

research^{eu}

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Keeping pace with an ageing society

One of the more obvious consequences of medical progress is the increased longevity of the European population. This, of course, is not surprising considering that science's main goal, in all of its diverse fields of expertise, is to improve the life of humankind wherever and whenever possible. Research has enriched our diets, improved our sanitation and increased our levels of safety.

Yet as our society grows increasingly older, European researchers have been focusing on ways to address the consequences of this demographic shift. Several projects presented in this supplement give an idea of what has been accomplished so far and how research on improving the lives of the elderly might evolve in the future.

The first section dedicated to biology and medicine opens up with a project studying genetic diversity. Researchers in the LD-Europe project have been mapping the human genome in an effort to deliver health benefits in the form of screening, prevention and treatment of common diseases.

The opening article of the energy section introduces the TIME project. A team of scientists has managed to develop a cost-effective and sustainable technology to produce ethanol from forest and agricultural waste. This project is of course significant, as it allows ethanol to be produced without the need for the often criticised dedicated plantations.

In another example of how much can be learned from the past, the lead article in the environment section describes how researchers in the Pacliva project have succeeded in forecasting the future state of the climate by deriving meteorological parameters prior to the introduction of meteorological instrumentation.

New IT applications that seemed like science fiction a few years ago look like they might become widely available in the near future. Such is the case for the topic covered in the introductory article of the IT and telecommunications section. It explains how researchers in several EU-funded projects have successfully developed a virtual environment to experience the feeling of touching an object and moving over its surface.

The industrial technologies section begins with an article describing how engineers in the Clever project have designed a novel lightweight vehicle with attributes that make it low in energy consumption, exhaust and noise emissions, benefiting both the economy and environment.

The events section for its part offers readers a selection of upcoming event announcements in the field of research, including relevant website references.

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Europe's population under the genetic microscope

Human genome research promises to deliver health benefits in the form of screening, prevention and treatment of common diseases. As an integral part of this drive, researchers have conducted a study of genetic diversity in populations across Europe.

The public health bill in Europe is steadily increasing due to factors including the ageing population and mounting costs of technologically advancing treatment. Furthermore, common complex disorders including diabetes mellitus, cardiovascular disease and asthma have become public health problems in Europe. Effective strategies for prevention and treatment depend on population studies focusing on trends of disease occurrence as a result of environmental and genetic factors.



Mapping of the human genome was never anticipated to supply direct answers to common complex disorders in the form of therapy. A complete map supplies a platform on which to base further genomic and proteomic study. Genome wide association studies (GWAS) are presently the main tool for understanding the causes behind disease, especially genetic

factors. The design of efficient GWAS depends largely on knowledge of linkage disequilibrium, haplotype frequencies and other parameters of genetic diversity in European populations.

Armed with 1 million single nucleotide polymorphisms (SNPs) from some 990 individuals, partners from the EU-funded project LD-Europe studied the extent of linkage disequilibrium in 11 populations across the continent. An African population was used as a means of comparison. A standard analysis tool devised by project partners was used for data interpretation and evaluation.

In total, information on 11 regions of the European genome was collated. The data shed light on several aspects of genetic inheritance patterns in the populations. Measures of genetic diversity among the populations were obtained. Linkage disequilibrium (LD) and fine-scale recombination patterns were studied as well as the conservation of LD blocks between populations.

The intricate information compiled in this research can lead to the development of specific therapies. More importantly, further research can lead to the ultimate goal of prevention.

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

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Genetic susceptibility to inflammatory bowel disease

Inflammatory bowel disease (IBD) is a complex, polygenic disorder which mostly affects young people, resulting in a major reduction in their quality of life. Researchers from the 'Genetics of IBD' project used sophisticated genotype-phenotype analysis of target populations to identify the genes responsible for this debilitating disease.

Scientists studied a cohort of 6 000 patients recruited from general practitioners who displayed general gastrointestinal symptoms. They also investigated a population-based cohort of sufferers newly diagnosed with IBD. Additional cohorts included 400 patients with *Helicobacter pylori* positive gastritis and 400 more with hepatitis C, which acted as control groups.

The investigation was based on the phenotype characterisation of the cohorts stud-

ied. Researchers gained greater insight at an individual level through studying genomic polymorphisms, expression and protein patterns, and phenotype characterisation.

The 'Genetics of IBD' team extended the existing database of phenotypic and genetic information. The characteristics of phenotypes were clustered and analysed to the same level of detail as information regarding molecular structure and function. The two most important cohorts were the

6 000 individuals with general gastrointestinal symptoms and the population-based cohort recently diagnosed with IBD.

The information gained was used to assess population-based relative risks in relation to those established environmental factors which cause a predisposition to IBD. Logistical regression was used to determine the effect of these factors and to lay the foundation for a general risk model for the disease. A database integrated information concerning phenotype-genotype and expression and was used as a basis for further studies.

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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Frequent acronyms

ERA European research area
FP5/6/7 Fifth/Sixth/Seventh Framework Programme of the European Community for research, technological development and demonstration activities

ICT information and communication technologies
IST information society technologies
R & D research and development
SMEs small and medium-sized enterprises

Statistical tools for genetic association studies

Statistical tools were developed to help in genetic association studies which employed population-based case-control studies.

Researchers from the Euragedic project used applied genetic association studies to understand the genetic basis of human diseases. This method can determine whether a genetic variant is associated with a particular disease or trait. The scientists took the frequently used approach of a population-based case-control study and applied it to the problem of mixing of genetically differentiated groups within a population. Evidence

of any resulting disease-marker associations were confirmed through alternative techniques.

One such method, the transmission/disequilibrium test (TDT) was used for compiling evidence of association from case-control studies. The odds ratio was used to determine the extent of a disease-marker association and was obtained without difficulty for case-control studies.

The Euragedic team developed statistical techniques to highlight how an odds ratio estimate and its associate standard error were gained via TDT results. Researchers also created techniques for integrating results from case-control studies and TDT to give a combined estimate for disease-marker association. These combined estimates were used to compare the findings from the two studies. They enabled scientists to achieve an overall view of the size of the effect that can be ascribed to polymorphism.

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

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Common genetic variation in kidney disease

The onset of complications in kidney disease is influenced by genetic factors. An inventory was therefore made for common genetic variation in 150 genes for cardio-vascular complications.

