolet C and ozone. However, treatment with ozone was the most efficient, causing resveratrol polymer to accumulate in grape berries. A sequence in the biosynthesis of stilbenoids was also studied by researchers, beginning with the resveratrol monomer before proceeding to resveratrol dehydrodimers. The sequence finally ended with four different resveratrol dehydrotrimers.

Factors for biofilm formation in Listeria

Listeria is a common and potentially dangerous food pathogen particularly in the dairy industry. To help combat this threat to food safety, scientists have investigated its modes of resistance to disinfection.

Listeria monocytogenes (L. monocytogenes) is a food-borne pathogen that normally possesses flagella for movement. It is a psychrophile and can also survive in a range of temperatures (up to 45 °C) that favour its survival in the dairy environment. Its survival arsenal also includes the ability to thrive in acid and salt conditions and form biofilms.

The microbe forms a biofilm on a variety of food processing surfaces, including glass, plastic, rubber and stainless steel. The micro-organisms encapsulated in the slime layer are often protected from biocides that would otherwise kill or inhibit those freely suspended in solution.

The aim of the LMTOOCHE project was to study the genomic and proteomic background behind persistence of the pathogen in the cheese-making environment. The ultimate goal then was to be able to control new products, and to find out acceptance of the new production technologies. The survey was taken by nearly 1 000 participants from across Europe.

The results showed that on average consumers have a neutral to mildly positive attitude towards products with enriched polyphenol content. From the range of products which were presented to the participants, yogurt and juice were perceived as the most appropriate carriers of the health benefits and wine not to be appropriate.

Conclusions drawn from the survey indicated that the overriding consideration for these consumers was the price of the product. This also was deemed to be the main obstacle for acceptance of the product.

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

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

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The Maxfun scientists also identified two alpha-viniferin isomers in the ozone treated grapes. However, they were found in very low concentrations and were not able to be quantified. The structure of these new trimers was similar to that of dimers already identified in grapes. Treatment with ozone gas resulted in a loss of flavour in white grapes, making them unsuitable as fresh table grapes. These grapes can, however, be used for preparing grape musts enriched with stilbenoids and nutraceutical polyphenol extracts.

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

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

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the presence of *L. monocytogenes* in the dairy industry and ultimately improve consumer safety.

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Preventing cheese contamination

Scientists assessed the presence of Listeria monocytogenes (L. monocytogenes) *in cheese-making dairies in various locations, in order to ascertain a better understanding of what causes contamination.*

Infection by *L. monocytogenes* causes the disease listeriosis, the manifestations of which can cause septicaemia, meningitis or a corneal ulcer in some cases. Since the main route of acquisition is the ingestion of contaminated food, it is of utmost importance that health and safety guide-lines are understood and adhered to. The LMTOOCHE project undertook the challenge of characterising *L. monocytogenes*, which can cause serious infections, in order to provide the knowledge necessary to predict biofilm formation during the cheese-making process.

As part of the project, a molecular typing system for Listeria was presented. The study

examined dairies in Europe. It was observed that the number of *L. monocytogenes* isolates was roughly equivalent for all the dairies taking part in the study, but that there was a prevalence found in specific areas of the dairies. Listeriae were recovered from many different types of surfaces including stainless steel, wood and a variety of plastics, indicating that all materials are at potential risk of colonisation by listeriae and possible sources of cheese contamination.

It was also discovered that when cheese rind is not washed but scraped, it may reduce the occurrence of this species in the final product. The scientists found there to be no association pattern, either qualitative or quanti-

For a taint-free wine cork

Cork stoppers are a natural means by which to seal that perfect bottle of wine. Researchers have developed and assessed protocols to eradicate the source of cork taint, an arch-enemy of cork and wine manufacturers.

According to campaigns to promote the use of cork stoppers, there are many reasons to continue its support. Biodiversity is one big reason. The cork lives for up to 250 years and hence can support many generations of workers and growers. Its importance in the rural economy is undeniable and Portugal hosts some 860 000 hectares of the attractive spreading tree that can be harvested for its bark every nine years.

Unfortunately, the cork stoppers' reputation has been marred by the fact that contaminating substances can cause taint and an inferior taste. The chemical culprit is 2,4,6-trichloroanisole (TCA), a contaminant mostly caused by fungal metabolism of chlorophenols. This gives a musty, dank taste to the wine and is responsible for EUR 1 000 million loss every year in the corking and wine industries.

The EU-funded Inocuous project aimed to repair the reputation of the wine cork industry by the development of disinfection and deodorisation methods and online tests. Various means of water treatment and recycling were also tested, and a cost-benefit analysis was undertaken for the processes.

Overall, taking into account costs and the size of production plants, the best combination was an improved boiling method using a steam pulse. Ozone treatment was not deemed to be necessary and is only commercially advisable if present as a product of other processes. For online testing, an enzyme-linked immunosorbent assay tative, which could be established with the periods of the production cycle.

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

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(ELISA) method was developed with an attendant cost of only a tenth of a cent per cork. However, the financial viability of these developments is a matter of economies of scale and again may only be viable in bigger plants.

Alternatives to cork stoppers include those made of oil-based plastic that carry the associated ecological disadvantages. Ironically, some tasters claim they leave a plastic taint. Furthermore, cork can produce beautiful resilient flooring from the waste products of stopper production. The findings from this comprehensive research indicated that the cork can continue to play a valuable role in the wine industry.

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

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

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continued from page 12 'Factors for biofilm formation in Listeria'

Project partners at the Institute for Biotechnology and Bioengineering in Faro, Portugal, focused on the resistance of different strains to acid and salt and their resultant ability to produce a biofilm. The success of sodium hypochlorite as a disinfectant on different surfaces was also examined.

Results indicated that adaptation of Listeria to the presence of salt actively promoted biofilm production. Ability to withstand acidity however did not affect its formation. Whether the bacteria were in the biofilm or planktonic, drifting mode also made a difference. As would be expected, planktonic cells were more prone to disinfection.

The cheese industry is one of the biggest users of chlorine as a disinfectant. One of the most common sources of chlorine is sodium hypochlorite. The data showed that worryingly, *L. monocytogenes* became very resistant to this disinfectant when attached to plastic surfaces. However, the scientists were able to determine the concentration of the biocide and time span required to completely inactivate cells on stainless steel.

This research can no doubt help to reduce Listeria contamination in dairies. An effective sanitation and monitoring programme can move the dairy industry towards the eradication of Listeria from food processing environments.

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

Assessing biodiversity in epibenthic communities

A sustainable approach to commercial fishing in Europe must aim at maintaining healthy levels of biodiversity throughout the entire ecosystem, including the ocean floor.

The effects of commercial fishing are known to extend beyond the species of interest. The Mafcons research project was established to investigate the negative impact of fishing on inhabitants of the epibenthic zone on the ocean floor. The project was coordinated by the School of the Environment and Society of Swansea University in Wales, United Kingdom.

A beam trawl was deployed to collect samples in areas of the North Sea covered by the 'International bottom trawl survey' (IBTS) and the 'Dutch beam trawl survey' (DBTS). In addition to location, information regarding species type, weight and dimensions was recorded. This data was used to estimate biodiversity, namely species richness, the

Shannon-Weiner index and the reciprocal of Simpson's index.

The ensuing analysis revealed two distinct epibenthic communities differentiated by their geographical position and local environmental conditions. As expected, a positive correlation between productivity and depth was established; however, the opposite was true for productivity and biodiversity.

Swansea University also observed that regions dominated by mud were prone to reduced productivity and in turn, less biomass. When examined at species level, biomass and productivity were found to vary considerably within the area sampled. For example, larger

Predictive modelling of fishing impact

Food production directives require that industries involved conduct regular assessments on the impact their activity is having on the environment. As such, the fishing industry sought to develop a predictive model to assist them in sustainable management policies.

The fishing industry has given a lot of focus to its effects on the environment, as its impact spreads beyond the fish group targeted. Adopting a more ecological approach in which sustainability is a central issue, the EU-funded Mafcons project



has sought to develop a tool whereby the fishing industry can monitor their impacts.

The ecological model taken into consideration as an algorithm was Hudson's dynamic equilibrium model (DEM). It is based on the relationship between disturbance, diversity and productivity. However, DEM was unsatisfactory for their needs as the model assumes that population growth is directly proportional to the number of mature individuals in the given population.

Since 1997, the directives on marine activity have moved to enforce sustainability and



invertebrates tended to fare better in the northern reaches of the North Sea.

These findings have been made available to the research domain through a series of articles in relevant scientific journals as well as databases on the Mafcons website.

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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conservation of biodiversity. Marine-based industries have therefore needed a predictive model that supports management decisions in a comprehensive manner.

The aptly named environmental approach to fishery management (EAFM) model considers a great many aspects in order to be an effective tool. Firstly, it requires mechanisms that support inter-fishery collaboration, as well as initiatives from scientists who are undertaking long-term environmental studies. It would need to be adaptive, thus pertaining to specific conditions which would make it geographically relevant. Hence, it would also need to consider multiple external influences as well as indigenous and local knowledge.

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 > 4717

Transgenic zebra fish report endocrine activity

Transgenic ZER-CALUX[®] zebra fish were used to detect the endocrine activities of chemicals and polluted environments in a study by the EDEN project. The results demonstrated the complexity of a genetic response to oestrogenic chemicals.

The transgenic reporter fish synthesised vitellogenin, an egg yolk precursor protein, following exposure to the potent oestrogen, ethinyloestradiol (EE2). Luciferase, an enzyme commonly used in bioluminescence, was induced in the liver of transgenic fish in response to oestrogen exposure. The brain and testes of the fish were also analysed for luciferase induction.

Results showed that no luciferase induction above control levels was found in the brains

of fish exposed to EE2. This could be due to the blood-brain barrier restricting the passage of chemicals to the brain tissue. However, exposure to the highest concentrations of EE2 resulted in a major induction of luciferase in the testes, revealing the existence of functional oestrogen receptors.

Partners from the EDEN project also studied the expression of the genes zfcyp19a and zfcyp19b. These encoded aromatase in zebra fish exposed to endocrine disrupting chemicals (EDCs). It was found that exposure to EDCs did not affect the expression of zfcyp19a in either cells or whole fish embryos. This was in contrast to expression of the other aromatase gene, zfcyp19b, which was strongly upregulated by oestradiol. This effect can be downregulated by coexposure to the dioxin, TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin).

Research by the EDEN project reflected the usefulness of *in vivo* zebra fish larvae and *in vitro* aromatase reporter gene assays for evaluating the actions of oestrogenic chemicals. The presence of a dioxin which can reduce or even eliminate the effect of a

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Virtual and interactive book of marine microbiology

Marine microbiologists are set to benefit from the development of a metagenomic interactive database which allows access to information on microbial ecology. It consolidates all current research in the field including that which has been published, but not previously incorporated, into the discipline's mainstream.

Research into genomics has marked a shift in the development of biological sciences. Nowhere has this shift been more apparent than in the study of microbiology. The morphological simplicity and metabolic diversity of prokaryotes makes them particularly easy to interpret from a genomic approach.

The Evolutionary Genomics Group of Universidad Miguel Hernández, Spain, is concerned with understanding microbial evolution. The team is also involved with bioinformatics, database development and management as well as microbial ecology, which has formed the group's methodological framework. It is through this framework that the researchers created Micro-Mar, which is a dynamic database for microbial metagenomics and biodiversity.

The database stores mainly publicly available marine prokaryote sequences along with their geographical and ecological profiles. Each entry represents an individual marine prokaryote, with one or more DNA sequences coming from a particular sampling location and depth. It is designed to be used primarily by marine biologists who

Carbohydrase assay with metagenomics application

Metagenomics and the culture of genetic material as small as a single gene has unbounded potential for biotechnology. Partners from the EU-funded project Gemini have developed a carbohydrase assay as a screening tool in this rapidly expanding field.

Microbial diversity is seemingly endless with micro-organisms able to live in every available biome on Earth. These include environments extremely inhospitable to other life forms in terms of acidity, temperature or toxins. Access to this molecular goldmine was limited, however, by the fact that most microbes cannot be cultured *in vitro*.

Biotechnology has therefore begun to shift its focus to the culture of isolated sequences of material. This dispenses with the need to isolate specific microbes or supply the needs of the whole organism. Gene mining was the focus of research of the Gemini project with the emphasis on antimicrobials and plant cell wall-degrading enzymes.

One of the tools necessary for advance of this research are screening methods to actually ascertain that the enzymes are acting on the appropriate substrate and giving the desired product. Project partners at Novozymes A/S in Norway concentrated on an assay for carbohydrases.

The biochemistry of the novel screening tool is based on the larger number of reducing ends when carbohydrases break down their substrate. The essence of the chemical test which gives a final quantifiable

purple colour is the reduction of copper+2 (Cu+2) ions by the sugar-reducing ends. Bicinchoninic acid combines with the resulting Cu+1 ions to give a purple colour. This is detectable at a wavelength of 550 nm and sensitivity of the test ranges between 0.2 and 50 micrograms. can access it as a virtual and interactive book, one which integrates all the information that is often published without being properly incorporated into the mainstream of marine biology.

This research took place as part of the EUfunded Gemini project. Gemini set as its goal the exploitation of the vast genetic potential of metagenomics. The project partners achieved this by combining the enormous potential of biodiversity with cutting-edge screening technology, molecular biology and bioinformatics to develop products with high biotechnological or pharmaceutical value.

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

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

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The scientists adjusted the design of the assay according to high background absorbances. Media contaminants in this case can comprise yeast extracts, peptones and glucose and protein that is detectable by bicinchoninic acid at microgram levels.

The screening assay was tested on two wild alpha-amylase bacillae and one alphaamylase recombinant clone of *Escherichia coli* as well as a *Bacillus spp* genomic library.

> 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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powerful oestrogen shows the complexity of an organism's response to a mixture of chemicals. This is particularly true for mixtures which contain chemicals with different mechanisms of action.

The EDEN team also used zebra fish to investigate oestrogenic effects on gene

expression. Researchers exposed the fish for 11 days to a range of concentrations of four oestrogenic compounds, including genistein and EE2. The microarray data confirmed that all oestrogenic chemicals upregulated the expression of the vitellogenin gene. As no other gene showed such upregulation, vitellogenin was considered an outstanding biomarker for exposure to oestrogenic chemicals.

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

Collaboration sought: further research or development support.

Data mining promises to dig up new drugs

A robot scientist that can make informed guesses about how effective different chemical compounds will be at fighting different diseases could revolutionise the pharmaceutical industry by developing more effective treatments more cheaply and quickly than current methods.

The robot, known as Eve, uses advanced artificial intelligence combined with innovative data mining and knowledge discovery techniques to analyse the results of pharmacological experiments it conducts itself.

By relating the chemical structure of different compounds to their pharmacological activity, Eve is able to learn which chemical compounds should be tested next, bringing a degree of predictability to drug screening procedures that, until now, have tended to be a bit hit and miss.

'Over time, Eve will learn to pick out the chemical compounds that are likely to be most effective against a certain target by analysing data from past experiments and comparing chemical structures to their pharmacological properties,' explains Saso Dzeroski, a researcher at the Jozef Stefan Institute in Ljubljana, Slovenia, who helped develop Eve's data mining capabilities.

'That should help scientists and pharmaceutical companies identify more effective compounds to treat different diseases, allowing them to find drug leads in a fraction of the time and at a fraction of the cost of current methods.'

Eve could minimise the need for random testing of chemical compounds, Mr Dzeroski says, noting that the robot scientist is the first computer system capable of originating its own experiments, physically performing them, interpreting the results and then repeating the cycle. Currently when a new drug is sought, pharmacological researchers conduct a blind study of tens or hundreds of thousands of chemical compounds, applying them to an assay for a disease. The results of those tests determine the so-called quantitative structure-activity relationships (QSARs) that relate the structure of a chemical compound to its pharmacological activity.

Exhaustive testing like this is time-consuming, costly and generally has to be repeated each time a new drug is sought. Eve offers a more 'intelligent' approach, says Ross King, a computer science researcher at the University of Wales, Aberystwyth, United Kingdom, where Eve is to be installed.

The robot conducts the QSAR testing in assays itself, analyses the results and stores the data for future use. Over the course of numerous experiments, Eve learns which chemical structures are likely to be effective in specific assays. So, instead of choosing compounds to test at random, it can pick ones that are more likely to be effective. 'We have carried out some preliminary trials and the compounds picked by Eve show more promise than those selected randomly,' Mr Dzeroski says.

New data mining techniques developed by a team of researchers led by Mr Dzeroski lie at the heart of Eve's groundbreaking drug discovery capabilities. Working in the EUfunded IQ project, the team developed new methods to analyse complex data, including chemical structures, from databases such as

the one in which Eve stores the results of its experiments.

Unlike most data mining approaches in which an individual analysis is carried out on a single dataset, such as a spreadsheet, the techniques developed in the IQ project allow knowledge discovery processes, consisting of several analysis steps, to be carried out across multiple sets of complex data.

The techniques rely on the use of so-called inductive databases that contain not only raw data but also information about patterns and models valid in the data. In the case of drug discovery, the structures of the chemical compounds tested and their effectiveness would be the raw data, while molecular structures that appear commonly in effective compounds would be patterns, and the equations that predict a compound's effectiveness would be models.

From experimental data collected by Eve, patterns would emerge that can then be used to make informed guesses about which compounds should be effective and which probably will not be. The same data mining techniques are also being applied by the IQ project partners in other fields, including genomics, systems biology and environmental sciences.

'Because much more than raw data is being analysed, the same process for identifying different patterns can be reused, regardless of whether you are trying to develop a drug to treat AIDS or tuberculosis,' Mr Dzeroski explains.

Eve will initially be put to work at the University of Wales to search for compounds that could be effective in treating malaria and schistosomiasis, so-called Third World diseases that are the focus of only limited research by commercial drug companies.

Mr King says their mission is both to demonstrate that the data mining technology works and to find new leads that could result in new drugs being developed in the future.

Mr Dzeroski foresees more robots like Eve being put to use in research labs and drug companies over the coming years. And although it will take 10 to 15 years for new drugs — based on compounds picked out by Eve — to start being used in treatments, the work done now 'could have a major impact on the pharmaceutical industry and on healthcare in general in the future,' he says.

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http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl= article&ID=90390

Profile of kidney gene expression for diabetic mice

Diabetic nephropathy (DN) is a complication of diabetes mellitus and patients often require dialysis as a result. European research has focused on mutations to elucidate the genetic components behind kidney complications arising as a result of diabetes.

Many genes are involved in the development of diabetic complications which include nephropathy and accelerated atherosclerosis. The EUfunded project Euragedic combined a largescale clinical and genomic study of diabetic subjects across European populations with genetic analysis of rodent models. One study at the Medical Research Council in Oxford, United Kingdom, followed two lines: phenotypic characterisation and expression profiling.

Nine mutant mouse lines were induced and histological analysis of kidney sections was performed to measure the increased extracellular matrix area deposited due to hyperglycaemia. Plasma glucose, insulin levels and urinary glucose, albumin and creatinine were also measured to identify interesting phenotypes.

Expression profiling was performed using the mouse compugene oligo-arrays, hybridised with RNA from control and diabetic strains. This initial analysis led the project team to identify 50 genes whose sequences were deduced from the arrays. A comparative analysis of genes differentially expressed boiled the list down to 10 to 15 target genes that were to be screened in the project gene pools.

Genes and pathways involved in diabetic nephropathy

Scientists studied the genes and pathways involved in diabetic nephropathy (DN) in order to create a record of candidate genes. The results were used to achieve a better understanding of DN as an aid to developing new medication and improved preventative strategies.

The Euragedic project identified genes and pathways involved in diabetic complications in humans and rodents. Researchers produced a record of positional and functional candidate genes for DN. This is the most common cause for end-stage renal disease, resulting in dialysis or kidney transplantation. Scientists used gene transcription profiling in rat models of diabetes mellitus. These included Wistar Kyoto (WKY) rats that had been injected with streptozotocin (STZ) to make them hyperglycaemic, and diabetic rats from the Goto Kakizaki (GK) and BN.GK congenic strains.

The ultimate goal of the Euragedic project has been to supply geneticists with an inventory of differentially expressed genes. These can be directly applied to studies involving diabetic patients diagnosed with DN. The expression level for over 14 000 rat renal genes was investigated using Affymetrix arrays to obtain profiles for WKY, STZtreated and GK rats. Results indicated a relationship between increased severity of

Screening for prion therapies

Prion diseases, although relatively rare, are still of major concern to the general public and health authorities alike. An EU-funded project has researched into novel therapeutic agents for conditions like bovine spongiform encephalopathy (BSE).

Transmissible spongiform encephalopathies (TSEs) are still the subject of intense research, especially since the advent of variant Creutzfeldt-Jacob disease (CJD). In the absence of an effective pharmacological treatment to halt the progression of the disease, the StopTSEs project devised trials to test the effectiveness of novel therapeutic strategies.

Previous research has elucidated the detailed biochemistry of the progression of prion dis-

eases. Candidate drugs were selected as targets for key events in the pathogenesis of the conditions. Partners at the Royal Veterinary College in the United Kingdom chose quinacrine, an antimalarial, anthelmintic drug that is anti-fibrillogenic in its action. The brains infected by TSEs have aggregates of prion protein (PrP) as large fibrillar proteins.

Quinacrine showed positive effects in a cell-free trial with PrP through anti-fibril

Further expression profiling was performed using the 32K oligo-array set as opposed to the 7.5K in the first study. Gene expression changes could then be tracked at critical times in the development of diabetic kidney disease. The data revealed differentially expressed genes at each time point of disease progression.

Further analysis of the data amassed was planned, including more detailed characterisation using ArrayStager for standardised annotation and processing within the 'European renal genome project' (Euregene). Genetic analysis of DN combined with population studies can form the basis for early diagnosis and consequent preventative therapy.

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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hyperglycaemia and increased number of genes differentially expressed.

The Euragedic team used comparative genomics and existing annotations of the rat genome sequence to focus on the functional interpretation of human susceptibility loci associated with DN. The researchers studied in detail rat chromosomal regions homologous to four human loci. These showed the greatest evidence of linkage with DN. Furthermore, studies indicated that the transcription of other genes can be influenced by hyperglycaemia and may add to renal histopathology as observed in GK and STZtreated rats.

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

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activity. However, there were no significant effects noted in the actual presence of prion in tissue culture models or animal models.

Details of the high-throughput screening test used in this research have been published. Targeting TSEs at the molecular level at key stages in the disease development can yield putative therapies.

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

Complete ryegrass genome is within grasp

Breeding of prime fodder species is essential for sustainable agriculture. Researchers have concentrated on genotyping one of the main forage crops, perennial ryegrass.

Perennial ryegrass or *Lolium perenne* is widely cultivated and forms the basis of mixed pastures on a global scale. It is fast growing and tolerant of most environmental conditions except drought. As such, it is a valuable fodder crop used for pasture grass, hay and sileage and has potential for use as biomass. Despite



its agricultural importance, the grass had been largely ignored in plant breeding circles until the advent of the GRASP project.

Overall, the aims of GRASP were to identify genes and their markers in Europe's major fodder grass to achieve the state of the art in breeding programmes. The accumulation of a large mass of genetic material from some 100 000 clones formed the basis of a library giving details of genes particularly for disease resistance and forage quality. This was spearheaded by project partners at the Institute of Grassland and Environmental Research (IGER) in Wales, United Kingdom.

The researchers generated a bacterial artificial chromosome (BAC)-based library. The DNA pools aliquoted into microtire plates

Allele frequency indicates effect of genes in ryegrass

Breeding programmes for perennial ryegrass (Lolium perenne) are undeveloped and do not reflect its economic importance and the extent to which it is used as a fodder crop in Europe. Researchers have sought to remedy this by developing a new method to evaluate the effects of selected genes on desirable traits.

The EU-funded GRASP project aimed to improve breeding strategies for the popular choice of fodder crop, *Lolium perenne*, globally. For the team at ILVO, the Belgian Institute for Agricultural and Fisheries Research, the aim was to devise a method to validate the effects of candidate genes in the forage grass.

To achieve this, they applied divergent phenotypic selection through a number of carefully planned recombinations. The first step was to create a panmictic population with genotypes from different origins and possessing different characteristics for the traits under study.

Three multiplication lines were then created. Positive selection over three generations was applied to produce the first population. For the second, negative selection for the trait over an identical time was applied and population three was produced by no selection at all.

Vegetative methods for ash propagation

Systems for the vegetative propagation of ash plants from adult trees were developed, resulting in enhanced genetic resources for European farmers and foresters.

The RAP project sought to improve *Fraxinus* (ash) production to meet European needs. The methods for this involved testing, selection propagation and promotion of improved genetic resources. In order to enhance micro-propagation, flower induction and propagation by cuttings, optimised physiological, biochemical and physical treatments were conducted. The purpose was to provide optimum plants on a large scale for cloning, variety testing and deployment to farmers and foresters. One of the ways this was manifested was through the vegetative propagation of ash plants from selected adult trees. In order for this to occur, grafted plants were used as sources of buds and thidiazuron was employed as a source of cytokinins to induce the proliferation of shoots *in vitro*. Cultures were started from 55 specially selected ash clones with roughly 20 to 30 buds per initiation. After four subcultures, 18 clones were found sterile and viable, 14 of which were usable for shoot proliferation. were prepared for distribution to GRASP partners for polymerase chain reaction (PCR) screening. Screening for individual clones was then executed in a second round of PCR analysis.

The library was constructed at IGER and the most promising genes were selected from 20 GRASP genotypes. Primers were designed to span 1 000 base pairs of gene sequence and incorporated the maximum number of single nucleotide polymorphisms in both coding and non-coding regions.

The data collected has been disseminated widely in scientific journals and conferences. Further research was planned along with the widening of this promising database.

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

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

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To determine whether a selected gene has an effect on the trait, its allelic frequencies in the three populations were monitored. Significant changes between the negative and positive populations as compared with the initial frequencies indicated a positive result. Software used to process the data included the population genetics software Genepop.

The novel method developed promises to replace quantitative trait loci analyses whilst mapping populations. The main advantage is that a larger number of alleles can be analysed simultaneously.

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

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

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The rate of propagation on standard medium and alternating media was compared on four established clones during six culture cycles.

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Recovering antioxidants from timber waste

In the search for compounds with beneficial antioxidative properties, scientists in Finland turned their attention to parts of trees normally overlooked, such as sapwood, knots and bark. Their curiosity was rewarded.

Throughout history, nature has been a source of medicines and other health-promoting substances. The EU's 'Life quality' programme dedicated funding to discovering new bioactive compounds. A prime example is the Cerberus project, which focused on unused waste products from the timber industry.

The research consortium, comprised of five organisations from three different EU Member States, assessed the potential of bark, knots and other discarded parts of trees. Scientists with MCA Research Laboratory Ltd in Finland were in charge of determining the antioxidative properties of extractives from several different species of tree.

In vitro PEROX- and TRAP-tests were performed on over 30 samples, providing feedback regarding inhibition of lipid peroxidation and peroxyl radical scavenging, respectively. Additional parameters, including inhibition of oxidation of low density lipoprotein lipids, myeloperoxidase activity

Overactive immune response reduced by tree extracts

Researchers have turned to nature's vast store of bioactive compounds to isolate substances that will moderate an overactive immune response. They tested extractive compounds from knots and bark extracts of Populus deltoides, a tree used for lumber and pulpwood production.

Many plants contain extractives that give protection against pathogens that attack cells and tissues. Scientists in the EU-funded project Cerberus aimed to harness the mechanisms of cellular protection afforded by these bioactive compounds. Properties tested for included antimicrobial and preservative action as well as overall health promotion.

At the University of Westminster in London, United Kingdom, project scientists specifically concentrated on the ability of plant extracts to depress the damaging effects of cellular defence mechanisms. Their particular target was the action of neutrophils, white phagocytic cells that swarm to a site of infection. One of the most common human body defences, the downside of neutrophil action, is an oxidative burst that can produce reactive oxygen species (ROS) including hypochlorous acid produced by the enzyme myeloperoxidase.

An overactive inflammatory response is thought to be responsible for many types of cellular damage and may even lead to the formation of certain forms of tumour. The team designed trials to test the effectiveness of extracts of *Populus deltoides* knots and bark extracts to inhibit the production of ROS.

Thirty six extracts were compared with reference compounds hydroxymatairesinol and nitecapone, known to have strong anti-myeloperoxidase action. The results were very promising, and the extract with the strongest action displayed comparable activity to the synthetic drug nitecapone and had more effect than the natural plant lignan hydroxymatairesinol.

continued from page 18 'Vegetative methods for ash propagation'

Propagation rates were shown to vary for each clone; however, they were similar for each culture system. Alternating media showed healthier shoots. Spontaneous rooting took place in the developed culture method and plants were successfully weaned to the glasshouse. Clonal field tests were conducted on two sites using four clones.

Following weaning in the glasshouse, a newly designed system showed that hedges could be created from micro-propagated

plants and that four crops of conventional cuttings could be obtained per year. Furthermore, both apical and nodal cuttings rooted well. Consequently a system which produces plants of selected genotypes of ash for the development of clonal lines could be proposed.

Surveys were conducted among farmers and foresters regarding their views and desires to plant trees of different types (conifer/ hardwood) and the use of improved plantand oxidative burst, were also measured and compared between species.

MCA Research Laboratory Ltd uncovered evidence of promising antioxidative potential in nearly all the samples. The best results were obtained from two species of pine, *Pinus pinaster* and *Pinus nigra*, but *Larix decidua* and *Abies alba* were also identified as strong performers. The next phase of research entails exploitation of these encouraging findings.

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

Collaboration sought: further research or development support.

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The results of this study show that wood extracts can modulate immune responses. Advantages for the biopharmaceutical industry could be the development of natural drugs with minimal side-effects that have antioxidant and anti-tumour properties.

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

Collaboration sought: further research or development support.

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ing stocks as available. Results indicated that farmers and foresters were usually keen on experimenting with new lines of ash plants emerging from research programmes, provided that the new material is officially approved.

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

Collaboration sought: information exchange/training.

Biomarkers point to reproductive disorders

Evidence is increasing of the damaging effects of endocrine disruptors on humans and wildlife alike. Scientists with the EU-funded EDEN project have investigated specific effects of dibutyl phthalate (DBP) on the rat reproductive system, drawing parallels with disorders of the testes in humans.

DBP is commonly used as a plasticiser and in personal health and cosmetics products. Male rats exposed to DBP *in utero* have malformations of the male reproductive tract. Under the umbrella of the EDEN project, partners at the Medical Research Council in Scotland, United Kingdom, have identified new biomarkers to indicate the effects of DBP.



Major cell types in the foetal testis were examined at different stages of development in detail. Cell types monitored for frequency and displacement were germ cells, multinucleated gonocytes, Leydig cells (LCs) and Sertoli cells (SCs), all with key roles in testicular development and fertility.

By birth there was found to be a 40 % reduction in germ cells (GCs) after exposure to high levels of DBP. Impaired GC differentiation in the foetus may be responsible for the high rate of infertility observed in DBP-exposed animals. Also affected were SCs responsible for nurturing the developing sperm cells. They also display a dosedependent effect, this time a reduction in number. The significance of this is that there may be a reduced capability to pro-

Action mode of key reproductive proteins elucidated

Endocrine disruptors are a major cause of concern due to their effects on reproductive system development. In order to further elucidate their impact, researchers have investigated the action of two key proteins in testicular development in rats.

Scientists at the MRC Human Reproductive Sciences Unit in Scotland, United Kingdom, conducted genomic and proteomic studies to investigate the action of insulinlike 3 (Insl3). This protein activates the ligand receptor 8 (LGR8), important in testis descent and suspected of having other roles in male reproductive development.

To unravel the functions of Insl3, the researchers, under the umbrella of the EDEN project, collected reproductive tract tissues of rats from the foetus stage through to the adult. The distribution of the Insl3 protein and its receptor were tracked to gain insight into specific sites of action. One major region of interest implicated in previous studies was the gubernaculum, a ligament between the testis and the bottom of the scrotum present at testis descent. Using messenger RNA (mRNA) profiling and protein expression studies, the scientists were able to piece together the interrelationship between the two molecules at this site.

Interestingly, mRNA for LGR8 was expressed heavily in the gubernaculum through foetal and postnatal periods but not for the Insl3 protein. Immunohistochemistry localised Insl3, indicating however that it is bound to its receptor in this tissue. duce sperm in adulthood although there is no direct proof to this in rats.

Induction of multinucleated gonocytes was found to be the most sensitive marker of phthalate action as effects were evident at low-dosage rates. Another indicator of phthalate action lay in the dose-dependent increase of LC aggregation in central regions of the testis. Overall, this results in focal dysgenetic areas where the cells are in the wrong place.

The data from this research has important implications for exposure to endocrine disruptors. For DBP in particular, significance extends to cancer and fertility rates in humans. Testicular germ cell cancers can arise due to failure of normal foetal GC differentiation. Furthermore, human patients with testicular cancer exhibit focal dysgenetic areas in the testis where LCs are displaced.

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

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Furthermore, LGR8 mRNA was isolated in many other areas of the male reproductive tract, implying a role in reproductive development previously attributed to androgens only. Abnormalities in foetal germ cells found in rats exposed *in utero* to dibutyl phthalate coincide with suppression of the Insl3 protein, suggesting a function in these cells also.

Furthering the knowledge of reproductive system development at the molecular level will provide a sound basis for the elucidation of the action of endocrine disruptors. The reproductive health of populations can be monitored more accurately, accompanied by intelligent regulation for the use of endocrine disruptor chemicals and their products.