The aim of the Euragedic project was to discover which genes and pathways were involved in the development of diabetic complications in humans and rodents. In order to realise this goal, scientists developed an inventory of validated candidate pathways for kidney disease in humans.

This was achieved through physiological and genetic studies for Type 2 diabetes in rodent models. Identification of the genes responsible for the condition has enabled better risk assessment and allowed early intervention and the development of new therapies.

Researchers from the Euragedic project recorded common genetic variation in more than 150 candidate genes for cardiovascular complications through the sequencing of individuals. The result was the identification of more than 2 000 polymorphisms, 60 % of which were newly identified single nucleotide polymorphisms (SNPs).

The frequency of alleles and haplotypes were calculated from data on pooled DNAs. The data is available in two public databases. The first was created by the National Centre for Biotechnology Information (NCBI) and can

be found at <http://www.ncbi.nlm.nih.gov> The second collection of cardiovascular candidate genes and their polymorphisms is available at <http://genecanvas.idf.inserm.fr/news.php>

The challenge of dealing with the huge volume and complexity of molecular data has resulted in new computerised databases and analytical tools. These have been used by the research community to mine massive and complex datasets. The outcome can be a greater understanding of the biological processes involved in health and disease.

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

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Documenting rehabilitative therapy sessions

As part of a collaborative project with the overall aim of improving the quality of rehabilitation of stroke patients, a scoring catalogue was developed. This scoring list allowed for comparisons to be made between the content of individual therapy sessions conducted in different settings.

The Cerise project was the title given to the EU-funded study which examined the impact of rehabilitation on the pattern of recovery after a stroke. Case studies were based on six stroke rehabilitation centres across Europe. The aims were to compare the patient outcomes across the rehabilitation centres, examine the differences in amount and content of therapy and improve knowledge of the management of stroke rehabilitation therapy, thereby minimising long-term activity limitations of patients.

As part of the evaluation of the recovery process, researchers undertook various studies. The development of a scoring catalogue was integral to evaluating the treatment of the patients. Researchers developed this catalogue, which defined the content of individual physiotherapy and occupational therapy sessions for stroke patients.

Forty stroke patients were monitored during their treatment sessions. The researchers on site were able to record and compare the frequency of occurrence of the categories identified in the score list. The scoring catalogue was reported to be a reliable tool and aided the comparison of the in-patient rehabilitation settings.

The results of the studies undertaken as part of the project were disseminated in various ways. A scientific paper was written, and the results were also presented at the European Congress of Physical and Rehabilitation Medicine in Spain.

For further information, please visit: <http://faber.kuleuven.be/onderzoek/dep3/neuro/cerise>



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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Genetic links for abnormal kidney development

Childhood end-stage renal disease is a rare but distressing disease with poor life expectancy and quality of life. Researchers from the EU-funded project Escape_trial studied mutations in two particular genes associated with abnormal kidney development.

Chronic renal failure in children as opposed to adults is primarily due to congenital inherited abnormalities. As a route to untan-

gling the genetics behind childhood renal failure, Escape_trial investigated mutations in BMP4 and SIX2, genes coding for morphogenesis in the urinary system.

The gene BMP4 both inhibits and promotes urinary system development. Kidney formation is prompted by the ingrowth of the Wolffian duct-derived ureteric bud. The protein Bmp4 prevents abnormal budding from the Wolffian duct. It also promotes kidney development by stimulating growth along the branching ureter.

The project team at the University Hospital for Paediatric and Adolescent Medicine in Heidelberg, Germany, investigated for the first time in research circles mutations occurring in the genes BMP4 and SIX2. Five unrelated children with severe renal hypodysplasia (RHD) were studied for mutations in each of the two genes.

Analysis of ribonucleic acid (RNA) of the BMP4 mutants revealed that there was reduced messenger RNA expression as compared with the normal form of the gene. This tends to suggest that there is either instability in the system or a form of negative feedback on the mutated gene's own RNA production.

Protein analysis showed that one form of BMP4 mutation caused the production of irregular protein complexes possibly due to the presence of extra disulphide bonds. It would appear that the pathology of human RHD is linked to abnormal protein-protein interactions.

Moreover, gene knockdown studies show that SIX2 is also an important gene in kidney development. A deficit of protein SIX2 leads to the congenital defects observed in RHD patients.

Exact confirmation of the molecular structure of the proteins implicated was planned in future research. Investigations into the genetic variation and genotype phenotype links can aid in the identification of novel developmental genes.

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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Chronic renal failure and hypertension in children

Trials were conducted on the use of ramipril, an angiotensin-converting enzyme (ACE) inhibitor commonly used to treat hypertension, particularly for its effectiveness on children with chronic renal failure (CRF)-associated hypertension.

ACE inhibitors are known for being reno-protective in adults with CRF and/or hypertension. ACE inhibitors lower the production of angiotensin II, therefore relaxing arterial muscles while at the same time enlarging the arteries. This allows the heart to pump blood more easily, and increases blood flow due to more blood being pumped into and through larger passageways.

However, in the case of children, the usefulness of ACE inhibitors for treating these pathologies had not been proven. In light of this, the Escape_trial project conducted a random trial of 350 children with CRF. The aim was to examine whether ACE inhibition is effective in decreasing CRF progression in acquired and congenital nephropathies. Additionally taken into account was if progression can be additionally influenced by intensified antihypertensive treatment in achieving low to normal blood pressure.

Also determined were which factors determine CRF progression and susceptibility to ACE inhibition.

A prospective assessment of the reno-protective efficacy of ACE inhibition and intensified blood pressure (BP) control was conducted on children with chronic renal failure and elevated or high to normal BP. Drug effectiveness was evaluated via two monthly office BP and proteinuria assessments as well as ambulatory BP monitoring at the start and after six months of treatment.

Results showed that the drug ramipril works effectively and safely as an antihypertensive and antiproteinuric agent in children with CRF-associated hypertension. The BP lowering and antiproteinuric effects are greatest in severely hypertensive and proteinuric children. Disseminating the results may help promote antihypertensive and antiprotein-

uric treatment by ACE inhibition in children with CRF as well as help prevent the progression of renal disease.

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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Synthesis of cell-penetrating peptides as gene delivery vectors

Molecular biologists sought alternatives to the use of viruses for delivering genetic material into cells. In their search for non-viral vectors they investigated the mechanisms of cell-penetrating peptides (CPPs).

Scientists from the CPP project designed synthesised and tested non-viral means of gene delivery based on CPPs. They facilitate the cellular uptake of peptides and proteins which contain them.