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

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Recommendations for human biomonitoring in Europe

The EU-funded ESBIO project represented a concerted effort to define a roadmap for the future of human biomonitoring (HBM) in Europe.

HBM is crucial to understanding the effects of a polluted environment on human health. The Institute of Public Health of the University of Copenhagen in Denmark, an ESBIO participant, helped organise an important workshop in Copenhagen that focused on the ethical aspects of HBM. Insight into the European perspective was gained by examining HBM practices in a number of EU Member States. The dialogue stimulated by the workshop culminated in a number of recommendations. First and foremost, a standardised protocol must be developed that addresses issues related to the rationale, minimum sample sizes, recruitment, consent and information exchange associated with HBM studies. It is essential that this protocol be defined prior to the experiments.

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Frost tolerance selection in faba beans

Tolerance to frost was used to indirectly select for winter hardiness in faba beans (Vicia faba). It was shown that marker-assisted selection (MAS) was more efficient at identifying traits than classical phenotypic selection (CPS).

A joint European initiative was established to address the chronic lack of plant protein within the EU. Faba beans are a valuable source of proteins for humans and as a fodder crop for animals. They also play a crucial role in crop rotation, reducing energy costs, improving the condition of the soil and reducing disease and weed populations. Researchers from the Eufaba project used MAS and conventional breeding techniques to develop enhanced faba bean genotypes. The genotypes contained characteristics important to sustainable agriculture.

The Eufaba scientists studied frost tolerance and physiological traits in a cross of two faba bean lines. The results were then applied to the MAS programme. The MAS was used to make faba bean breeding less vulnerable by enhancing winter hardiness. Field-based winter hardiness is a complex trait linked to frost tolerance. Frost tolerance was used by researchers to indirectly select for faba bean winter hardiness. They identified quantitiative trait loci (QTLs) that can be associated with frost tolerance and auxiliary traits, quantifying the efficiency of MAS in contrast to CPS.

Recombinant inbred lines (RILs) derived from the crossing of two frost-tolerant lines were tested under controlled conditions for their hardened and unhardened frost tolerance. Hardening is the process of gradually introducing plants to harsher conditions. The fatty acid content before and after hardening was also analysed. The researchers

observed significant differences for all the traits studied.

The Eufaba team identified five putative QTLs for frost tolerance, three for unhardened tolerance and two for hardened. A further three QTLs were identified for oleic acid, a type of fatty acid, in unhardened leaves, which was significantly correlated with unhardened frost tolerance. The results indicated that combined MAS was more efficient at selecting for winter hardiness than CPS alone. This was expected to be even more efficient when applied to large populations. Furthermore, favourable alleles can be introduced from other lines to European winter hardy beans for even greater improvements.

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

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

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Breeding crops tolerant to drought conditions

As part of an EU-led initiative, a team of scientists sought to breed a leguminous crop to be used for animal feed, one which also holds the characteristics important to sustainable agriculture. In order to achieve this, the scientists set to work to understand sources of improved drought tolerance.

The Eufaba project addressed the lack of availability of sustainable, home-produced plant protein in the EU. The project partners therefore set out to develop enhanced faba bean genotypes. This was achieved through



utilising a combination of marker-assisted selection (MAS) and conventional breeding methods, and resulted in supporting the breeding of a crop to be used for animal feed. This crop is expected to incur high value in European crop rotations of low

inputs and stable yields.

One part of the project put together a team of specialists who were solely concerned with identifying sources of improved drought tolerance. This was of particular importance to the project because drought is the major abiotic factor which limits the faba bean yield in many environments. In order to study this theme, experiments were carried out to screen the germplasm and its tolerance during times of drought. The plants were studied and the transpiration response was recorded. Methods used to measure this response included stomatal conductance, relative water content, leaf temperature and carbon isotope discrimination.

The results of the experiments singled out the lines which presented good drought tolerance attributes. These attributes included evidence of osmotic adjustment in response to moisture stress, which was a characteristic not previously found in the faba bean.

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

Collaboration sought: information exchange/training.

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Additional recommendations put forth by the ESBIO consortium refer to sample management (biobanking) and economic issues such as financial incentives for participants. Finally, it was emphasised that discrepancies between EU Member States must be eliminated in favour of an approach harmonised at the European level.

The proceedings of the workshop are available in a special issue of the online journal *Environmental Health*, in reports accessible from the ESBIO website as well as in other publications. Funded under the FP6 cross-cutting activity 'Research for policy support'.

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

Tracking from the farm to the fork

Improving upon available methods for tracing the meat people eat is a priority for health and consumer protection regulation at EU level, and also a primary concern for the individual consumer.

The tracing methods available for meat have not yet fully evolved, difficulties remain in applying these methods consistently and in retaining their reliability and evaluating findings.

The EU-funded 'EID + DNA tracing' project brought together a team of experts who undertook the task of developing electronic identification (EID) and molecular markers in order to improve existing methods of traceability of the meat we consume. In accordance with EU regulations, a double system based on EID and DNA profiling was proposed.

The main hurdle for the research team was to overcome the obstacles which limit the use of bolus and injected transponders. In order to do this, a new reader was developed and tested. The study also focused on automatic data transfer from animal to meat and examined the recovery of the transponders in the abattoir.

As part of the project, one team of experts built a logistic model which was used for the prediction of bolus retention rates in the fore-stomachs of ruminants. This was tested on cattle and sheep for which the bolus retention rate was predicted. It achieved a standard error mean of less than 2 %. This was also tested on buffaloes; the rate was satisfactorily predicted by the model.

From this research, prototypes were produced and tested. New boluses were developed for the identification of cattle, buffaloes, sheep and goats. It was found that these prototypes

Smart tags for tracing animal carcasses

Researchers developed a real-time tagging and tracing system for farm animals and meat, thereby demonstrating the advantages of using electronic identification (EID) to protect consumers.

The 'EID + DNA tracing' project developed a dual system for tracing meat from the farmer to the retailer. This dual approach uses EID and DNA profiling to track both animals and meat in accordance with EU regulations. The researcher team developed and tested trans-



ponders that could be identified with a portable reader. At the same time, they investigated the automatic transfer of data from animal to meat and the recovery of transponders following slaughter.

An automatic system was developed for transferring the animal EID to carcasses. It was based on the use of read and write high frequency (HF 13.56 MHz) transponders which were incorporated into flexible smart tags. The smart tags are both economic to use and capable of being read in groups. The system enabled automatic transfer of information from low frequency (LF 134.2 kHz) electronic devices to HF smart tag labels located in the carcass. The LF devices were used in identifying the animals and included electronic boluses, ear tags and injected transponders.

Circumstances necessary for the bystander effect

The consequences of radiation are not always limited to the cells directly under bombardment. Researchers have investigated this so-called bystander effect in order to determine its relevance in both radiation protection and therapy.

When cells are exposed to ionising radiation, neighbouring or adjacent cells sometimes show the same molecular symptoms of stress even though unexposed. However, the bystander effect appears to vary according to the origin and type of cell. Researchers from the EU-funded project Interstander aimed to elucidate the molecular mechanisms involved. To achieve this, they set up a range of biological model systems and measured frequency of DNA double strand breaks as the initiating lesions of the phenomenon.

Experiments showed that damage to irradiated Chinese hamster ovary (CHO) cells fused with resting lymphocytes can be less than in



did in fact overcome the main drawbacks of the boluses previously available, with their mid- to long-term retention rates greater than the standard ones previously available.

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

Collaboration sought: further research or development support; joint venture agreement; licence agreement; marketing agreement; manufacturing agreement; information exchange/training; privatepublic partnership; available for consultancy.

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Once the animal was placed on the slaughtering line, one or two smart-tags were placed on the lower leg before it was eviscerated. The hook from which the carcass was suspended activated a LF reader when it passed the reading point. The LF transponder, the animal's EID, was read within the animal or at evisceration and the LF reader switched off. The EID code was then transferred to a HF reading unit, where it was recorded on the HF smart tag and the reader deactivated. Optional information could also be recorded on the smart tag before the carcass was removed from the slaughtering line.

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

Collaboration sought: further research or development support; joint venture agreement; marketing agreement; manufacturing agreement; financial support; venture capital/spin-off funding; private-public partnership; available for consultancy.

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unirradiated dividing CHO cells that were not fused with lymphocytes. A protective or negative bystander effect therefore appears to be at work under these circumstances.

This interesting phenomenon was explored further by scientists at the National Centre for Scientific Research, Demokritos, in Athens, Greece. Using CHO cells and human lymphocytes after irradiation of one or the other type, they specifically investigated this protective effect.

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Database for rice reverse genetics

Cereals are the staple of the world population and rice is agriculture's model cereal. To extend the scope of functional genomics in rice, researchers have created a large mutant population by insertion of maize transposons.

Ten percent of the world's cereals are grown in the EU. As two-thirds of the world's energy supply is from cereal staples, they represent a very important set of crops economically. Genetic improvement of cereals has been opened up with the advances in functional genomics. Rice, *Oryza sativa*, is a good candidate to work on as its genome is small (12 chromosomes only), mapped to a large extent and open to transformation.

The overall objective of the EU-funded project Cerealgenetags was to fully exploit the genetic potential of rice using proteomics and genomics. The gene trait links could then be applied to cereal crops where possible. The project team based at Plant Research International in the Netherlands created a mutant collection of rice variants to create a database for users to identify tagged genes. Transposon technology was used to insert maize sequences into rice genotypes to generate extended mutant populations. The DNA flanking these inserts was then isolated from 6 000 plants to create a flanking sequence tag database. This resulted in

a resource of some 1 000 genes, including many with functions potentially very useful in plant breeding such as regulatory sequences from homeobox, MADS and kinase genes as well as those for disease resistance.

Molecular geneticists and plant breeders can find insertion lines in genes of interest and then retrieve all the associated information relating to these sequences. Details of this rice reverse genetics facility are accessible at: http://orygenesdb.cirad.fr/tools.html



The site is equipped with a set of tools that have been developed for the user to search and retrieve required genetic and proteomic information from a number of starting points.

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

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

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Modifying the metabolism of cysteine in maize

The nutritional quality of maize crops was enhanced by improving the composition of protein-bound amino acids. This was achieved through modification of the cysteine metabolism pathway.

Human beings and some animals, such as pigs, possess a single chambered stomach and are referred to as monogastric. Monogastric organisms are unable to produce sulphur-rich amino acids such as cysteine, methionine and lysine and must obtain them through their diet. Maize, which is often used as animal feed, has a limited amount of these sulphur-rich amino acids. The use of transgenic maize to produce increased levels of cysteine was addressed by the OPTI-2 project.

The synthesis of cysteine involves the production of a carbon backbone from the organic compound serine, through the action of the enzyme serine acetyltransferase (SAT). The process continues with the addition of sulphur through the action of the enzyme adenosyl phosphosulphate reductase.

The OPTI-2 project increased cysteine production by introducing a gene from common duckweed (*Lemna minor*) which encoded for adenosine 5'-phosphosulfate reductase. Researchers attempted to achieve cysteine production in maize by cloning a bacterial, cysteine-insensitive SAT and introducing it into a maize crop. The cysteine, which was produced in an increased quantity, was then trapped in a sulphur-rich protein sunflower seed albumin (SSA).

However, expression of SSA alone did not result in an increase in total cysteine and methionine levels. This was possibly due to a limitation in the synthesis of these two amino acids. Therefore, experiments were undertaken which combined both the SAT enzyme and the SSA protein. These results are easily transferable to other crops and can help develop new tools and breeding strategies. Consideration was also given to safety aspects and acceptance by consumers.

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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continued from page 22 'Circumstances necessary for the bystander effect'

The team conducted various experiments using irradiated cells that were stimulated with phytohaemagglutinin (PHA). This was to test if the protective effect was evident in actively dividing cells, not just at the resting stage. Peripheral blood cells treated with PHA were fused with dividing irradiated CHO cells. No bystander effect was detected in the lymphocytes.

The next step was to determine the effect of radiosensitivity present during the G2

stage of the cell cycle. Peripheral blood cells from a female donor were mixed with irradiated blood from a male source and cultured with PHA. Again, no bystander effects were recorded in either type of cell. Furthermore, using irradiated CHO cells fused with radiosensitive peripheral blood lymphocytes failed to show any transmitted bystander phenomena.

Although bystander effects can be observed in some models, it has been demonstrated

here that their presence is limited to specific conditions. This demonstrates the need for further research into this phenomenon to fully realise the implications of the processes involved in radiosensitivity.

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

Collaboration sought: information exchange/training.

Genetic weapons against bacterial resistance

To counter the inappropriate use of antimicrobials, both the members of the public and policy-making bodies must be aware of the means of resistance in bacteria. As an integral part of a European study, genomic tools were developed and validated to analyse mechanisms that render antibiotics useless.

Resistance to antibiotics is of major concern on a global scale. Low-income countries face a particularly aggravated situation due to insanitary conditions combined with irrational and uncontrolled use of antimicrobials. There is therefore a high prevalence of antibiotic resistance in countries with poor resources, which is a constant threat to community health.

The EU-led consortium of the Antres project chose to base their study in both urban and rural communities of Bolivia and Peru to monitor antibiotic use and consequent resistance levels. The project team at Ospedale le Scotte in the Tuscany region of Italy specifically researched into the development of molecular tools to investigate resistance mechanisms.

The scientists probed for resistance genes to the most commonly used antibiotic classes, beta-lactamases, tetracyclines, sulphonamides, trimethoprims and phenicols. In gram-negative bacteria, resistance to aminoglycosides is normally associated with integrons, so the detection protocol used was designed to take this factor into account.

Integron cassette arrays including primers for conserved integron regions were amplified using the polymerase chain reaction. Sometimes primers for the most common aminoglycoside resistance genes were incorporated. The uncovered resistance genes were then sequenced.

The spread of antimicrobial resistance can be attributed to plasmid transfer during bacterial conjugation and the ability of the circular non-chromosomal DNA to replicate. The team adapted existing protocols to devise a methodology to characterise plasmid replicon types and to increase the understanding of the spread of resistance.

Reducing the invisibility of early psychosis

Health care involving early recognition and intervention at the first stages of psychotic disorders has been improved.

Early psychosis is a disorder which requires a dedicated effort for prompt recognition and intervention. The EU-funded EPOS project undertook the first study spanning five countries which set out to foretell transition to psychosis and the path of psychopathology and disability in patients at an increased risk of schizophrenia. The assessment occurred on a multilevel basis and was comprised of psychopathology, neurocognition and brain imaging.

Furthermore, EPOS endeavoured to examine methods and obstacles within care procedures in order to estimate proper treatment. The project pioneered analysis of the composition of disabilities and quality of life during schizophrenia programmes. Intervention (for example, psychotherapy or medication) was surveyed and results were evaluated accordingly.

Additional progress was made in terms of developing and implementing novel casefinding strategies and innovative health care services for patients who may be at the onset of psychosis. From a clinical perspective, this meant lessening the impact of early psychosis on persons affected. It also meant offering care for the numerous clinically ill at-risk patients who may not be transitioning to manifest psychosis. Furthermore, numerous first-episode patients can be discovered by early recognition of psychotic

Bioreactors for producing meniscus material

A large number of European citizens suffer from meniscus defects, causing persistent pain, loss of mobility and a reduced quality of life. Scientists from the EU have undertaken research into state-of-the-art tissue engineering technologies to reconstruct the living material of the meniscus.

The first stage of the Meniscus-regeneratio project validated a rotary cell culture system (RCCS) bioreactor which was used for cartilage tissue engineering. Non-woven meshes of esterified hyaluronan were seeded with primary bovine and human culture-expanded chondrocytes, these being the only cells found in cartilage. The cells were then cultured in the RCCS, or statically, in the presence of insulin and the growth factor TGF3, for up to a month.



The vast amount of data accumulated in the study was also used for a genotyping method, again developed from existing protocols, to investigate the clonal relationships between resistant *Escherichia coli* isolates. The study overall stands to provide data to use at community level right up to government bodies to improve both individual awareness and health policymaking.

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

Collaboration sought: information exchange/training.

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disorder units, which also helps in lessening the length of time that psychosis goes untreated.

End-users may include governmental as well as non-governmental agencies and organisations, clinicians and researchers in the fields of mental health care and policy as well as patients and their families. Above all, the knowledge obtained may be useful in applying and maintaining early detection and prevention programmes suited to European as well as non-European mental health care systems.

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

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

http://cordis.europa.eu/marketplace > search > offers > 4929

Researchers found that culture in the RCCS did not generate major differences in the contents of glycosaminoglycans (GAGs) and collagen deposits. However, use of the bioreactor did significantly affect their distribution. Compared to statically grown tissues, the cartilage cultured in the RCCS exhibited a bizonal structure which comprised an outgrowing fibrous capsule lacking in GAG, but rich in collagen. The inner region contained more GAG.

continued on page 25

Predicting driving deficiencies in the elderly

Being able to continue to drive is of utmost importance to the mobility and so the empowerment of older members of the community. Researchers designed a driving simulator in order to evaluate and predict factors which restrict elderly drivers' skills — anxiety was found to play an important part.