Researchers investigated the structure of CPPs by synthesising peptides which demonstrated systematic changes in their structure, charge and size. Modified apolipoprotein E (ApoE)-derived peptides were

produced and their cellular uptake studied. The new methodology developed by the CPP project was very helpful in preparing extremely pure and well-characterised conjugates.

When the uptake of cargo-CPP conjugates was studied using different cell cultures and analytical tools, it showed significant accumulation within the cell. However, concentration is not only affected by the

cell's uptake, but also by its ability to export material such as acidic peptides.

However, strongly basic peptides and amphipathic peptides which display both hydrophilic and hydrophobic properties are retained inside cells. This is probably achieved by binding to proteins or oligonucleotides, which are short segments of DNA or RNA, within the cell. The team also assessed the affect of novel CPP-conjugations on the biological activity of peptide nucleic acids (PNAs), artificially synthesised polymer mimics of DNA and RNA.

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

Collaboration sought: information exchange/training.

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Gene mining in the human colon

A novel resistance gene to the antibiotic tetracycline has been isolated whilst combing through a metagenomic library.

The advent of metagenomics meant that genes could be isolated from any environmental sample and stored in a library. Ready for screening by interested molecular biologists and geneticists using appropriate selection pressures, they can be mined according to industry's requirements.

The EU-funded project Gemini focused on the isolation of novel enzymes for a wide range of industrial purposes as well as anti-microbials. Partners from the Rowett Research Institute in Scotland specifically investigated the genes from a faecal sample housed in a fosmid metagenomics library. The donor patient had received long-term tetracycline treatment increasing the likelihood of finding resistance genes.

Two genes were isolated which conferred tetracycline resistance. The first was a mosaic resist-

ance gene in an *Escherichia coli* (*E. coli*) host. Downstream from this gene, a novel efflux gene was found that codes for a membrane-associated protein. Interestingly, the same arrangement of genes was found in a Clostridium-related bacterium from the same donor.

Further investigation revealed that, by itself, the novel efflux gene conferred a high level of resistance. Measurements indicated a minimum inhibitory concentration of 60 µg of tetracycline per millilitre in *E. coli*.

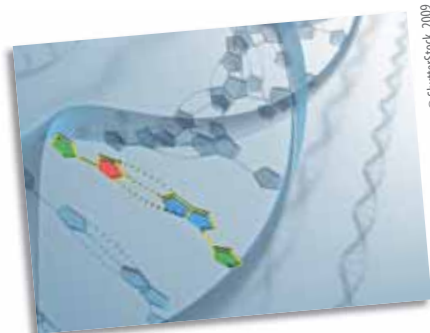
The data collected from this research suggests that mosaic genes appear to confer higher resistance levels than their 'parent' genes and can increase in frequency in conditions of high selection pressure such as long-term antibiotic use.

Furthermore, the discovery of a novel gene that gives high resistance could well represent important progress in disease control in humans and animals. This could further aid the development of modified and more effective anti-infectives for the biopharmaceutical industry.

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

Collaboration sought: information exchange/training.

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Metagenomics yields potentially new chitinases

Microbial genetic material recovered directly from the environment stored in gene banks appears to be an unlimited resource for the biotechnology industry. Researchers have screened these metagenomic libraries for enzymes with antifungal activity.

Organic long-chain polymers based on glucose such as cellulose and chitin are the molecular foundations of plant cell walls and fungal exoskeletons respectively. Their abundance makes them valuable economically for use as renewable resources. Moreover the enzymes for chitin breakdown, chitinases, are important as anti-fungal agents.

The scope of the EU-funded project Gemini was broad in its goal to isolate gene sequences with particular relevance in anti-microbial and plant cell wall breakdown.

Partners at the University of Göttingen in Germany focused in particular on chitinases that hydrolyse the chitin in fungal cell walls.

Having identified chitinases with indicator agar, the scientists tested their anti-fungal prowess with a hyphal extension inhibition assay. Genes from six resulting chitinolytic clones were sequenced and analysed. The clones were then compared with the two known families of chitinases to test if they had novel status.

Three of them showed similarities with the two established groups and possessed weak anti-fungal properties. The good news was that the isolates with the strongest chitinase activity did not belong to either of the classified groups.

The potentially novel chitinases therefore have good potential as industrial agents and enzymes. As such, they can be used in agriculture as biological control agents of phytopathogens and for food and seed preservation.

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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Role of telomeres in the development of cancer

Telomeres are specialised structures found at the ends of chromosomes. Researchers addressed the question of whether telomere integrity is a factor involved in oncogenesis in human cells.



Scientists believe that these structures can play a role in the development of cancer. The Telosens consortium brought together 12 leading European laboratories from six countries to study the ability of telomere dysfunction to cause abnormal proliferation of cells. Scientists studied the human gene TRF2 which encodes a protein which plays a key role in the protective activity of telomeres. However, it has been demonstrated that TRF2 dysfunction can trigger some of the steps involved in the development of tumours.

The research team established a link between telomere instability and changes to human cells. They also showed that the effect of TRF2 in the development of cancer can occur in the presence of telomerase. Telomerase is an enzyme which adds DNA strands to telomeres, elongating the structures after each cell replication cycle. The effect of TRF2 on the steps towards cancer

development suggested it can operate at the later stages of human cancer.

Researchers observed that, for a given cellular system, ionising radiation did not appear to contribute to changes in cells, while telomere dysfunction did. It was found that either procedure resulted in a similar number of chromosome breaks. Therefore, it would appear that telomere dysfunction was more likely to trigger the formation of a tumour than gamma radiation. This suggested existence of telomere-specific events leading to changes in cells.

Team members using multicolour-fluorescent *in situ* hybridisation (M-FISH) analyses, a molecular technique which allows the visualisation of chromosomes, were unable to identify chromosome rearrangements that would explain the difference. For this reason scientists believed that telomere dys-

function triggered a reprogramming of the cell, making it more susceptible to tumour-causing properties. Results suggested that cells exhibiting damaged telomeres are more likely to experience changes. Targeting cells with fragile telomeres, such as premalignant telomerase negative cells, would therefore favour transformation. Future research was planned to investigate this premise using other cell types and fully transformed cells.

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

Collaboration sought: information exchange/training.

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Focusing on DNA repairing

Sensitivity to radiation varies among the population, although the source of this variation is not clear.

The EU-funded Telosens project looked into the genetic differences that shape individual responses to radiation. This information is of specific value to anti-cancer radiotherapy researchers when it comes to the ability of certain cancer cells to survive treatment. More specifically, the role of telomeres in the emergence and treatment of cancer was reviewed at a number of levels.

Research showed that a number of repair pathways are activated during radiation exposure including the repair of DNA double strand breaks. DNA ligase III, although primarily thought to repair single strand breaks, has been implicated in double strand breaks as well although not at the primary level. These events were often accompanied by chromosome fusions.

These observations hinted at the existence of at least one back-up repair mechanism at the chromosome level. These pathways however may themselves lead to the formation of tumours and telomeric instability. Further studies into the occurrence and repair of double strand breaks could lead to insight regarding cancer incidence and potential treatments.

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

Collaboration sought: information exchange/training.

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Human bystander cells avoid radiation damage

Researchers have investigated the bystander effect in human skin cells exposed to radiation. This has important implications for cases of radiation damage and determining dosage in radiotherapy.

When cells are bombarded by radiation, nearby cells known as bystander cells can suffer damage even though not directly targeted by the charged particles. This effect in neighbouring cells can therefore exaggerate the impact of small doses of radiation. It is thought that these effects are transmitted via signals conveyed through gap junctions connecting the cytoplasm of adjacent cells, soluble factors or a combination of both.

The relevance of this effect is undeniable and the Interstander project therefore aimed to elucidate the mechanisms involved in bystander effects. The consortium's overall

objective was to identify molecular means of cellular interconnection and DNA breaks as the initiating event.

Project partners at the Physikalisch-Technische Bundesanstalt in Germany bombarded human skin fibroblasts with alpha particles at an energy level of 4.5 MeV. As there were no recorded bystander effects and the effects recorded in rodents were much more severe, bystander effects appeared to be species specific.

Furthermore, higher doses of protons at 10 MeV induced responses that appeared to

be protective, resulting in higher survival, rather than negative in nature. Therefore, despite the fact that human primary fibroblasts are competent to form gap junctions, no bystander effects are seen, even at high exposure levels.

Overall, this indicates that the origin of the cell can have a significant impact on the presence or absence of bystander effects. Taken as a basis for further research, this has implications in the determination of the damaging effects of radiation and measuring the impact of radiation therapy.

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

Collaboration sought: information exchange/training.

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Wood knots tied in with anti-cancer agents

Bioactive substances isolated from wood frequently confer protective properties to tree cells. Researchers have therefore investigated the anti-tumour potential of extracts from bark and knots in three types of trees.

Wood is a natural polymeric cellular product consisting of structural components cellulose, lignin and hemicelluloses. These contain non-structural components collec-

tively called extractives. Integrated into the cell walls or cavities, they are complex mixtures of molecules such as tannins, flavonoids, stilbenes, fatty acids, waxes, sterols and simple sugars. Advantageous biochemical properties are linked with cell viability and protection. They can confer decay resistance, increased UV stability and possess anti-oxidant properties.

Bark and knots, usually waste products in the paper and pulp industry, are a good source of extractives. The main objective of the EU-funded project Cerberus was to test wood extractives for their potential as bioactive compounds having the added advantage of minimal side-effects. The project team at the MCA Research Laboratory in Finland focused on their potential anti-tumouric properties.

Three types of knotwood were analysed — European silver fir, European larch and the Austrian pine. The extracts from these conifers were tested for their ability to cause or

prevent DNA oxidation *in vitro*. There is a tendency for oxidation of DNA to occur at the guanine base. The product 8-oxo-deoxyguanine was therefore used as a measure of the extent of oxidation.

The results were promising in that none of the substances under scrutiny caused DNA oxidation and they all showed ability to prevent this form of DNA damage. However, further research using definitive quantitative assay methods is required to yield scientifically significant comparisons against reference compounds.

The development of anti-tumour agents from renewable bioresources would have many advantages. Removal of wood extractives is desirable as they are highly toxic in water run-off. Furthermore, the exploitation of forests would aid the movement towards crops geared to renewable energy resources.

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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Standards for DNA microarray data

DNA microarray experiments have become one of the most commonly used source of expression data for genes. The lack of standards for their presentation and exchange, one of the major barriers to accessing experiment data on a genomic scale, has been addressed within the Temblor project.

In life sciences, the principle that all data and materials that support conclusions published in a peer-reviewed journal must be made publicly available is well established and widely accepted. However, making the data from DNA microarray experiments available to the public in a usable manner is not trivial. The data generated were usually in differing formats and it was extremely challenging to obtain, understand and reanalyse data generated by another researcher.

In 1999, the European Bioinformatics Institute (EBI) laid the foundations for a consensus-based document that describes the information that would be needed to adequately understand biomedical data. The *Minimum information about a microarray experiment* (MIAME) document outlines the minimum information that should be reported to enable unambiguous interpretation and more importantly, reproduction of DNA microarray experiments.

With the publication of the MIAME document it became clear that authors, reviewers and editors needed help in identifying which

information needed to be made available. During the Temblor project, these guidelines were adopted by most of the major scientific journals as a guide for providing the supporting data for publications based on DNA microarray experiments.

Furthermore, the 'Microarray gene expression-object model' (MAGE-OM), a formal model describing the logical structure common to most DNA microarray experiments, has been developed. The 'Microarray gene expression-markup language' (MAGE-ML) was derived from this model to allow the description of DNA microarray experiments in a way that can be parsed by software. This data transfer format is based on the extensible markup language (XML) and supported by a collec-

tion of software packages that can be used to package datasets from DNA microarray experiments.

The latest version of the MIAME document, along with details about MAGE-OM and MAGE-ML are available at the website of the Microarray Gene Expression Data (MGED) Society: <http://www.mged.org>

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

Collaboration sought: information exchange/training.

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Heat shock protein — a cell saver

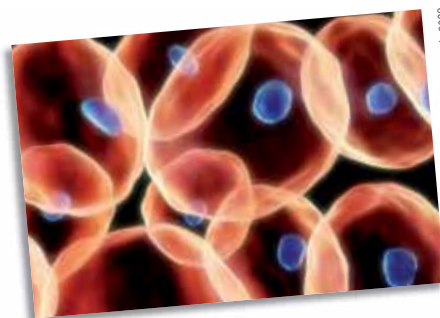
Cell apoptosis is the focus of intense research due to its significance in differentiation and disease. Scientists with an EU-funded project have investigated the role of heat shock protein 70 (Hsp70) in the execution of the process.