The Eurokinesis project created experimental situations which simulated vehicle driving circumstances under kinetic conditions. The aim was to create conditions which enabled testing of the reactions of the elderly participants in order to describe the types of deficits which lead to shortcomings in movement perception in aged members of society.

The results were used to develop ergonomic training and rehabilitation to prolong their driving skills. The programs were all designed to encourage active and anticipatory behaviour as opposed to passive avoidance measures. One of the experiments in this project turned its attention to designing a driving simulator rather than using optic flow patterns to get results. In the use of the driving simulator, however, a base problem needed to be overcome. This was the occurrence of simulator sickness.

In order to overcome this, the scientists recorded various parameters using microcaptors. These recorded heart rate, respiratory rate, skin conductance and temperature and capillary blood flow. The investigation into the autonomic nervous system activity

A molecular chaperone and its activator

EU scientists have researched into the action of the heat shock protein, Hsp90, and its activator molecule, Aha1. Elucidation of the mechanisms and pathways involved may have applications in the field of therapeutic proteins.

The assembly of proteins within cells requires the folding of thousands of different polypeptides into a range of conformations. In many cases, the action of molecular chaperones is required to handle substrate polypeptides from initial synthesis to the final folding process of the client proteins.



The aptly named, EU-funded project 'The Hsp70 chaperone' aimed mainly to investigate the action of the molecular chaperone Hsp70. The project team at the University of Bonn, Germany, focused their attention on another member of the heat shock protein

family, Hsp90. Together with Hsp70, this protein is involved in the folding and conformation of proteins that have medical significance. Included are nuclear receptors for steroid hormones and members of the protooncogenic kinases.

The interaction of Hsp90 together with its activator Aha1 was investigated using genetic and biochemical protocols. The scientists associated with developing simulator sickness allowed them to develop a 'simulator sickness prediction program'.

The results showed that skin resistance and temperature decreased with increasing sickness in the subjects, whilst heart rate increased. These patterns were analysed and it was concluded that these correspond to the stress response that is a known component of kinetosis. Furthermore, it was found that sickness correlated strongly with anxiety increase during the simulated driving lesson.

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

Collaboration sought: information exchange/training.

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identified the specific binding site of the activator and found that Aha1 activates the heat shock protein ATPase (adenosine triphosphatase) activity.

The activator also increases the efficiency of the chaperone by activating the client proteins. Moreover, under suboptimal growth conditions where Hsp90 levels were limited, Aha1 was crucial to cell viability.

These findings indicate that Aha1 can be classed as a novel regulatory cofactor of Hsp90. Furthermore, as it activates protooncogenic kinases, it may well enable Hsp90 to act as a cancer chaperone. As such, knowledge about Aha1 may help to elucidate the pathways involved in tumourigenesis.

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 > 4875

continued from page 24 'Bioreactors for producing meniscus material'

During the project's second stage, researchers showed that differences in the composition of bizonal fibrocartilaginous tissues resulted in different compression and tension properties. Scientists loaded bovine hyaluronan-based meshes with articular chondrocyte cells and cultured them for four weeks either in a mixed flask, an RCCS or statically.

The resulting tissues were assessed mechanically as well as using the techniques of histology, immunohistochemistry and scanning electron electronmicroscopy. Compression was assessed using indentation-type scanning force microscopy. Tensile tests were undertaken on punched-out concentric rings of tissue.

Results showed that tissues cultured in mixed flasks revealed an outer region which stained positively for versican and type I collagen. The inner region stained positively for glycosaminoglycans and collagen types I and II. The outer fibrocartilaginous capsules contained bundles of collagen fibres, which were stiffer under tension in contrast to the inner region, which was stiffer when compressed. However, in statically grown tissues there was a similar distribution of molecules and mechanical properties between the inner and outer regions. It was concluded that exposure of the chondrocyte-based constructs to a hydrodynamic flow produced tissues that differed in composition and mechanical properties. In this way they resembled certain aspects of the complex structure and function of the outer and inner areas of the meniscus, the two moon-shaped cartilaginous structures in the knee.

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

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

Increasing efficiency in photovoltaic wafers

The development of silicon-based photovoltaics (PV), which convert sunlight directly into electricity, has been an important step towards securing energy independence for Europe. Low-cost multicrystalline silicon (mc-Si) wafer technology has made a major contribution to the achievement of this goal.

In order for PV technology to be implemented on a large scale, it must be environmentally friendly and cost effective. One way to achieve this is to significantly increase the efficiency of mc-Si PV. Researchers from the Topsicle project accepted the challenge of producing super high-efficiency mc-Si wafers with low levels of impurities and crystal defects. The consortium's work also led to a greater understanding of those properties which limit the efficiency of solar cells.

The Topsicle team used a hybrid screen/print contact process especially optimised for mc-Si material to achieve an efficiency of 18.1 % for a large area cell. The front of the cell was made using the conventional buried contact technique and mechanically tex-



tured with a single blade, resulting in parallel v-shaped grooves. The reverse side of the cell comprised a back surface field created by screen printing and firing aluminium paste. A more effective back surface field and greater homogeneity of material resulted in a better spectral response in the long wavelength region.

When researchers applied a similar process to wafers produced by the Topsicle project, the highest rate of efficiency achieved was 15.8 %. The wafer is a thin slice of semiconductor material, such as a silicon crystal, which serves as the substrate for microelectronic devices. The reduction in efficiency was in part due to the wafers being etched with sodium hydroxide (NaOH), rather than being textured. There was also the possibility that the efficiency of Laser grooved buried contact (LGBC) cells on the wafers were limited by relatively poor minority carrier diffusion length.

Studies of LGBC cells created on Topsicle wafers indicated that the inclusion of Microwave induced remote hydrogen plasma (MIRHP) in the process increased mean bulk diffusion length. However, screen-printed cells produced on neighbouring wafers showed an even higher mean diffusion length. Therefore, it could be concluded that when MIRHP was applied to the buried contact process it was not effective in achieving the optimum bulk lifetime for the Topsicle material.

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

Collaboration sought: further research or development support.

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Studying the effects of heat on geological repositories

Opalinus clay is a leading candidate as a medium for the storage of high-level waste from the nuclear industry. Research carried out in the context of the HE project has shown that this rock type resists drying out in high-temperature conditions.

Many types of radioactive waste generate heat. This must be taken into account when planning long-term underground storage solutions for nuclear waste. In response, the Euratom programme supported a consortium of European research institutes to study the effects of heat upon the host rock of deep geological repositories.

Experiments were performed in boreholes in the field in order to obtain the most accurate results possible. A heating tube was positioned adjacent to the bentonite buffer surrounding the host rock, Opalinus clay, and maintained at a constant temperature for a period of 18 months.

Experts with the Gesellschaft für Anlagen- und Reaktorsicherheit (GRS) mbH in Germany applied geoelectric techniques

to acquire resitivity data, which provided insight into the distribution of water in the clay. Remarkably, saturation was observed to be relatively homogeneous. Only minor

losses were detected near the floor and these were attributed to the development of microfissures.

The researchers at GRS therefore concluded that temperatures reaching 50 °C did not cause the Opalinus clay to dry out. Fur-



this finding to temperatures approaching 100 °C. Such information is essential for the proper selection and design of deep geological waste repositories.

ther study is required in order to extend

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

Collaboration sought: further research or development support.

Reaping the benefits of monocrystalline technology

Researchers at a Spanish university investigated new ways of producing multicrystalline silicon (mc-Si) solar cells in an effort to incorporate the benefits of their monocrystalline counterparts.

Solar cells based on monocrystalline silicon currently outperform mc-Si versions, but are considerably more expensive. The Instituto de Energia Solar of the Universidad Politecnica de Madrid (UPM-IES) took up the challenge of trying to boost the performance of mc-Si solar cells by applying monocrystalline manufacturing techniques. Their research, which formed part of the Topsicle project, was supported by the EESD programme.

Efforts to adapt passivated emitter, rear local contact (PERC) techniques were rewarded

with cell efficiencies in the range of 17 %. However, despite good frontal reflectance and light trapping, the analysis indicated that lifetime values were, in fact, substandard. Fortunately, UPM-IES was able to produce both an optimal efficiency rating and lifetime by employing rear side passivation via wet oxide.

The Spanish scientists also dedicated considerable effort to adapting back surface field (BSF) and bifacial structure to mc-Si solar cells. In order not to compromise the

Shedding light on solar energy applications

A new solar energy operational processing chain put together by the University of Oldenburg in Germany is providing a range of high-quality solar radiation data to its end-users.

The launch of Meteosat second generation (MSG) satellites into space heralded a new age in Earth observation science. The Heliosat-3 project was established to develop new data products for solar energy applications with MSG data. The goal was to enable more efficient installations of photovoltaics (PV) and other solar energy technologies.

The University of Oldenburg led a group comprising eight other research institutes during Heliosat-3. One of the major deliverables was the implementation of a solar energy operational processing chain in an effort to supply end-users with a continuous flow of data products.

Relevant hardware and software components were developed and installed at the University of Oldenburg to ensure a steady inflow of MSG data. System reliability was enhanced with back-up mechanisms established with other Heliosat-3 participants. The MSG data is subsequently fed to data mc-Si substrate, it was necessary to reduce the thermal load associated with the intermediary steps, such as diffusion, of the different elements. The investigation revealed encouraging results for oxidation masking, a spin-on boron diffusion source and screenprinted emitters.

UPM-IES and its Topsicle partners are following up on these encouraging results, which they hope will eventually be able to deliver cheaper solar cell technology to consumers.

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

Collaboration sought: further research or development support.

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processing software that incorporates the new Heliosat-3 algorithms. Efforts were also made to semi-automate data exchange.

The result is that end-users of the solar energy operational processing chain have access to a number of different types of solar data. Near real-time solar irradiance data is available for specific locations, while historic data can be provided as a time series or plotted on a map.

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

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

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and improving the measurement of discharge phenomena, pulse currents and voltages. The full implementation of quantum effect standards of electrical quantities also needed to be addressed. The upgrading of contactless temperature measurements and related calibration services was also taken into consideration and a technical project was prepared.

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

Collaboration sought: information exchange/training.

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Laboratories prepared for the Low Voltage Directive

The EU supported measurement and testing laboratories and related infrastructure in the newly associated states in an effort to fully implement the Low Voltage Directive (LVD). This included establishing institutional triangles comprising laboratories, users of laboratories such as industry, as well as administrative and regulatory bodies.

The LVD is concerned with safety, largely for mass-produced electrical household equipment. Through the harmonisation of EU legislation, barriers to international trade can be eliminated. By developing the required expertise in the field of measurement and testing, the Incolab project improved the technical quality of electrical products and increased competitiveness. Actions undertaken by the Incolab project included workshops, visits and presentations.

Project partners established contacts with accredited calibration and testing laboratories as well as manufacturers of electrical equipment and measuring instruments. The team focused on problems of traceability and on raising general awareness of requirements under the LVD. The collected data was compared against the best measurement capabilities of accredited laboratories within the Czech Republic.

Results indicated that metrological services connected to the LVD cover all the current requirements of calibration and testing laboratories. Challenges facing the Incolab team included improving the calibration and measurement capabilities of currents over 1 000 amperes

Understanding ageing in nuclear power plants

Researchers in Finland have conducted benchmark tests to determine the fracture toughness of laboratory specimens with internal defects. The results obtained have provided valuable insights on the transferability of data obtained on standard materials to the assessment of detectable flaws in real nuclear reactor components.

tion date.

While bearing in mind that the lifetime of nuclear power plants is definitely limited by



the ageing of non-replaceable components, utilities have developed dedicated procedures to assess their structural integrity. Measurements of fracture toughness on laboratory specimens have a key role to play in ensuring the safe operation of nuclear power plants until their expira-

However, significant obstacles remain as regards the application of laboratory-generated representations of fracture initiation for assessing postulated defects in critical components such as reactor pressure vessels. Disparity between measurements on laboratory specimens and on nuclear reactor components provided motivation for the Vocalist project funded under the Fifth Framework Programme (FP5) of Euratom.

Project partners at the Technical Research Centre of Finland contributed to the Vocalist project with their accumulated expertise in applying

Fatigue evaluation in nuclear power plants

The first step towards a unified methodology for evaluating thermal fatigue failures in the piping systems of nuclear power plants (NPPs) has been taken within the Therfat project.

As operating NPPs become older and life extension activities are initiated, detection and integrity assessment of flaws or defects is a key part of their safety assessment. Plant manufacturers and providers of structural integrity services have developed effective procedures to address this issue.

However, a series of incidents over the past 10 years have put in doubt the reliability of existing procedures for integrity evaluation and life extension of NPPs. Funding from the Euratom Framework Programme was therefore used to rigorously verify the existing procedures for assessing safety-critical components.

The Therfat project was initiated to advance the accuracy of procedures developed to assess the significance of minor cracks and leaks in the austenitic piping system. Inservice inspections have revealed that cracks may occur in welds and base material as well as pipe elbows and T-connections. These effects have been attributed to their limited ability to resist extremely low and extremely high temperatures and more importantly, their ability to withstand cyclical exposures to temperature extremes.

An important component of work undertaken within the Therfat project was the collation of validation cases and benchmarks, covering both industrial examples and R & D feature tests. Conventional integrity evaluation procedures were applied to determine safety margins at different stages of thermal degradation in a plant's piping system. Furthermore, crack initiation and propagation were simulated numerically to estimate the capacity of pipe components to support thermal loads.

The results have been enclosed within an overall integrity evaluation procedure that has been developed to help identify locations susceptible to thermal loadings. The new methodology may be used to mitiresults obtained from 'Master curve' models. The basic Master curve model was used to simulate two sets of fracture toughness data derived from specimens with deep and shallow notches.

Thermal shock tests are characterised by higher probability of defect extension on the components' surface, where assessment of the fracture's toughness is complicated due to the constraint effect. In light of this, experimental results were re-evaluated to improve imprecise correlations between results obtained by empirical test methods and fracture toughness curves with direct use of fracture toughness data.

Through comparisons of the probability of notch extension for given values of temperature and stress distribution ahead of the notch tip, the model's sensitivity to individual parameters was optimised. Although difficult to apply, the Master curve model was proven to provide reliable estimates for fracture propagation in material samples from the pressure vessels of real nuclear reactors.

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

Collaboration sought: further research or development support.

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gate or even avoid high thermal and stress loads by optimising the operation conditions of NPPs.

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

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

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ENVIRONMENT

Local businesses trial alternative fuel vehicles

Traffic is responsible for much of the pollution and energy consumption which occurs in cities. In response to this, a scheme was established which allowed local businesses to test a range of vehicles which produced low levels of emissions.

The historic city of Winchester in the south of England, United Kingdom, played host to an innovative scheme, which encouraged local businesses to try out vehicles which ran on alternative fuels. The intention was to overcome barriers to the uptake of such vehicles and to provide a business case for their use. Due to high concentrations of air pollutants in the city centre, an air quality management area (AQMA) had been declared for Winchester. It was hoped that the use of cleaner fuels under the auspices of the Miracles project would help improve air quality.

Project partners from Hampshire County Council ran an awareness-raising campaign to highlight the benefits of environmentally friendly vehicles. The council purchased six vehicles. These



were two petrol/electric hybrid cars, two duel-fuel liquefied petroleum gas (LPG)/petrol cars, and two electric vans which ran on batteries. Local businesses were able to loan one of these vehicles for a period of up to a month. The scheme was extensively promoted at events in and around the city and through the local media. Researchers equipped each vehicle with a tracking device so that data concerning routes taken could be carefully analysed. This information was used to estimate emissions' savings and was compared with the emissions from the businesses' usual vehicle.

Before each trial began, businesses were asked which factors would influence their decision whether or not to purchase an environmentally friendly vehicle. Respondents claimed that the three most sig-

> nificant factors were operating expenses, reliability and purchase cost. Following the trial, two-thirds of participating companies said that in the future they were likely to invest in an alternative fuel vehicle for business use.

Researchers from the Miracles project noted that companies renew their vehicles over cycles of several years. For this reason the benefits resulting from the scheme will not manifest themselves immediately. However, one business and three employees purchased environmentally friendly vehicles following trials. The emissions' savings from these clean vehicles were also determined. Savings in the form of fuel cost per km were around 40 % for hybrid cars and around 20 % for LPG/petrol duel-fuel cars.

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

Collaboration sought: information exchange/training.

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Sequencing of alleles in desirable ryegrass genes

Scientists studied perennial ryegrass (Lolium perenne), a major component of European grassland systems. They identified genes related to agronomic traits in order to develop allele-specific molecular markers for improving the efficiency of breeding grass crops.