The significance of programmed cell death in the differentiation and homeostasis of an organism is immense. From destruction of damaged or malfunctioning cells to the prevention of cancer and the correct development of an organism, the timely occurrence of apoptosis is crucial.

The EU-funded project 'Hsp70 chaperone' investigated the role of Hsp70 as a survival protein. Its depletion triggers the type of cell death that is independent of one of the prime enzymes active in apoptosis, caspase. When levels of Hsp70 fall, lysosomal enzymes are released into the cytosol. Proof of action is that these molecules can be inhibited by pharmacological inhibitors of lysosomal cysteine proteases.

The scientists showed that the action of Hsp70 is linked to the inhibition of lysosomal membrane permeabilisation. Revealed by immunoelectron microscopy, Hsp70 is present in lysosomal and endosomal membranes. Moreover, lysosomes positive for Hsp70 show increased resistance against membrane destabilisation caused by chemical and physical agents.

There are many different apoptotic pathways and on investigation, the scientists found two unaffected by Hsp70 depletion. These involve cytochrome c and Fas ligand (FasL) induction. Despite this, the evidence collated points to Hsp70 as a survival protein acting at membrane level.



The elucidation of biochemical mechanisms involved in apoptosis can be exploited in anti-cancer therapies. Another bioindustrial application could be the creation of anti-apoptotic cell lines for production of therapeutic proteins.

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

Collaboration sought: information exchange/training.

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Increasing expression of recombinant proteins

Researchers improved the use of cells as factories for therapeutic proteins. They developed a technique which enabled them to increase the expression of recombinant proteins in mammalian cells.

Some genes contain a high proportion of guanine (G) and cytosine (C) nucleotides in their coding sequence. These are expressed with greater efficiency than those with a low proportion of G and C nucleotides. In order to fully exploit this fact, scientists from the 'Hsp70 chaperone' project developed a technique for changing the sequence of a gene encoding a protein.

This was done in a way that allowed a greater proportion of G and C nucleotides to be obtained in the coding sequence. It was also achieved without any changes to the protein's sequence of amino acids. Scientists from the consortium learnt of this phenomenon through the comparison of the sequences of Hsp70 and Hsc70 human genes.

The new methodology devised by the research team presented a wide range of new possibilities for therapies. It can be employed in biotechnology for producing therapeutic proteins, including enzymes, cytokines, growth factors, receptors and antagonists. This work is also relevant to the field of gene therapy by increasing gene expression, particularly that of transferred sequences, in human cells.

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

Collaboration sought: information exchange/training.

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Expression Profiler regenerated with user algorithms

Establishing the order of sequences in genomes has been a huge step in genetic research. To fully capitalise on these maps, the Temblor project has developed algorithms to identify the function of these genes.

The mechanics of the genetic code are amazingly simple. Only four bases form the component parts of the DNA code which is transcribed, via RNA, to express the protein. The complexity of the system, however, lies within the interaction and timing of gene expression.

For researchers to unravel the exact nature of gene function and the proteins transcribed, the Temblor project has developed a new web portal, *Integr8*. It can access bioinformatics centres all over Europe. Researchers are therefore able to extract comprehensive information from genomic and proteomic data.

An important part of the project was to develop new algorithms to exploit the inte-

grative layer. With various other research centres, existing algorithms were developed, modified and implemented in *Expression Profiler*. This web-based collaborative platform predicts gene function from microarray data, sequence and protein-protein interaction (PPI) data analysis. *Expression Profiler* incorporates the 'signature' algorithm developed by the Weisman Institute and the 'in between group analysis' from Cork University as well as many other normalising algorithms.

Researchers at EMBL in the United Kingdom worked on the analysis of gene expression data clusterings. One limitation is that application of different methods and different limits for variables used can result

in various outcomes. To overcome this, a method was devised to ascertain how different clusters relate to each other in two sets of cluster results.

Clusters for comparison can be different types or the same category. For example, a flat hierarchy may be compared with a hierarchical clustering. Using simulated data, they showed that the method can be used to approximate the true clusters. Furthermore, using gene expression data, biologically meaningful clusters can be restored.

Expression Profiler itself can be accessed at <http://www.ebi.ac.uk/expressionprofiler> and all interested parties can contribute algorithms expressed in any language.

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

Collaboration sought: information exchange/training.

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Programming the death of a cell

The role of resistance (R) proteins in the induction of programmed cell death (PCD) has been investigated by the EU-funded project 'Insight inside'.

PCD is a critical developmental phenomenon necessary for controlled, timely development and homeostasis in multicellular organisms. Using micro-spectroscopic techniques, the 'Insight inside' project investigated molecular interactions involving relevant signalling molecules. The molecular basis of PCD could then be elucidated by determining the signal transductions leading to biochemical cascades and the final apoptosis.

The role of R proteins was specifically investigated by Netherlands-based project partners at Wageningen University. Many plant disease R genes encode proteins with three functionally important regions. The terminal domains are coiled coil (CC) and a leucine rich repeat (LRR). Centrally there is a nucleotide-binding site (NBS). These CC-NBS-LRR proteins recognise pathogen-derived products and initiate a resistance response that often includes a type of cell death known as the hypersensitive response (HR).

On the premise then that these R proteins act as molecular switches using the NBS, the researchers aimed to further elucidate these

molecular cascades. One other feature of note is that the R proteins are translocated directly to the nucleus. Here, they are strategically placed within the cell to interact directly with transcriptional factors.

The scientists found that the LRR region is responsible for the recognition of a pathogen effector which triggers intramolecular autoinhibition. This then makes way for the binding of further signalling molecules or oligomerisation. Finally, anti-pathogenic compounds are produced followed by a reactive oxygen burst and then the critical end-point, cell death.

To speed up the screening for the protein-protein interactions involved in the cascades, the same project partners merged the library-versus-library technique with phage display. Moreover, the use of fluorescent

phages enabled the identification of protein interactions in real time.

The data from this research has been incorporated into plant breeding programmes to obtain resistance against pathogens and parasites. Knowledge of molecular pathways also provides unlimited scope for the development of specifically tailored drugs for diseases and cancers.

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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Effect of endocrine disruptor chemicals on cells

Researchers successfully developed advanced tools for diagnosing and assessing endocrine disruption in fish and mammals.