The aim of the GRASP project was to create and validate a framework that could support the development of allele-specific single nucleotide polymorphism (SNP) markers. These gene-derived markers are associated with important traits in *Lolium perenne* such as the plant's nutritive needs and response to environmental factors. The research undertaken bridged the gap between knowledge concerning the functions of plant genes and their successful commercial application.

Allelic selection tools were developed which resulted in the efficient targeted breeding of crops. This has led to great improvement in plants, which are not genetically modified organisms (GMOs). The SNP markers generated through the GRASP project were distributed to European crop-breeding companies and public institutions. A strategy of 'direct selection' from DNA was implemented for investigating germplasm collections and describing varieties in order to protect intellectual property rights.

The sequencing of alleles was carried out on 91 genes for *Lolium perenne*, with their reported functions linked to desirable traits. The allele sequences generated through the project form the basis for parallel high-throughput SNP assays. The work has resulted in major benefits for plant breeders and researchers and may be utilised by service providers for marker assays.

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

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



Car sharing in Rome

Committed to achieve a modal shift from using private cars to commute to work towards more collective forms of transport, the main public transport operator in Rome, Italy, implemented a new car sharing service.

11 vehicles.

transport vehicles.

rail network.

All roads lead to Rome' is a notion that many associate with the imperial period of Roman influence. However, those same roads are now choking the very livelihood that made Rome great. A population of more than three million and almost two million cars have created two interrelated problems, traffic congestion and environmental degradation.

The car sharing service was implemented under the auspices of the Miracles project for the occasional needs of employees who travel to and from work every day. In particular, commuters who use their private car for less than 10 000 km per year were identified as the ideal target group for this new form of collective car ownership.

The main public transport operator in Rome was commissioned to start the pilot trial of the car sharing service in March 2005. Together with Legambiente, one of the most important environmental associ-

Magnetic indicators enhance climate change models

High-resolution magnetic analysis has shown that the North Atlantic was subject to rapid climate change thousands of years ago during the Holocene period. The result of the research was a better understanding of the long-term variability of the North Atlantic's climate and improved models for predicting the effects of climate change.

The top 25 m of a core taken at a water depth of some 400 m from the mid-outer shelf off north Iceland was subjected to high-resolution magnetic analysis. This area is a key boundary region for climate change. It is connected to atmospheric and oceanographic variations



affected by the moving boundary between the cold and warm water masses at the polar front, and associated westerly winds.

free of charge in every car park of the city.

These alternative fuel vehicles could also

enter lanes restricted to taxis and public

From the first experimental phase, it was

estimated that every shared car can reduce

the number of cars used to get from home

to work by 10. Moreover, 54 % of the ser-

vice subscribers sold their second family

cars. The car sharing service encouraged the

use of collective transportation systems not

only for companies and their employees but

also for families residing outside the city's

An age model based on this core had been produced previously using tephrochronology to date samples. This technique utilises discrete layers of volcanic ash from a single eruption to create a chronological framework. The age model enabled accurate dating of significant variations in the sample's magnetic mineral concentration and grain size over the last 10 000 years.

The Holocene climatic optimum, which occurred in north Iceland between 10 000 to 6 000 years ago, was characterised by minor variations in the magnetic record. There is also clear evidence of increasing oceanographic instability from 6 000 years ago until now. The decreasing trend in the magnetic mineral content was associated with a change in the circulation pattern and coincided with decreasing North Atlantic Deep Water (NADW) formation.



New funds are expected from the municipality of Rome and the Italian Ministry of Environment and Territory in order to expand the existing car sharing fleet with hybrid vehicles. The ultimate aim is to extend the service to areas in the centre of Rome where universities, shopping centres and big hospitals are located and which are congested with traffic.

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

Collaboration sought: information exchange/training.

http://cordis.europa.eu/marketplace > search > offers > 4982

Scientists from the Pacliva project successfully identified a number of short-term intervals of decreased magnetic mineral content. The most recent interval occurred between 1020 AD and 1330 AD, which corresponds in time with the Medieval Warm Period. These events indicate periods of increased activity from the warm and highly saline Irminger current in relation to stronger input of North Atlantic waters into the Nordic Seas.

Spectral analysis of selected magnetic parameters indicated periods of increased activity, which lasted for hundreds of years. These were more clearly shown over the last 6 000 years than in the previous period. The changes could be due to persistent intervals in the North Atlantic Oscillation (NAO) lasting hundreds of years. These findings are an indication that the climate of the Holocene was more unstable than previously assumed. This demonstrates the importance of high-resolution climatic studies for this recent time period, which should enable researchers to deliver more accurate predictions through the use of improved climate models.

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

Collaboration sought: further research or development support.

Tourists give their verdict on the industry

Twelve European regions were the subject of this EU-backed study. As part of a wider investigation into the merits of integrated tourism in lagging rural regions, project partners conducted interviews with tourists and people in the field of tourism promotion, in order to understand trends which exist between the regions.

The Sprite project defined integrated tourism as 'tourism explicitly linked to the economic, social, cultural, natural and human structures of the localities in which it takes place'. It represents a shift towards a more holistic approach to development of the tourism industry, thereby ensuring that economic activity is integrating and not exploiting local parameters.

The research took place with the participation of regional stakeholders in six European countries. These included two regions in the Czech Republic, Ireland, Greece, Spain, France and the United Kingdom.

Surveys in the form of questionnaire-based interviews were designed by the research teams and consultation panels. One hundred tourists and 10 gatekeepers (for example, travel agents and tour operators) in each of the 12 study regions examined took part.

The questionnaire was designed in order to examine the perception of links between tourism and place, tourists' requirements, their expectations and experiences. Also, questions were asked in order to foster links between local resources, local activities and tourism, as well as to identify opportuni-

ties for development of integrated tourism including the development of marketing channels and local participation.

The research findings were collected and presented in individual country reports. In the case of Greece, the rural areas examined were the regions of Kalavryta and Evrytania. The research showed that Kalavryta attracts rel-

atively young tourists for day trips whereas Evrytania seems to attract older people who stay for longer. Furthermore, marketing strategies and promotion in Evrytania has been more effective. The report suggested that this may be because Kalavryta is isolated from administrative services.

> 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 > 4965



Hybrid technology for the decontamination of industrial wastewaters

Aiming to address the inability of conventional wastewater treatments to effectively remove major toxic contaminants, the CADOX project has coupled chemical with biological oxidation processes. Their use as a pretreatment step in an integrated treatment system has been proposed as a cost-effective solution to enhance the biodegradability of industrial wastewaters.

Water pollution is not only a problem of developing countries. Through the establishment of laws and stringent controls, the European Commission is able to regulate the production and use of chemical substances which may be hazardous to humans and the environment. In some industrial areas wastewaters, however, are not treated appropriately due to the lack of available onsite treatment technologies. The CADOX project was supported by FP5 to develop a suitable technology to fill this gap.

Among the available wastewater treatment technologies, oxidation processes attracted the interest of project partners at the Autonomous University of Barcelona, Spain. Oxidation processes were extensively studied for organic contaminants that are not treatable by conventional biological techniques due

> to their high chemical stability and low biodegradability.

Partial oxidation by ozone of watersoluble pesticides such as alachlor and atrazine was shown to substantially increase wastewater biodegradabil-

> ity. More specifically, the evolution

of contaminants' concentration was followed in order to assess the effectiveness of the ozone oxidation on intermediate products of the pharmaceutical industry. The mineralisation rate was monitored by measuring the total organic carbon (TOC) content, along with the consumption of ozone.

While proven to be highly efficient, this process is currently quite expensive (tens of euros per m3 of treated wastewater). Complete mineralisation of organic compounds was also hard to accomplish, but ozone oxidation provided the possibility of being coupled with a secondary treatment.

Based on experimental results, the conditions obtained after ozone oxidation were optimised to meet the requirements of the subsequent application of an advanced oxidation process driven by solar irradiation. Trials on a pilot plant provided valuable insight into the potential treatment of wastewaters by photo-Fenton, followed by an inexpensive biotreatment as an economically attractive second step.

Collaboration sought: further research or development support.



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

Solar treatment technology for recycling wastewater

There is a need to appropriate methods for recycling wastewater so that it is restored to a good chemical and ecological status, as well as ensuring that pollution from discharges and emissions of hazardous substances is reduced. In line with these objectives, the CADOX project examined the use of solar photocatalytic treatment on wastewater plants.

The CADOX project participants set themselves the task of developing an optimised hybrid technology able to treat wastewater containing hazardous substances, so that this water can be reused safely. The project



led to the development of a new technology with market possibilities, which could be suitably applied to the remediation of wastewaters with organic contaminants.

In order for this to be achieved, a designated research team focused on the design and control of solar photocatalytic wastewater treatment plants. It was founded on the premise that treatment of industrial wastewater seems to be one of the most promising fields of application of solar detoxification.

Preliminary research conducted on a caseby-case basis assessed potential pollutant treatments. The researchers were able to identify the best option for fixing specific problems as they came up. It was found that solar photocatalytic degradation technology may be feasibly used for the treat-

New ruthenium catalyst drives water purification system

A novel approach to water purification based on photosensitising strips developed at Universidad Complutense de Madrid (UCM) in Spain has delivered promising results.

The Mediterranean is a region where water is in limited supply and climate change is threatening to make it an even scarcer commodity. Sunlight is, on the other hand, abundant. Hence, considerable value could be gained from exploiting the power of the sun to generate potable water. This was precisely the goal of the Aquacat project.

Aquacat brought together researchers from both European and African nations bordering the Mediterranean Sea. One participant, the UCM, helped develop a ruthenium-based (Ru) catalyst to enhance the cleansing capacity of the system. More specifically, the UCM produced and evaluated a singlet oxygen photosensitising material composed of silicon and a polyazaheterocyclic Ru(II) compound.

During Aquacat, tests were performed on water samples artificially contaminated with *Escherichia coli* and *Enterococcus faecalis* bacteria. Remarkably, the catalyst enabled the purification of up to 20 litres of

Saving the lagoons of southern Europe

An extensive suite of software tools produced during the DITTY project aims to promote the sustainable management of lagoons in southern Europe, whose health has been threatened in recent years.

Aquaculture, shipping and other human activities have resulted in serious environmental degradation of these valuable natural resources. The EESD programme funded a collaborative research effort dedicated to exploiting information technology to improve the outlook for these lagoons. The National Institute of Fisheries and Sea Research, Portugal, led an investigation of Ria Formosa, a lagoon located in the Algarve region of southern Portugal. Relevant water, soil, biological and climatological data was collected into a single database. A geographic information system ment of wastewater containing hazardous contaminants.

In cases in which biological treatment is impossible, it is this treatment that could remove medium or low pollutant concentrations. Furthermore, the scientists discovered that the success of the technology in the treatment of wastewater depends on the energy applied not fluctuating too much. Following testing, it was ascertained that the types of compounds which had been degraded included alkanes, haloalkanes, aliphatic alcohols, carboxylic acids, herbicides and dyes.

This project was born out of a need to address the limitations of conventional biological wastewater treatments. As such, pollution control and legislation have become a high priority. The adoption of the Water Framework Directive emphasised this. This policy tool also emphasised the importance of ensuring treatments that prevent the deterioration of surface water.

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

Collaboration sought: further research or development support.

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water per day, outperforming the benchmark method of photocatalysis with titanium dioxide (TiO_2) .

When in use, the Ru(II) catalyst was able to disinfect water for six months or more. When not in use, it could be stored for long periods of time without degradation. In addition, the catalyst strips were designed in order to easily be attached to the solar reactor prototype created during Aquacat. Further to these positive results, UCM acquired patent protection for the new Ru(II) catalyst.

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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Sustainable progress for Mediterranean coast in Egypt

The Egyptian coastal region of Rosetta was the study site for an expert team of biologists, geographers and socioeconomists. They were brought together in the Med-core project to work at designing a set of guidelines for achieving sustainable development in the region.

The purpose of this EU initiative was to study the coastal ecosystems of zones in the Mediterranean, in order to design a comparative and integrated approach to sustainable development management in these areas. The project brought together about 100 experts from different disciplines. Academics specialised in socioeconomy, biology and geography as well as managers and SMEs. A number of study sites were chosen to provide the basis for the research.

One such site was in the port city on the Mediterranean coast of Egypt, Rosetta. The

specific site studied was located on the western bank of the Rosetta branch of the Nile, 100 m or so from the river mouth. The site was chosen because it is considered to have great potential for tourism activities, yet a high level of poverty and low levels of public participation. Therefore it was identified as being in urgent need of having a set of guidelines for sustainable development.

Firstly an analysis was made of the geography of the site. The area was found to be quite flat. Fine sediments were found to characterise it,

Using spent mushroom substrate for biofilters

Researchers have used waste substrate material from the production of mushrooms as a basis for biofilters to remove harmful gases from contaminated air.

Spent mushroom substrate (SMS) is the residual compost waste generated by the mushroom production industry. The SMS project investigated alternative uses for the material. These included the use of SMS as bioorganic filters for polluting industries. The demand for a developed SMS biofilter has increased due to the enforcement of stricter laws and regulations for air and water filters.

The result has been new business opportunities in agriculture, agroindustry and the processing food industry. These business sectors are under growing pressure to reduce or eliminate unpleasant odours and harmful gases, including greenhouse gases. Therefore, the requirement exists for filtering large volumes of contaminated air.

Researchers from the SMS project developed a technique to use SMS from the production of *Pleurotus spp.* mushrooms as the basis for a biofilter. Results showed that the filters significantly reduce the amount of ammonia (NH_{*}) that is passed through them.

Traditionally the mushroom growing industry has treated SMS as waste material that needed to be disposed of. Now, however, it can be treated as a useful resource, helping the industry to reduce its waste and to become more sustainable as well as increasing its profitability. This means also that additional jobs can be created.

also there were some gravel-sized particles and pebbles. In addition, medium-sized to large boulders were found, which were attributed to human agency in order to minimise coastal erosion. The vegetation throughout the area was found to be somewhat sparse. However, where blue algae were found to predominate, vegetation was found to be even sparser. Guidelines for sustainable development were put together following consultations with the researchers. The guidelines emphasised the need for a participatory approach. This means that stakeholders and residents should be incorporated in the planning, decision making and implementation processes involved in the development strategy.

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

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

http://cordis.europa.eu/marketplace > search > offers > 4728

continued from page 32 'Saving the lagoons of southern Europe'

(GIS) tool was used to display the data as well as results from a number of computer models.

One of the models applied, the soil and water assessment tool (SWAT), simulated hydrodynamic and biogeochemical parameters on daily, monthly and annual timescales for the entire watershed. In addition, an ecological dynamics model (EcoDynamo) provided the opportunity to assess the impact of various policy options. This step was facilitated by special meetings between DITTY participants, stakeholders and local authorities. A key aspect of the approach was the proper inclusion of the financial aspects of the various initiatives.

The interaction between internal and external factors was addressed via a strengths, weaknesses, opportunities, and threats (SWOT) analysis. Several useful recommendations evolved from the SWOT analysis concerning bivalve aquaculture and channel geometry. A final tool developed during DITTY was a decision support system (DSS) that incorporated both environmental and economic constraints. The DSS was made available to the Ria Formosa Natural Park, the entity responsible for the management of the lagoon. Workshops were held to disseminate the findings and tools to local authorities and stakeholders. In addition, a Portuguese coastal lagoon network (Planet) was established to encourage application of the tools to other lagoons throughout Portugal.

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

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

Engineering DNA to make the tiniest of wires

Great potential exists in using DNA molecules as generic instead of genetic material. The 'DNA based nanowires' project sought an alternative to silicon-based microelectronics in using derivatives of DNA, which could enable a reduction of current devices' size by a thousand times.

The use of DNA molecules to assemble nanowires for nanoelectronic devices is one of the first steps towards using biological molecules as a manufacturing tool. Instead of moulding electronic components from conventional materials, project partners experimented with ways to exploit the self-assembling properties of DNA.

DNA is in itself probably not a good conductor of electricity, and molecular wires are characterised by their limited ability to transport electrical charges. Scientists at the Hebrew University of Jerusalem, Israel, turned therefore to derivatives of DNA that can be used as templates for the formation of conducting nanowires.



Composed of self-folded polydeoxyguanylate (poly(dG)) strands of thousands of guanine tetrads, G4-DNA nanowires offered the desired conductive properties. Guanine, distinctive among the DNA constituents for its low ionisation potential, had a key role to play in the electrical conductivity of G4-DNA nanowires.

Guanine-rich DNA strands were synthesised from a double helical complex of poly(dG) and polydeoxycytidylate (poly(dC)). To separate poly(dG) strands, a new method was introduced that is based on the use of long and continuous poly(dG) strands attached to short poly(dC) fragments as source material. Through the controlled folding of the derived poly(dG) strands, long and

uniform G4-DNA nanowires were subsequently produced.

The truly innovative nature of this research work rests, firstly, in the use of the self-assembly potential of DNA strands. Secondly, it lies in combining sophisticated techniques for nanoengineering DNA strands and scanning tunnelling microscopy with computational simulations of the stability and properties of the synthesised nanostructures. As a result, designing nanowires using DNA derivatives is now a reality.

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

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

http://cord is.europa.eu/marketplace > search > offers > 4956

Organising sensory and motion information for use

Challenging interactions have emerged during the Amouse project — between engineers designing an intelligent robot and neuroscientists questioning how movements are being planned and executed.

All information received by the five senses — vision, hearing, smell, taste and touch — are processed and interpreted in the brain to create an internal representation of the outside world. On the other hand, internal senses inform on the position of different parts of the body, as well as how the body is to move.

To further current understanding of how all this input is organised and integrated, a computational model that summarises existing results of neurophysiological studies was proposed by the Amouse project. Based on simple and well established mechanisms for the integration of information across different sensory modalities, it was used to investigate to what extent motion perception contributes to planning movements. The autonomous robot developed within the Amouse project and a simulated approximation of this robot was used in the experiments conducted in the laboratories of the University of Osnabrück in Germany. The neural model was used to control the robot as it learned to move about within the confines of a maze.

Direct evidence of changes in the planning of their movements was provided by investigating the robot's trajectories. The robot's uncertainty to drive straight, turn to the left or to the right at crossings was gradually reduced as information from the light and touch sensors on the robot were mapped. Nevertheless, interpretation of motion information was seen as an integral component in the process of making the optimum decision under rational constraints. The Amouse project partners suggested that sensory neurons can encode all the essential information, but they neither contribute to the process of making a decision nor carry its outcome. On the other hand, the part of the peripheral nervous system that is involved in movement control could regulate whether high-level decision making is required by assessing the complexity of task demands.

The emerging reconceptualisation of information processing principles has already been exploited for the construction of flexible and task-adaptive systems for the Amouse robot.

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

Collaboration sought: information exchange/training.

e-procurement one-stop shop, big deal for small business

A European project is proving the benefits of e-procurement to public administrations and SMEs in five European regions. And by linking the different platforms, Europe is set to get its first cross-border e-tendering technology.

'For far too long, I think, public authorities have been bad purchasers. All too often their contractors deliver poor services at too high a price,' says Louis-François Fléri. 'But there is technology now that enables public organisations to procure top quality, efficient services, yet save tax payers thousands of euros at the same time.'

Mr Fléri is talking about the e-bourgogne tendering system. Launched in 2005, this online procurement platform serves over 900 public bodies — from local councils to utility companies — from the Burgundy region of France.

So far, more than 12 000 businesses (mostly local SMEs but also many companies from across Europe) have used e-bourgogne, generating a total of nearly 240 000 down-loads and more than 8 000 electronic tenders, two-thirds of which are below the threshold for publication in the *European Journal*.

'We have seen a 15 to 20 % reduction in the value of regular small tenders which represents a substantial saving of tax payers' money,' remarks Mr Fléri. 'Public organisations now receive 10 to 20 answers to a tender instead of the one or two they used to get.'

Tried, tested and proved, the technology is now being made available to other regions of the EU thanks to the EU-funded Procure project. The platform was built with an open-source licence, making it straightforward for any other organisation to take it, adapt it and deploy it for their own e-tendering protocols. Procure has benefited from the expertise of the e-bourgogne team to roll out an e-tendering platform in several other EU regions. The project partners also plan to share their expertise and experience to improve existing e-procurement platforms and protocols.

The project is working to get the platform to market, prove its value, and to encourage other public administrations to adopt e-procurement at a regional scale. But Procure goes a step further than simply deploying isolated systems. The project is linking them together and creating the first interregional network of shared e-procurement platforms. In the future, it could also provide access to the central European tenders database, Tenders Electronic Daily (TED).

'This network of regional e-procurement platforms is a major boost for greater competitiveness and innovation in the delivery of public services. But it is also great news for SMEs who should benefit from a onestop shop,' says Mr Fléri.

'They will be able to find and bid for public contracts from across Europe — especially low value ones which do not get published through TED. It is a great step towards a single market and will drive the growth of Europe's most efficient, innovative SMEs.'

Procure is a first tentative step in overcoming the legal complexities of cross-border e-tendering. The Procure partners have conducted a careful review of the laws governing e-tendering within different EU Member States. 'Interoperable regional systems must conform to local as well as European law,' notes Mr Fléri.

'There are EU directives about e-procurement and public contracts, but how these are applied at the local level is very different between [EU] Member States. When we link regional platforms together, we must ensure that a company in Spain, for example, will be able to meet the legal e-tendering requirements for, say, a Swedish tender,' he explains.

For example, most (but not all) EU Member States require bidders to validate high-value electronic tenders with a special identity certificate — the digital equivalent of a signature on paper. But e-signatures have a varying legal status in different EU Member States.

Such cross-border issues could prove a major stumbling block in Procure's vision of integrated, Europe-



Along with the technical deployment work and legal studies, the Procure project is also looking at the best ways to promote e-tendering platforms to SMEs. Through seminars, workshops and other events, the Procure partners have witnessed a five- or six-fold increase in the number of SMEs registered with Brittany's e-tendering platform and significant growth in tender submissions from SMEs via the e-ordering system in Uddevalla, Sweden. Procure has also launched e-tendering platforms in Central Bohemia, Czech Republic, and the French island of Guadeloupe.

'We have had tremendous success with the Burgundy e-tendering system and we are now seeing these benefits being realised in other regions of Europe. By sharing our experiences with others and learning from other regions with well-established e-tendering platforms, Procure will help to demonstrate how e-tendering can become the norm and make electronic bidding for public contracts accessible to companies of every size, no matter where they are located in Europe.'



Promoted through the ICT Results service.

Tuning in to the virtues of virtual labs

The grid's huge communication and computation capacities could let scientists gather data and run remote experiments anywhere in the world. European researchers have now mapped out how that can be done.

Two years ago, researchers in the EU-funded project Ringrid ('Remote instrumentation in next-generation grids') took on the challenge of mapping out how scientists around the world can efficiently carry out remote research using the grid.

The grid is the emerging next-generation internet. It uses fibre-optic cables and advanced routers to carry torrents of data some 10 000 times faster than broadband and to connect thousands of computers and supercomputers worldwide.

The researchers with Ringrid view the grid as a rich new environment in which — with the right tools — scientists anywhere in the world can collaborate, control instruments, run experiments, and tap into the grid's vast computing power.

Marcin Lawenda, deputy coordinator of the Ringrid project, sees great potential for remote research using the grid in the nottoo-distant future. 'Then, almost all rare and expensive laboratory devices will be accessible to the worldwide science community via virtual laboratories,' he says. 'Thanks to remote access and collaboration tools, data could be easily shared and scholars from different countries or continents will be able to work together.'

From the start, the Ringrid researchers knew that they needed to help scientists access the grid's capabilities as simply and consistently as possible. If it was feasible, they wanted to design interfaces and protocols that could be used to set up and control many different kinds of experiments using different kinds of instruments and generating different kinds of data.

'We analysed the general aspects of remote instrumentation,' says Mr Lawenda. 'Many scientific communities were taken into consideration, along with their needs in terms of scientific devices and the requirements of those devices.' Ringrid researchers worked with more than 50 scientists in a wide range of disciplines in order to learn what kind of equipment they use and how they carry out their research.

By identifying the most general and universal steps involved in setting up and carrying out almost any kind of experiment, the Ringrid team were able to develop coherent guidelines for developing practical, userfriendly interfaces and protocols for remote research — in effect, blueprints for building virtual laboratories.

They detailed those guidelines in their *White Paper on Remote Instrumentation*, published in July 2008. The white paper details every step in the remote research process, from the kinds of physical instruments that can be used through the process of representing the devices in a virtual interface, to experimentation and data collection, distribution, visualisation and analysis.

To test the concepts and methods they had developed, Ringrid partners carried out two

remote research trials. In the first experiment, researchers in Mexico were able to study the effects of noise and fading on a video transmission in Italy. The researchers used a virtual research platform called GRIDCC, developed by a separate EUfunded research group working in cooperation with Ringrid.

In a second trial, researchers in Chile used a different virtual-lab platform called VLab, developed at the Poznan Supercomputing and Networking Centre to perform nuclear magnetic resonance spectroscopic measurements in Poland. Polish researchers then used a Chilean system called UCRAV to perform similar measurements in Chile.

These experiments allowed the Ringrid researchers to note and respond to realworld challenges as well as technical and scientific issues. 'Many unexpected problems appeared,' says Mr Lawenda, 'for example communication delays, security issues, and transferring data via many administrative domains.'

However, Mr Lawenda believes that the biggest remaining obstacles are neither technical nor practical, but educational. Most scientists and laboratory administrators are simply not aware of the potential for remote experimentation via grid computing.

'The most surprising issue in our research was low levels of awareness about remote instrumentation among device owners — institutes and laboratories,' says Mr Lawenda. 'In most cases, the owners of scientific instruments and their users are not aware that it is possible to put their resources into the grid environment and make them remotely available for research.'

Mr Lawenda hopes that Ringrid's white paper as well as other publications and presentations will spur the scientific community to link their labs to the grid, and design and carry out much more collaborative and remote experimentation.

Two other European-funded research projects, DORII and Expres, are building on Ringrid's roadmap to push this process forward. The Ringrid project received funding from FP6.

Mr Lawenda expects that the necessary grid infrastructure and fully functional systems for remote experimentation will be in place within five to seven years. The challenge is to use that time to educate the scientific community to the many virtues of virtual laboratories on the grid.

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Testbeds to breed next-generation systems

The systems that let you zap a photo to a friend, or an astronomer control a telescope continents away, require intensive simulation and testing. European research has now made these key steps far easier.

Two years ago, the European research programme UNITE took on the challenge of creating a virtual testbed that IT developers across Europe could use easily and effectively to fine-tune new devices and services, and make sure that they will interact smoothly with existing systems. Without an improved testing and simulation infrastructure, it will be extremely difficult to achieve the 'network of wireless networks' that communications researchers envision and hope to create.

The goal the UNITE researchers set for themselves was to build an online platform that would let groups across Europe share existing test equipment and protocols, easily add new capabilities and use the platform to optimise new communications products, store and share results.

'Until now, when a research group wanted to test something, they often had to "reinvent the wheel", says Georgios Kormentzas, UNITE's technical manager. That might mean modifying an existing simulator or writing a new one, running extensive tests, and then laboriously searching the literature for comparable results.

Making matters worse, researchers often kept their results, and the simulation and testing tools they developed, to themselves. 'One research team might develop a new simulator,' says Mr Kormentzas, 'but this

more or less remained hidden from the rest of the community.

Inspired by the spirit of opensource software, the UNITE team wanted to accelerate progress within and across technologies, such as cellular, wireless and digital video broadcasting, by encouraging researchers and developers to share

and add to one another's work. 'This is the most important thing,' says Mr Kormentzas. 'If you give your testing tool to the research community, you gain access to the tools of the other teams.'

When the EU-funded UNITE project took a close look at the testing and simulation tools already being used by their 10 academic and industrial partners, they were struck by their diversity. 'There were software tools, hardware tools, single-layer simulators, system simulation tools, traffic generators — a heterogeneity of tools,' reports Mr Kormentzas.

The team had to identify the common features that would allow all these tools to interface. And, says Mr Kormentzas, they had to look to the future so they could easily incorporate new tools in the UNITE platform.

The UNITE platform, which was featured at the '4th International week on the man-

the system,' says

Mr Kormentzas.

The VDT links

users to the UNITE controllers, which offer

access to all of the testing and

simulation tools





that are connected to and supported by the system.

The controllers also define and designate UNITE time slots for specific actions, such as testing a specified communications protocol. 'For a simulator, for example, one time slot may have an actual duration of one hour, while for a hardware device that might mean just milliseconds,' says Mr Kormentzas. 'But it's all synchronised according to the UNITE time slots.'

The UNITE controllers also maintain a database of prior simulations that can be accessed through the VDT. The team recognised the importance of easy access to the database and intuitive ways to view results. 'We had to find a way to navigate through thousands of results from hundreds of algorithms and be able to illustrate those results in a friendly way, explains Mr Kormentzas.

The controllers also manage the stand-alone simulators that perform the actual tests and simulations. Right now, UNITE links researchers to seven different simulators scattered across Europe. Its generic design ensures that new tools can readily be added to the system. 'The tools are distributed all around Europe,' Mr Kormentzas says, 'but in terms of your access to the virtual testbed, you feel that you have everything in your own lab.'

With UNITE up and running, Mr Kormentzas now hopes to get more communications companies and researchers to link to the platform. 'We have to convince the research community that it is to their advantage to share their tools and findings,' says Mr Kormentzas. 'The more UNITE is recognised, accepted and used, the more tools and results it will offer and the more effective it will be?

Promoted through the ICT Results service.

Reality gets hyperlinked

European researchers can now attach hyperlinks to pictures you take using your mobile phone. It offers the prospect of new ways to discover, engage and navigate your surroundings.

You wake up in a strange city with no recollection of how you got there and no information about where you are. Demonstrating nerves of steel, you calmly pick up your mobile phone and take a picture of the streetscape.

Quickly, the picture comes alive with hyperlinks, offering the names of the buildings, monuments and streetscape features that appear in the photograph. The hyperlinks lead to information about the history, services and context of all the features in the photograph. You have just hyperlinked your reality.

That scenario might be a little far-fetched, but the technology exists and is no figment of some fevered imagination. This is not a gee-whiz gadget invented by Q for the next James Bond movie; this is a working technology just developed by European researchers. It could be coming to a phone near you, and soon.

This, as the marketing types say, is a game changer. It develops a completely new interface paradigm that meshes web technology with the real world. It is big and fresh like Apple's game-changing multitouch interface for the iPhone. But it goes much further and has implications that are much more profound.



The Mobvis platform completely rewrites the rules for navigation, exploration and interaction with your physical environment. It identifies the buildings from a photograph you take in an urban environment and then places icons on points of interest.

Then you simply click on the icon, using a cursor or, more frequently, a touch-screen phone, and the Mobvis system will provide information on the history, art, architecture or even the menu, if it is a restaurant, of the building in question.

Mobvis stands for 'mobile attentive interfaces in urban scenarios' and is the brainchild of the EU-funded Mobvis project, a team of engineers and scientists who have successfully demonstrated the technology working in a real environment, with real users unconnected to the project. The project's work is all the more remarkable because image recognition technology has long been pregnant with promise, but seemed to suffer from an unending labour.

Now Mobvis has not only developed image recognition. It has also developed compelling applications for the technology, and it has done so in the most striking and visible manner by adapting it to the world's most ubiquitous technology: the mobile phone.

> The system begins with geo-referenced panoramas, photographs that populate a database to establish points of reference in the streetscape. These panoramas form the basis of a city database. It can match buildings, monuments, banners and even logos that appear in the panoramas. Information relating to individual buildings or monuments is then added to the database manually.

> > Once annotation is complete, it is ready to take queries from mobile users. A user simply takes a picture of the streetscape, Mobvis compares the user's photograph to the reference panoramas and the relevant links are returned.

It is as if your picture becomes desktop background, with icons attached to each feature that you can click to navigate the history and culture of the location, or shopping opportunities in front of the user.

This is a lot trickier than it might first seem, because photos are taken in all kinds of light and weather, often at odd angles, and many buildings in Europe's most beautiful cities, like Graz, Austria, actually look quite similar. How can the system tell them apart, and how can it be sure it is the right building?

This is where the Mobvis demonstrates its greatest strength and most impressive advance over previous image-recognition technologies. The matching system is cloaked in impressive, intimidating technical concepts, like local invariant feature detection, epipolar geometry and planarity constraints.

But the genius of the system boils down to a higher-dimension, feature-matching algorithm developed by the University of Ljubljana in Slovenia, one of the partners of the project. It can very accurately detect minute but telling differences between similar objects, such as buildings or monuments, both by the appearance of the buildings themselves and their context in the streetscape.

For example, if a building with a particular geometry is beside a bridge, but not neighbouring a department store, then it must be building X. That marks the spot for the relevant information stored in the database, which is rendered as an icon. It sounds perhaps a little improbable. How could such a system produce reliable results?

In fact, it is remarkable just how accurate this technology turned out to be in real-life tests. Users were given a five-minute instruction by an outside contractor, and then sent around to explore the city of Graz with their mobile phones. The system reliably detected the right building 80 % of the time, a figure that Aleš Leonardis, head of the Ljubljana team, is convinced can be improved.

'But that's not the most remarkable result of the prototype test,' stresses Mr Leonardis. 'It was remarkable that there were no false positives. Sometimes the system couldn't identify a building, but it never put the incorrect link on a building.'