Endocrine disruptor chemicals (EDCs) are substances that act like hormones in the endocrine system. They have been linked to adverse biological effects in animals, giving rise to concerns that low-level exposure might cause similar effects in humans. The aim of the EDEN project was to apply a single coherent approach when carrying out hazard assessments on exposure to EDCs in the environment. The project supplied fresh data con-

cerning the reproductive health of Europe's citizens, providing the scientific basis for a coherent strategy for dealing with EDCs.

Tools produced by the consortium included antibodies and reverse transcription polymerase chain reaction (RT-PCR) protocols for quantifying molecular responses induced by EDCs. In molecular biology RT-PCR is a technique for amplifying defined pieces of ribonucleic acid (RNA). Other tools developed included microarrays for assessing EDC-responsive genes in fish and mammalian tissue and cell-based reporter assays for identifying mixture effects of EDCs. The research team also identified novel targets of EDC action. Scientists were particularly concerned with the signalling pathways mediating the effects of EDCs and the effects of aromatase isoforms on steroidogenesis.

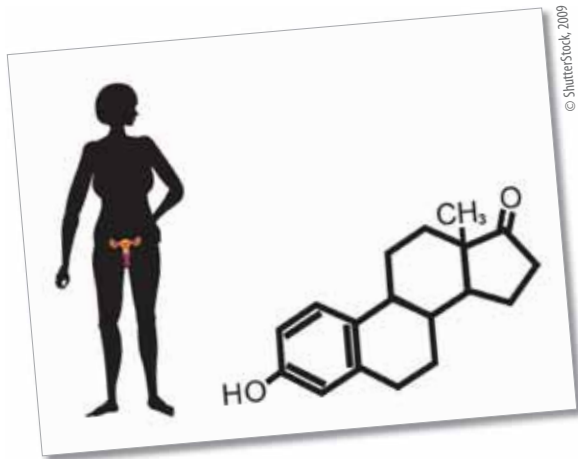
The study of signalling pathways, which regulate cellular characteristics and processes, showed that the effect of EDCs on the genome can be regulated in several ways. This included not only classical receptor-binding activity but also interference of rapid cell signalling pathways, which lead to ligand-independent endoplasmic reticulum (ER) activation. This underlined the importance of taking into account short-term effects when evaluating the possible influence of oestrogen in chemicals.

The form of the enzyme aromatase found in the brain was responsive to oestrogens, while the form found in the gonads was responsive to dioxin-like compounds. Inhibition of the aromatase system as a result of EDCs in the environment can lead to major changes in sexual development and reproductive functions. Moreover, it can also affect other functions that are separate from the reproductive system, such as the creation of nerve cells.

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 > 4763



Pituitary hormones and puberty in farmed fish

One of the biggest factors affecting production levels in aquaculture is premature puberty in stocks. To help control this, researchers in the EU-funded project Pubertiming have characterised novel receptor variants for sex hormones in farmed fish.

During the course of sexual development in some fish under farm conditions, precocious puberty leads to decreased flesh quality and growth performance. Early sexual maturation accompanied by production of sperm and eggs is considered to be one of the most prominent problems in finned fish. Associated losses are thought to be in the region of EUR 30 million per year.

The appropriately named Pubertiming project aimed to identify and quantify the determinants that trigger the timing of puberty and its development. Artificial lighting, nutrition and genetic background are well known as the major factors involved. The project team based at the Institute of Marine Research in Norway set about to unravel the hormonal basis of puberty development at a molecular level. As an integral part of their investigation, they researched into receptor site variants for sex hormones produced by the pituitary.

Techniques used included real-time polymerase chain reaction (PCR) and *in situ* hybridisation studies together with

pharmacological characterisation. This way, the scientists were able to ascertain how ligands bind onto receptor sites for hormones involved in sexual maturation.

The team identified a new range of receptor variants. These were characterised and included gonadotrophin releasing hormone and oestrogen receptors in trout and sea bass. Equally important in the economic picture of aquaculture, the Atlantic salmon revealed four new types of receptor for both male and female differentiation.

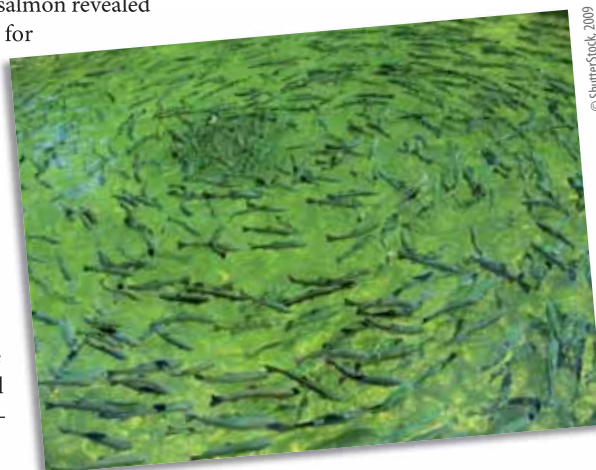
The next step was to use the messenger RNA profiling to correlate expression of these hormones in relation to the stage of gonad development and plasma sex steroid profiles. The stages of development were in turn linked to seasonal development and photoperiod treatments.

The environmental factors most likely to be able to control early puberty in fish are thought to be seasonally linked to day length and, on a daily basis, light/dark cycle length. Knowledge of the molecular basis of these biorhythms can be used to control the incidence of precocious fish puberty in the farming environment. Fish farms can then control the production of the highest quality flesh at maximum levels using prescribed lighting regimes.

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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Total effective xenoestrogen burden in tissue

Hyperfractionation was used to determine levels of xenoestrogens, man-made compounds which mimic the effect of naturally occurring oestrogens. Scientists studied their occurrence in the tissue of humans and wildlife to gain a better understanding of environmental exposure to these substances.

A method for hyperfractionation was standardised by the EDEN project, in order to assess the total effective xenoestrogen bur-



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den (TEXB) in tissue. Through the use of extraction and high-performance liquid chromatography (HPLC) separation, two fractions containing lipophilic xenoestrogens and endogenous hormones were obtained. The oestrogenicity of the two fractions was assessed using MCF-7 breast cancer cell-based E-screen and yeast estrogen screen (YES) bioassays. Although both assays could be used to assess TEXB, the E-screen was preferred, due to its superior ability to identify and quantify oestrogens in human placenta. Scientists also carried out regression analysis on the hyperfractionation data, which provided a mechanistic basis for the hormonal activity of the combined fractions.

One out of three sites sampled showed a positive correlation for vitellogenin levels, an egg yolk precursor protein, and atrophy of spawning tubercles in male fish. Comparing bream affected by ovotestis to bream without ovotestis revealed substantially higher concentrations of oestrone (E1) and

ethinyloestradiol in the bile of ovotestis fish. However, these results were not seen in the total bile oestrogenicity determined using the YES assay, a possible indication of the presence of other endocrine disruptor chemicals (EDCs). Therefore, the EDEN team concluded that ovotestis gonads did not affect vitellogenin levels or the total oestrogenicity measured using YES.

The oestrogenicity and steroid concentration in the fish bile was not significantly different between samples of bream with high and low plasma vitellogenin levels. This indicated two possible conclusions. Either, not all xenoestrogens causing induction of vitellogenin were identified, or the sampling period did not correspond to the situation which resulted in high levels of vitellogenin. The YES bioassay revealed that the majority of oestrogenicity found in bile or the adipose tissue of male bream comprised the natural steroids E1 and E2 (17-oestradiol). Ethinyloestradiol was also identified by the EDEN researchers, but in much lower concentrations.

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

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Continual light spells new insight on maturity of fish

Regulating maturity in an effort to reduce annual loss of profit in aquaculture, the EU-funded project Pubertiming investigated the use of photoperiod control.

Approximately EUR 30 million a year are lost in the fish farming industry due to precocious maturity in fish. Whether early maturity is caused by hormonal stimulation, environmental factors, genetic or nutritional sources is unclear. What is clear is that early maturation is costing the fish industry a lot of money. As such, Pubertiming conducted trials on timing of maturity with regard to continuous light treatment.

Three species of fish were used for the duration of these photoperiod experi-

ments: sea bass, salmon and trout. All were conducted in a variety of tanks but an additional experiment for salmon in sea cages was also run. In the sea bass, differing time-point-related photoperiod regimes were used throughout the life cycle of the fish. The sea bass trials showed that continuous photoperiod treatment can be used to regulate, or rather delay early maturity of the fish. However, using 11-ketotestosterone implants showed a cancelling effect on the sea bass under continuous light treatment.

Interestingly enough while sexual maturity tests were conducted on the fish in tanks, it was also discovered that continuous light tests on salmon in sea cages reduced the volume of sexually mature adults. Even so, the reduction was less than expected and varied between age groups and feeding history. Overall, this innovative research was able to determine critical periods in fish life spans in which continuous light treatments would have the greatest impact on arresting maturity.

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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Managing species diversity in the North Sea

The fisheries management advice process is complex and must take into account many possible consequences if it is to be effective. The Mafcons project has compiled a database of results which have contributed to the creation of a model for management protocol which will preserve species diversity in the North Sea.

Benthic invertebrate species and ground-fish, which are found at the lowest level of a body of water, make for a rich marine ecosystem. Species diversity is however under threat from the fishing industry and this goes against the Rio Convention on Biological Diversity.

The Mafcons project took stock of this problem and developed a management protocol to aid those with the capability to respond to the situation. The International Council for the Exploration of the Sea already provides some management advice which helps authorities to predict what will happen to species diversity when different policy courses are taken.

The Mafcons research team went further, they developed a theoretical model to underpin the management protocols specified and to provide a better understanding of their consequences. The model provides the mathematical tools to set species diversity goals as well as single species total allowable catch levels.

One party of the project led by researchers at the University of Swansea dealt with the creation of a database. It contains the data collected from the international bottom trawl surveys, part of a fishing effort for the North Sea to which all the project partners contributed. Data is included for seven species

including cod, sole and *Nephrops*, the Norway lobster. The consortium made use of the database for research which culminated in the publication of a number of scientific papers. The database has been made available to the general public via the 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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Sea bass sperm bank freezes genetic resource

*A sperm bank was established for the European sea bass, *Dicentrarchus labrax*, by the Freezebass project. For the first time and under strictly controlled conditions, the bank brought together all the wild genetic resources currently known for this species of fish.*

Three genetically and geographically separate populations exist in the Atlantic Ocean, the western and the eastern Mediterranean respectively. The Freezebass group collated samples from all three populations. The sperm bank ensured that captive-bred populations reared for the table would be genetically diverse enough to guarantee the long-term future of the farmed population. The work of the project will also benefit future domestication and selection programmes throughout the EU and can be applied to other fish species.

The work undertaken by the Freezebass project was a further step towards achieving

sustainable fisheries and aquaculture, contributing to the development of industrial selective breeding programmes. Because sea bass sperm quickly deteriorates when kept under refrigeration, cryopreserved sperm was used. This enabled the wild genetic resource to be stored under secure and sanitary conditions and sea bass to be reared from selected stocks containing sufficient genetic variation.

The sperm bank facilitated the sophisticated and large crossing scheme required by a breeding programme. The ability to store sperm also allowed optimised breeding to

take place with species pairs of selected fish. The ability to preserve the sperm of each generation of male safeguarded the long-term protection of the species' genetic inheritance. The use of cryopreserved sperm also allowed offspring to be produced from a selected male. The Freezebass sperm bank helped avoid problems associated with keeping live adult fish. It has also been the first step towards setting up of a bank for preserving genetic variability in other species.

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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Successful deep freeze for fish eggs

Successful cryopreservation of fish gametes is essential for optimum broodstock management in aquaculture. As part of the development of a protocol for oocyte preservation, researchers have determined the toxicity levels of cryoprotective agents used.

Preservation of fish spermatozoa is an established and successful practice. Yolk-laden oocytes however are far more of a challenge. The main objective of the EU-funded project Cryocyte was to develop methods of cryopreservation while maintaining viability and genetic and biological integrity after cryogenic storage and thawing.

Two fish were studied, zebrafish (ZF) and the gilthead seabream (GSB), representative of hydrating and non-hydrating oocytes respectively. The GSB is a commonly farmed marine fish and the ZF is a freshwater species that has become one of the most popular model organisms in research circles.

During cryopreservation, cryoprotection is essential to prevent freezing of water within the cell — eggs contain more water than most cells in the body. Cell 'antifreeze' is therefore used but to be effective, the agent must be taken across the cell membrane

which is notoriously impermeable to such chemicals. Furthermore, cryopreservatives tend to be cytotoxic. Cryobiology is therefore about achieving a compromise between preserving the egg against the ravages of disruption by ice crystals without toxifying and damaging the egg.