So the system wasn't always right, but it was never wrong. Sometimes, about 20 % of the time, it just did not know. This was its first live test. It is a notable achievement, and promises rapid deployment in commercial applications.

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Optical firewall aims to clear internet security bottlenecks

European researchers are developing the world's first optical firewall capable of analysing data on fibre optic networks at speeds of 40 gigabits per second (Gb/s). Their work promises to save the internet from the looming threat of network security bottlenecks.

As demand for data-intensive services such as video-on-demand and online gaming increases, telecommunications providers are expanding the high-speed fibre optic networks that form the backbone of the internet. But while network performance has improved, the electronic processes and algorithms used to filter data for security threats are struggling to keep pace.

With demand for data-intensive services only likely to intensify further in the future, bottlenecks seem inevitable unless security processes can be implemented at optical network speeds.

'The amount of data being transmitted can and will get much higher as data-intensive services become more commonplace,' says Graeme Maxwell, the Vice-President for Integration Technologies at CIP Technologies in the United Kingdom. 'Even with mobile phones, the data sent over 3G networks ends up on a fibre optic cable very quickly, in as little as two or three hops ... It's the data analogy of many little streams quickly feeding into a river and causing a massive flood.'

Add to the growth of wireless communications the expansion of fixed-line and cable broadband services in homes and offices, and, according to some estimates, traditional electronic security processes will soon be unable to cope. 'There is a real need for an optical security solution — and that is what we are developing,' Mr Maxwell says.

Working in the EU-funded Wisdom project, Mr Maxwell leads a team of researchers who have demonstrated novel optical circuits capable of searching for and identifying target data patterns at wire speeds of 40 Gb/s — the

fastest data rate of current commercial networks. Using custom algorithms, their groundbreaking optical firewall looks for patterns in the header content of data packets (the part of the data containing information about the sender, recipient and format) to single out possible viruses, attacks or other threats.

'Our goal is not to replace electronics with optics but to complement existing security processes,' Mr Maxwell notes.

The Wisdom firewall acts as a kind of primary, high-speed filter that routes suspect packets to electronic processes for further analysis. It is able to carry out optical packet

recognition, interrogation and manipulation of data streams incorporating features of parity checking, flag status, and header recognition. And, because there is no optical equivalent of electronic memory, the entire process has to be carried out on the fly.

Described as an 'optical firewall on a chip', the system is built on a state-of-the-art hybrid integrated photonic technology platform, developed by CIP, in which silica-on-silicon circuits form an optical equivalent of an electronic printed circuit board (PCB). Much like a PCB can host different electronic components depending on its intended use, different optical and optoelectronic components can be fitted to the optical circuit board, resulting in a cost-effective and scalable solution.



The hybrid boards can also be fitted with components fit for other uses, with the Wisdom project partners foreseeing applications in sensor systems, avionics, data transmission and optical processing, as well as network security. 'Think about all the applications for today's electronic PCBs — they are everywhere! Optical boards could have a similar range of uses in the future,' the project coordinator says.

Indeed, Mr Maxwell expects the first commercial application of the boards to be for data transmission over fibre optic networks, with their implementation for network security likely to follow within the next five years. 'The Wisdom project is demonstrating the functionality of an optical firewall, hopefully to the point where we can bring additional manufacturers onboard in a follow-up project,' Mr Maxwell says.

He admits that the idea of an optical firewall is still a new concept to many in the network security sector. 'There are barriers to its acceptance that need to be overcome,' he notes.

However, having survived the bursting of the dot.com bubble eight years ago that led many research groups trying to develop optical security solutions to disband, the research team, which launched the Wisdom project in 2006 with funding from FP6, are well placed to rise to the challenge. And, with the recent boom in data-intensive services, their solution is likely to be in high demand.

Promoted through the ICT Results service.



New procedures for environmentally friendly flying

New approach and departure procedures were developed to reduce aircraft noise and emissions around airports. These took into consideration capacity and safety issues, and acceptance by stakeholders.

Aircraft noise and emissions have become major issues for communities which surround Europe's airports. The problem is expected to become more serious due to continuing growth in air traffic. However, if new noise-friendly procedures are to be implemented, it should be done at the European or even worldwide level. The 'Sourdine II' project involved stakeholders and an expert panel in the development of new approach and departure procedures in order to reduce the environmental impact of aviation around airports.

The new procedures were assessed according to noise, capacity, safety and acceptance. This was achieved through the use of computer models, tools and simulators. They revealed that all 'Sourdine II' procedures significantly reduced noise compared to conventional practices. Single event simulations showed an improvement of around five A-weighted decibels (dBA). Research-



ers carried out an impact study on residents living around Madrid-Barajas airport in Spain. The study showed that all four approach procedures resulted in lower impacts for the surrounding population.

Researchers found that implementation of the 'Sourdine II' approach procedures could result in a decrease in an airport's peak hour capacity. However, this reduction would only be a problem during those operations where demand exceeds capacity. It was assumed that departure procedures would have no influence on capacity.

The use of parallel runways with continuous descent approach (CDA) procedures was highlighted as a safety issue. This was because it did not reflect current International Civil Aviation Organisation (ICAO) guidelines. A possible solution was for the aircraft to perform a curved approach, based on an approach procedure with vertical guidance (APV). This generally required the use of augmented satellite navigation systems.

Airport approach and departure procedures, aimed at reducing the impact of noise and emissions around airports, required a coordinated solution from all stakeholders. Such procedures should be introduced on a large scale through European and international harmonisation. This avoids the need to develop tailor-made procedures for each airport, which could increase the risk of pilot error when flying and using many different procedures.

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

Collaboration sought: further research or development support. http://cordis.europa.eu/marketplace > search > offers > 4976

Child neck simulation model

An anthropomorphic child neck model was designed in order to heighten awareness regarding child restraint design, evaluation testing and regulation.

Although vast research had been previously conducted on adult vehicle occupant safety, the same was not true regarding children. In light of this, the CHILD project delved into the area of child restraint testing and regulations which has produced highly useful real world crash injury data. Additionally it has resulted in the output of real and virtual reconstructions and child-based simulation methods and tools.

As part of the simulation methods, child dummy models for particular body segments were developed to assist in determining injury criteria and risk curves. One example is the child neck model based on the geometry of an existing adult model but tailored according to a three-year-old child. The scaling process was necessary so that the finite element model dimensions could resemble the physical model as closely as possible.

Anatomical parts that were modelled through the use of non-linear shock-absorbing springs included the head, vertebrae and major ligaments. In order to extract the soft tissues and bones in the reconstruction, the images were initially semi-automatically segmented. Following this, different bones were separated one slice at a time on the previously reconstructed model. Once the anatomical structures were acknowledged, each vertebra was reassembled independently and attention was given to each process. A polymer physical model of the bones was possible with the use of a prototyping machine and can be used as a geometrical reference.



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

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

••• • • INDUSTRIAL TECHNOLOGIES

Soft hardware for a flexible chip

Technology is struggling to meet demands for high-performance, specialised computing systems. A European consortium is responding with a new kind of reconfigurable chip that is both efficient and flexible.

Computers are everywhere, from washing machines to medical body scanners, from MP3 players to air traffic control systems. Yet as these specialised 'embedded systems' become ever-more common, the technology is struggling to keep up with the demand for computing power.

Pressure is coming mainly from high-performance applications that need to process huge amounts of data in a short time. Examples include digital video processing, telecoms, and military applications. 'This kind of equipment needs high computing performance for signal processing and for making decisions,' says Philippe Bonnot of Thales Research and Technology Ltd, who is coordinating the Morpheus project. 'But the solutions are not as efficient as we would like.'

The challenge is to design embedded systems that are both efficient and flexible. A normal microprocessor is cheap and flexible and can be used for many applications, but with power consumption at around 100 watts (W) it is not an efficient use of energy and cannot be used in a confined space.

On the other hand, a circuit designed specifically for one application, known as an ASIC, can be extremely efficient but totally inflexible. For that reason, they are very expensive to design and manufacture. 'Another type of device, called an FPGA [field-programmable gate array], is a partial solution but difficult to use in practice because of the hardware programming skills required,' Mr Bonnot says.

The EU-funded Morpheus project, which includes big manufacturers of embedded

systems such as Thales, Thomson, Alcatel-Lucent, STMicroelectronics and Intracom, is exploring a new approach. 'We tried to solve all these problems by merging a processor with reconfigurable units embedded in the same component,' says Mr Bonnot. 'We think we can both have the flexibility and the efficiency.'

Reconfigurable hardware can be programmed to connect itself in many different ways. When a new application is required, the hardware can be modified just as a piece of software can be altered to do a different job. 'The reconfigurable technology makes specific solutions possible. You can design exactly what you need so you are efficient, but it's reconfigurable so you can reuse the component for another application.'

Several different types of reconfigurable building blocks have been integrated into the chip to increase the range of possible applications. 'The flexibility we have in the chip is even higher because we inserted an operating system which can modify the configurations of the building blocks at runtime,' Mr Bonnot explains. 'So, during execution, we can modify the functions that are implemented in the reconfigurable units.'

This design means that the chip is more complex to program but the project has developed a set of programming tools to help.

A design company would be able to take a Morpheus chip and configure it to do exactly what a customer requires. It would have the advantages of an ASIC but would be cheaper as it could be manufactured in large numbers.





Applications examined in the project include professional video processing, broadband wireless access systems, network routing applications, and many defence and security systems such as 'smart' cameras. The chips could also have wide application in multimedia, communication, instrumentation and robotics. What these applications all have in common is a need for intensive data processing in real time and in a compact space.

Early in 2009, partner STMicroelectronics produced the first prototypes of the Morpheus chip. It contains 97 million transistors and is expected to consume no more than 1 W of power.

The chip will be integrated into several application boards for testing by the larger industrial partners. Video and network applications will be a priority. 'It will be interesting to see if this new approach can really attract the interest of our companies,' says Mr Bonnot. 'It's almost a new kind of paradigm.'

He expects there will be several modifications to the prototype before it can be considered for commercialisation. In the meantime, the SMEs in the project may be able to market one of the reconfigurable units and a compiler.

There is still more to do. Mr Bonnot points out that the silicon technology used in the chip is several years old. 'We only used 90 nanometre technology,' he says. 'So with more aggressive technology we could get some better results — we could put more units on to the chip and we could have a higher clock frequency.'

Promoted through the ICT Results service.

A robot in every home?

Observers like Bill Gates believe that by 2025 we could have robots in every home. In labs across Europe, researchers are creating designs that could become the robo-butler of the future.

Bill Gates likens the current state of robotics research to the earliest days of personal computing history when he formed the then fledging company Microsoft. Like the 1970s personal computer market, robotics designs and breakthroughs are following one another rapidly, and consumers are beginning to take an interest, too.

In Europe as in the rest of the world, there is a surge in robotics research, reflected in part by the European Network of Robotic Research (EURON), an EU-funded network of excellence that completed its work in May 2008. It was an important network. The dozens of research programmes united by EURON represent a state of the art in robotics and a tantalising glimpse of the future.

That glimpse shows that researchers across Europe are creating new designs and tackling fundamental problems that eventually could lead to a world standard for domestic robots. Already enthusiasts are buying kits, making and programming their own robots. In Japan, every year sees a new toy robot, while in the United States commercial robot vacuums like the Roomba are readily available.

But what will the robot butler of 2025 look like? Bruno Siciliano, a European robotics researcher and dissemination officer for EURON, believes there will be many different types of robots adapted to different purposes. 'In robotics, we have a whole taxonomy of robotics, differentiating field, service and industrial robots, and in the future there will be many designs for each of these domains,' he says.

In the domestic sphere, robot designs will range from the discreet vacuum cleaner that hides under a chair until required, to the fully realised mechanical maid. Current European research reflects this variety.

For example, the TAMS Service Robot created by the informatics department of Hamburg University, Germany, is an unwieldy but powerful creation that is helping researchers to develop robots that can grasp objects, operate light switches or open a door. 'One of the most interesting aspects of the TAMS Service Robot is that it coordinates mobility with two moving arms. With most robots, either the whole platform moves or their arms move, not both at once. But the TAMS Service Robot can move itself and its arms at the same time. This is a non-trivial problem and their work is very interesting,' explains Mr Siciliano. The Quirl is a precursor of the robotic appliance. It looks nothing like a robot that one would imagine. Like the Roomba vacuum robot it is a simple, flat device that moves in a two dimensional world. But it moves vertically, along glass, and cleans the windows as it goes along. It may not look like C3P0, but it indicates just how useful robots could be in the home or office of the future, particularly given the fact that, for example, solar panels work much more effectively when they are clean.

The Quirl is truly a breakthrough for the designers, the Fraunhofer Institute for Manufacturing Engineering and Automation IPA in Stuttgart, Germany. When they began the quest for a window-cleaning robot, their first design weighed 6.5 kg and was A3 in size. But the Quirl is the size of a postcard and weighs an incredible 600 g. And it still cleans windows effectively.

With Quirls, Roombas and lawn-cutting robots multiplying, there will be a need to organise the mechanical workforce, and the Applied Autonomous Sensor Systems Lab at Orebro University Sweden is working on an ecology of physically embedded intelligent systems (PEIS).

The PEIS ecology coordinates a wide variety of robots, whether it is artificial intelligence in a refrigerator or a roaming butler. That researchers are already working on a 'field marshal' for the mechanical workforce is an indication of how rapidly domestic robotics is developing in every direction.

James is a robot butler that looks like a mechanical version of 'the hand' from the movie and TV series *Adams Family*, but it can negotiate its way around obstacles and can grasp objects. It could lead to the development of assistive robots for the tetraplegic, for example.

Robots that work with and around humans will need to obey Asimov's laws of robotics, and European researchers are working toward that end. The Kuka lightweight robotic arm is the first robot to obey Asimov's first law of robotics: 'A robot may not injure a human being or, through inaction, allow a human being to come to harm'.

The Kuka is safe in several respects. It is incredibly lightweight for its power, it weighs just 13 kg and it can lift its own weight. 'Normally a robot arm that can lift 13 kg would weigh 100 kilos or more,' explains Mr Siciliano. So the Kuka is passively safe, in that it does not have the mass that usually causes injuries.

But the Kuka goes further; it carefully tracks its motion, using sensors in its joints. Finally, if the robot comes into contact with an object or person, its motors immediately start reversing direction, an impressive active safety system.

Systems like these will be absolutely essential if robots are to acquire the safety and reliability needed for widespread acceptance in the domestic sphere. Fortunately, European researchers are turning their attention to every aspect of domestic robotics.

This is the third of a four-part special series of features exploring European robotics research. You can read the final part in the next issue of the research*eu results supplement.

Promoted through the ICT Results service.



Best molecularly imprinted polymers to detect plasticiser

Researchers have devised the optimum recipe for an assay based on molecularly imprinted polymers to detect various endocrine disrupting compounds (EDCs), including a common plasticiser. To achieve this, a complex set of trials to explore the best possible combination of assay parameters was designed.

EDCs and their omnipresence in food chains at all levels are of great concern. One EDC, di(2-ethylhexyl)phthalate (DEHP), is present in virtually all environments because it is used in plastics as a softener. Although normally present at low levels, it is also believed to be a potential carcinogen. Members of the EU-funded project Mendos aimed to design artificial biorecognition layers in the form of molecularly imprinted polymers (MIPs) for detection of EDCs. The ability to design an appropriate polymer makes this an extremely potent form of enhanced monitoring scheme.



The essence of the MIP is that the polymer is formed in the presence of the target molecule which is later extracted to leave a gap. The polymer then has a resulting affinity for the molecule being assayed. Project partners at the Institut für Wasserchemie in Munich, Germany, performed trials varying the available parameters of the process. These included three different means of polymerisation, and the cross-linker and the porogen used in the polym-

Generating high-contrast laser pulses

In the last few years, intense research has been conducted on applications of ultra-short laser pulses. To avoid going towards very large and costly facilities to support a number of applications involving probing dense matter, the SHARP project has achieved significant improvements in existing laser facilities.

Modern titanium-sapphire laser systems can emit light pulses with a duration well below one trillionth of a second (1 femtosecond) and incredible high intensity. This unprecedented evolution in the generation of laser pulses has created exciting opportunities for physics experiments that can probe unexplored domains, including laserassisted acceleration of ion beams.

Nevertheless, a low-intensity background the so-called pedestal — preceding the main laser pulse has been linked to the destruction of targets before any interaction with the ultrashort laser pulse takes place. To reduce this harmful background light, the SHARP project was funded under FP5 to develop new techniques combining laser amplifiers with robust filters.

Discrete steps were pursued by researchers at the Max Planck Institute of Quantum Optics in Germany to improve the contrast in their own advanced titanium-sapphire laser facility. First, seed pulses from the titanium-sapphire oscillation of two laser sources were amplified and then compressed to recover laser pulses with a duration of a few femtoseconds.

When the femtosecond laser pulses were transmitted through a coloured glass filter that acted as a non-linear temporal filter, the pedestal was partially removed. With the use of Pockels cells rotating the polarisation

of the passing light beams, the pulses' duration was also restricted to less than 10 nanoseconds.

To maintain their high contrast and the broad spectral bandwidth, an optical parametric chirped-pulse amplifier (OPCPA) was installed without making major changes in the original laser system. Pulses pre-amplified by the OPCPA were further amplified by means of multierisation. Three different EDCs were used as templates. Only one functional monomer was selected for the formation of the polymer, methacrylic acid (MAA).

The use of DEHP as template molecule in combination with MAA and ethylene glycol dimethacrylate (EDMA) as a cross-linker yielded a polymer which exhibited most significant selectivity. On the grounds of the results, DEHP-MIPs were prepared using bulk polymerisation for the molecularly imprinted solid phase extraction. Mixtures of 19 EDCs were then evaluated. A concentration of 24 ng in 1 litre of water is the assay limit of detection (LOD) to ensure a robust signal-to-noise ratio of threefold for DEHP.

The precise effects of toxins on living systems are extremely hard to unravel given the complexity of food webs and physiology of animals and plants concerned. Research of this nature can be invaluable in the quest to ascertain the impact and levels of safety, not only for EDCs but also other pollutants.

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

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

http://cordis.europa.eu/marketplace > search > offers > 4906

pass titanium-sapphire amplifiers, cooled to temperatures lower than 100 kelvin (K) to suppress any thermal distortions.

These steps resulted in the first titaniumsapphire laser system to yield a contrast greater than 10 orders of magnitude between the main laser pulse and background light within a few picoseconds.

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

Collaboration sought: further research or development support.



Detecting elements detrimental to the performance of turbine blades

Coatings for turbine blades, such as those found in the engines of airplanes, protect the blade material against high-temperature oxidation and corrosion by forming protective scales. To evaluate the composition of these materials, an EU-funded project has developed a robust means of non-destructive measurement of sulphur and trace element concentrations.

The ultimate aim of the Ordico project was simple: improve the balance of oxidation and fatigue protection offered by diffusion coatings deposited on the surface of metal superalloy components. For this purpose, the composition of straight aluminium and platinum-aluminium diffusion coatings was modified, as well as the small additions of active elements used for retarding corrosion and oxidation.

The performance of the produced coatings was investigated under well-defined thermal and mechanical loading conditions in the laboratory. Scientists at the Technische Universität Braunschweig in Germany collaborated with the Ordico project consortium in providing an in-depth understanding of the extent to which composition contributes to better coating qualities.

The coatings' composition at particular depths was identified by analysing the pro-

files of layered materials obtained with the use of glow discharge optical emission spectrometry (GD-OES). The GD-OES technique is relatively inexpensive and is based on monitoring light emissions of characteristic wavelengths after sputtering the sample surface with ionised argon atoms.

When compared to standard methods used for the detection of trace elements in surface coatings, GD-OES proved to be a powerful and reliable technique. However, precise calibration was essential to guarantee reliable results even at extremely low concentrations of sulphur and other trace elements that can be detrimental to the performance of diffusion coatings.

Several European laboratories participated in the joint effort initiated for the establishment of common standards for the analysis of multicomponent diffusion layers. The Ordico project partners' hope for the future



is to phase out current methods for material analysis in favour of the GD-OES technique. The possibilities for international standardisation activities are therefore being explored.

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

Collaboration sought: joint venture agreement; marketing agreement.

http://cordis.europa.eu/marketplace > search > offers > 4907

The answer is blowing in the wind — new rotor models

Wind energy researchers used advanced computer models to gain new insights into how air flows around the rotor blades of wind turbines. This information was used to develop new models, resulting in more efficient and safer turbines.

The EU is committed to substantially increasing its capacity for wind power from turbines based on land and offshore. However, a number of previous studies have revealed uncertainties in the calculation of design loads. The result has been the need for high safety factors in the certification process to counter this cause for design risk.

This problem, however, becomes more serious as turbines become larger and more costly. Therefore, it is of major importance to the European wind industry that these uncertainties and risks are reduced. This challenge was addressed by researchers from the Energy Research Centre of the Netherlands (ECN) through the auspices of the Mexico project.



As the size of wind turbines increases so do the investment costs, which have been matched by an equally growing demand for greater reliability in design methods. Scientists and engineers from the Mexico consortium therefore worked to reduce the existing level of uncertainty regarding the modelling of rotor aerodynamics. The study revealed new insights into the aerodynamic behaviour of wind turbines. These findings were included in new aerodynamic models and provide information regarding the models' accuracy.

Researchers analysed the results and compared them with existing engineering models, and used advanced Navier-Stokes equations which describe the flow of air around the rotor. These fresh findings were developed through the use of models and applied as new computer codes. The validation of the data provided valuable information regarding the accuracy of current models, resulting in a reduced safety factor.

The work of the Mexico team has also contributed towards EU goals for sustainability and a reduction in carbon dioxide (CO_2) emissions by promoting renewable energy. This, in turn, has contributed to the quality of life within the region. The knowledge gained through active participation in the project has also given project partners a competitive advantage in the international wind energy market.

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

Collaboration sought: information exchange/training.

Acoustic oscillation in combustion systems

Flow measurements were studied in the combustion system of gas turbines in order to better understand their sensitivity to acoustic excitation. The findings contributed to the development of improved low emission aircraft engines.

Aero-engine manufacturers in Europe have collaborated on a key research programme to develop new low-emission combustor technology. The benefits associated with this work include a reduction in air pollution and noise, thereby improving the quality of the environment. All low emissions, combustion systems suffer from acoustic instability which has hindered the wider application of this technology.

The objective of the Muscles project was to identify aerodynamic features within a gas turbine combustion system. These features can be influenced by pressure fluctuations due to heat release. Under certain frequencies, this phenomenon can behave as a feedback mechanism, magnifying oscillations linked to uneven heat release. Researchers therefore measured different areas of the combustor's aerodynamic flow field to determine the velocity of the flow at a given point in space and time. This information was used to establish the system's sensitivity to acoustic excitation. The work was carried out in two stages. In the first phase, fuel injectors for low-emission combustors were studied on their own. This included axial injectors which were laid out in a line and radial injectors which radiate from a point like the spokes of a bicycle wheel. The measurements initially only involved the flow of air. The response to excitation by each injector flow field was characterised for a range of frequencies ranging from 50 to 1 500 hertz (Hz).

Liquid fuel was simulated by introducing water via the injectors and then taking the

flow measurements. Laser light sheeting imaging helped to visualise the break-up of fuel downstream from the injector. The information was used to identify the effect of excitation relative to random fluctuations to the fuel spray. Researchers observed periodic fluctuations to the fuel spray at different frequencies. These changes matched the flow field response identified during the initial measurements, which only used airflow.

During the second phase, the effects of excitation on the overall combustion flow field were studied. Measurements were carried out using an aero-style gas turbine system and included a prediffuser, dump cavity and flame tube. The evaluation showed how the regions of the combustor, including the flame tube and internal flow field, were affected with regard to acoustic oscillations.

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

Collaboration sought: further research or development support.

http://cordis.europa.eu/marketplace > search > offers > 4999



New ESA invitation to tender — business opportunities targeted at SMEs

The dynamism, flexibility and innovative capabilities of high technology SMEs are of high value to Europe's space industry. The European Space Agency (ESA) actively encourages this industrial group to become involved in its space programmes.

The aim is to enable ESA, and the European space industry, to tap into the potential of innovative SMEs and to open up opportunities for them to work more extensively with ESA and its space contractors.

Under its LET-SME instrument (LET stands for leading edge technology and SME indicates that small and medium-sized enterprises are the main target of this call), ESA has issued an announcement of opportunities (AO6037) calling for innovative technology proposals and solutions.

The aim of the LET-SME instrument is to foster spin-in of SMEs' technologies in fields where ESA strives for innovation and new ideas. As innovation is often the result of cooperation between SMEs and research organisations with established expertise in technology, these organisations may also participate but as subcontractors of SMEs.



The LET-SME programme is therefore open not only to SMEs who already have a significant business commitment to the space industry, but also to SMEs operating in other industries, and who feel they are in a position to address technology challenges which will maintain Europe at the forefront of scientific and commercial endeavours in space.

The proposals called for are to be focused on feasibility demonstration of new technologies, or on improvement of existing

ones, provided this improvement is clearly substantiated.

The announcement of opportunities addresses the following technology areas:

- on-board data systems;
- space system software;
- electromagnetic technologies;
- life & physical sciences;
- mechanisms & tribology;
- optics;
- propulsion;
- materials & processes.

The deadline for submission of tenders is Friday, 18 September 2009, 13:00 Paris time.

For further information about the invitation to tender, please visit: http://emits.esa.int

Please refer to invitation to tender number AO6037.

EVENTS

The following upcoming events were selected from the event diary of the Directorate-General for Research and from the CORDIS event calendar. For further information on past and upcoming events, please visit:

http://ec.europa.eu/research/events http://cordis.europa.eu/events

Conference on natural dynamos

A conference on natural dynamos will take place in Stará Lesná, Slovakia, from 30 August to 5 September 2009.

Planned sessions include:

- geodynamo and magnetohydrodynamic processes in the Earth's core;
- dynamos and magnetoconvection in planetary interiors;
- solar dynamo and magnetoconvection;
- hydromagnetic instabilities and dynamos in astrophysics;
- laboratory experiments.

The event is jointly organised by the Institute of Geophysics of the Academy of Sciences of the Czech Republic, the Geophysical Institute of the Slovak Academy of Sciences and the Department of Astronomy, Physics of the Earth and Meteorology (DAPEM) of Comenius University, Bratislava.

For further information, please visit: http://rebel.ig.cas.cz/Tatry2009

Conference on space research

The 'Ninth Ukrainian conference on space research' will be held from 31 August to 5 September 2009 in Yevpatoria, Ukraine.

Topics of the conference will include:

- solar-terrestrial physics and space weather;
- space exploration projects and prospects;
- study of the Moon and lunar environments;
- electromagnetic and gravity fields, ionosphere, dust and particle emissions;
- remote sensing of celestial bodies and utilisation of remote sensing methods in planetology;
- life and microgravity science for exploration missions;
- search for extraterrestrial life, production of materials, biomedical research.

The conference will also include a roundtable on the 'Exploration-UA' programme and Selena mission, as well as a school for young scientists and a workshop on space research.

For further information, please visit: http://www.nkau.gov.ua/ukrspace09/index.html

Conference on parallel computing

An international conference on parallel computing, entitled 'ParCo 2009', will take place from 1 to 4 September 2009 in Lyons, France.

The programme combines keynote and contributed papers, mini-symposia on advanced topics and an industrial exhibition.

The conference aims to give an overview of the latest developments, applications and future trends in high-performance computing for all platforms. Further, the event addresses the various aspects of parallel computing, including applications, hardware and software technologies, as well as languages and development environments. Special emphasis will be placed on:

- the role of high-performance processing to solve real-life problems, including scientific, engineering and multidisciplinary applications;
- innovative directions in high-speed and large-scale computing, strategies, experiences and conclusions.

For further information, please visit: http://www.ens-lyon.fr/LIP/ParCo09-3

Workshop on the restoration of fish populations

The 'International workshop on the restoration of fish populations' will take place from 1 to 4 September 2009 in Düsseldorf, Germany.

This conference is intended to provide an opportunity to bring together experts from all around the world to exchange experiences and technical data, improve and optimise current fish restoration projects and plan for the future. The key aim is to synthesise international knowledge on fish restoration by facilitating the presentation of research results from a number of different disciplinary fields.

The workshop will be hosted by the 'The re-introduction of allis shad (*Alosa alosa*)

in the Rhine system' project, funded under the EU's Life programme. The allis shad fish species died out in the Rhine river in the first half of the 20th century, and the project aims to restore it.

For further information, please visit: http://www.lanuv.nrw.de/alosa-alosa/int/tagung_2009

European cancer cluster event

The Cancer-Bio-Health Cluster and the Oslo Cancer Cluster are organising the 'European cancer cluster (ECC) partnering 2009' event to take place on 3 and 4 September 2009 in Toulouse, France.

The event will bring together business representatives, investors and scientists from the fields of diagnostics, therapeutics, drug delivery, medical devices and medical imaging.

Keynote speeches, presentations and discussion roundtables will address such topics as:

- evaluating the oncology industry;
- building partnerships with investors;
- the 'Innovative medicines initiative' (IMI).

Beyond that, the aim is to build a 'Europe of the cancer clusters' and to support companies, spin-offs, SMEs and large pharmaceutical enterprises in building new partnerships.

For further information, please visit: http://www.eccp2009.com

Conference on biomethane fuel

The EU-funded Biogasmax project will be hosting the 'European biomethane fuel conference' from 7 to 9 September 2009 in Gothenburg, Sweden.

Over the past three years, Biogasmax has implemented cross-analysis, research and innovation developments on biomethane as a vehicle fuel. This conference will focus on the outcomes of the project. The event will also offer the opportunity to participate in study visits and to discuss with those having hands-on experience.

During the conference, participants will have the opportunity to meet and network with a wide range of stakeholders involved in the production and use of biomethane, both informally and through expert panel sessions.

For further information, please visit:

http://www.biogasmax.eu/european-conference-onbiomethane

Conference on energy efficiency in motor-driven systems

The sixth international conference on energy efficiency in motor-driven systems (Eemods '09) will be held from 14 to 17 September 2009 in Nantes, France.

The event will provide a forum to discuss and debate the latest developments in the impact of electrical motor systems on energy and the environment, adopted and planned policies and programmes, as well as technical and commercial advances made in the dissemination of energyefficient motor systems. Particular attention will be given to energy management, international harmonisation and standards, and innovative financial schemes for motor systems.

The Institute for Energy at the European Commission's Joint Research Centre (JRC) is responsible for the scientific programme of the event.

For further information, please visit: http://www.eemods09.fr

Call information day 'The ocean of tomorrow'

The European Commission is organising an information day on the upcoming call for proposals dubbed 'The ocean of tomorrow' on 16 September 2009 in Brussels, Belgium.

Participants will learn about the rationale of the call, its modalities for implementation and the three individual call topics. Experts from the Commission will address questions about integration and multidisciplinary features. A brokerage session will allow participants to give a short presentation of their project idea and start or join a consortium.

The call for proposals, part of the 'Food, agriculture and fisheries, and biotechnology' theme of the Seventh Framework Programme (FP7), is scheduled for launch on 30 July 2009.

For further information, please download the leaflet: ftp://ftp.cordis.europa.eu/pub/fp7/kbbe/docs/oceaninfoday_en.pdf

Call information day 'FP7-ENV-2010'

The European Commission is organising an information day on the upcoming call for proposals 'FP7-ENV-2010' on 17 September 2009 in Brussels, Belgium.

The info day should be of interest to researchers, research institutions, companies, industry, SMEs, civil society organisations and national contact points (NCP) that may wish to take part in the call.

The aim of the call is to continue supporting the main environmental policy and science and technology (S & T) drivers in the area of climate and environmental change, their consequences and the link to other sectors such as energy, transport, agriculture etc.

For further information, please download the leaflet: http://circa.europa.eu/Public/irc/rtd/rtdenv2010call/ library?l=/programmepdf/_EN_1.0_&a=d

Call information day 'FP7-AFRICA-2010'

The European Commission is organising an information day on the upcoming call for proposals 'FP7-AFRICA-2010' on 18 September 2009 in Brussels, Belgium.

The info day is directed at everyone interested in this call's research opportunities — researchers and research institutions, universities, industry, SMEs, civil society organisations, other non-state actors and national contact points (NCP). Participants from African international cooperation partner countries (ICPC) are particularly welcome.

For further information, please download the leaflet: http://circa.europa.eu/Public/irc/rtd/rtdafr2010call/ library?l=/africa-programmepdf/_EN_1.0_&a=d

Conference on gender and diversity in science, technology and business

On 29 and 30 October 2009, the technical universities of the IDEA League are hosting the conference 'Going diverse: innovative answers to future challenges — international conference on gender and diversity in science, technology and business'. It is the final event of the FP6funded project TandemPlusIDEA, which is conducted by the project partners Imperial College London, TU Delft, ETH Zürich and RWTH Aachen.

The conference will take place at RWTH Aachen University and deal with the different aspects of gender and diversity in technology, science and business. In key note lectures, sessions and poster presentations, it focuses on gender and diversityoriented human resources development, the institutionalisation of gender as well as diversity management and processes of cultural and organisational change. During the two-day programme there will be plenty of time for networking and discussions with international experts from academia and companies, among them several members of the WiST II group.

Participation in the conference is open to all interested scientists and practitioners. The participation fee of EUR 90 includes all material, the conference publication and catering during the time of the conference. Registration is possible until 30 September 2009.

For further information, please visit: http://www.idealeague.org/tandemplus/conference

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