Project partners at Israel's Oceanographic and Limnological Research Centre developed a protocol for successful cryopreservation of small-sized GSB oocytes. Part of this was to tackle the permeability issue and measure the accumulation of radiolabelled methanol in ZF and GSB oocytes.

Cryoprotectant toxicity was also measured in all stages of GSB and ZF oocytes using thiazolyl blue tetrazolium bromide that only stains living cells. Additionally, a method was developed to determine functional viability of GSB oocytes during *in vitro* incubation.

Achievements during this research will no doubt increase overall fish production on farms. Efficiency also stands to increase by banking genetic resources from both wild and cultivated species.

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

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

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Maternal markers for vertebrate embryo development

Researchers in the EU-funded Cryocyte project created a catalogue of messenger ribonucleic acid (RNA) stored at the end of oogenesis in zebrafish germ cells. This promises to form part of the initiative to identify functionally important sequences and proteins involved in oogenesis and development of the embryo.

Intensive aquaculture would appear to be the answer to bolstering the deficit in supply of fish whilst helping to protect wild populations. In order to maintain genetic diversity during breeding programmes as well as fulfilling breeding objectives, successful cryopreservation of gametes is essential. There are many effective protocols for freezing fish spermatozoa but oocytes pose many more problems.

To this end, the Cryocyte project performed a multidisciplinary study to research oocyte development and maturation and the impact of the rigours of cryopreservation. Also investigated were *in vitro* methods for fertilisation and nucleic acid and protein markers as a reflection of oocyte viability and stage of development.

The development of a viable embryo after fertilisation depends on the presence of specific accumulated maternal factors including nucleic acids and expressed proteins. Large numbers of follicles at different stages of

development are available from the zebrafish facilitating the identification of these maternal factors.

Using this model organism, project partners at the University of Bordeaux, France, compiled a complete set of sequence data of messenger RNA present in the mature oocyte. Serial analysis of gene expression (SAGE) was then performed together with compilation of profiles of the resultant proteins expressed. Development of the zebrafish follicle follows a cytological path similar or the same as other vertebrates. This made it possible to extend the scope of the research and make transcriptome comparisons between the zebrafish and other vertebrates.

Information on the research has been published in scientific journals and libraries of the molecular phenotype of the zebrafish ovarian follicle have been published in journal for-

mat and are also available online at <http://www.biomedcentral.com/1471-2164/7/46>

This research has provided an important platform on which maternal transcripts and proteins necessary for embryo development can be deciphered. As such, it forms the basis for the development of protocols for the farming and preservation of fish species and other higher vertebrates including poultry.

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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Aquaculture's answer to bone defects

A technique was developed for evaluating the density and growth rates of a coral weed used for a biodegradable bone-forming material for the treatment of bone defects.

Bone defects are commonly encountered after multiple fractures of a long bone or the extraction of a bone cyst. Unfortunately complete recovery is rare and such defects can lead to social and personal difficulties for patients.

In light of standard medical treatment not always being completely successful, the Algisorb project developed a tested, biodegradable bone-forming material based on cultivated marine red algae containing bone growth stimulating substances. Furthermore, it is able to be completely resorbed and can even lead to full restoration of the injured bone.

More specifically, techniques were developed for assessing the density and growth rates of natural populations of the coral weed *Corallina officinalis* as well as for the aquaculture of this species. These techniques designed for this raw material will assist in the sustainable harvesting and future aquaculture of the species.

The techniques were employed commercially and the information obtained was used for further exploration of this and related species in terms of being a source of



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natural scaffold material for tissue engineering. The technology is applicable to the facial area as well as the hands, skull, ribs and arms.

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

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Peas for better fish feed

Peas are high in protein content and an EU-funded project has investigated means by which they can be used as substitutes for fish meal. The developed protein fractionation process aims to reduce Europe's reliance on imported fish feed, making Europe's industry more sustainable and competitive.

Europe imports massive amounts of fish feed to support its growing aquaculture industry. This expense is also hampered by inconsistencies in supply quality and prices making it difficult for fish farms to operate optimally. Furthermore, health risks associated with imported products, such as dioxin levels, have caused some concern.

The 'Fishmeal replacement' project, driven by the above factors, sought to develop a suitable production method for a supplement based on peas. To this effect, the project successfully developed a modified dry-wind sifting platform and an effective

extrusion process capable of dealing with very fine powders.

The dry-wind sifting process could produce enough protein concentrate to replace more than 40 % of the fishmeal for salmon diets. Moreover, the protein content could be customised to any percentage desired and, using a high-tech extraction method, improved both the nutritional value and shelf life of the product. Notwithstanding these results, the extrusion process also ensured the removal of anti-nutritional factors that did not affect amino acid availability or protein quality. Finally, the starch in the protein fraction can

be simultaneously gelatinised making the product highly digestible for the fish.

With results like these, it is not surprising that successful joint ventures occurred. Under this agreement, a factory in Stavanger, Norway, was built with an initial capacity capable of processing 100 000 tons of yellow peas. The factory actually produces two fractions: a protein-rich fraction (60 % protein or greater) and a starch-rich fraction. The developers are now looking for marketing agreements for their products, both of which do not require further processing or can be further extruded in the plant and then sold.

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

Collaboration sought: marketing agreement.

<http://cordis.europa.eu/marketplace> > search > offers > 4535

Transplantation and identifying cod origins

Techniques were developed to provide legally indisputable evidence for the harvesting site of unidentified cod. These were verified through tests involving the transplant of eggs and as a result of double blind tests for samples of cod.

The Codtrace project experiments used eggs from Irish Sea cod which were successfully transplanted to Iceland. These were then reared under the same conditions as Icelandic cod. Siblings from the same batch from the Irish Sea were reared in waters at the Isle of Man at the same time as the fish in Iceland.

The three groups of fish were all sampled when they reached the age of five months. They included Irish Sea cod raised in Irish Sea water (Isle of Man), fish from the Irish Sea raised in water around Iceland, and Icelandic cod raised in Icelandic sea water.

Two of the methods used by the Codtrace team were unable to produce useful results due to the fish being too small and the water treatment employed in the hatchery. The methods in question used communities of bacteria and parasites found in cod to identify the harvesting location of the fish.

Studies into the microchemistry of small structures found in the inner ear of cod, known as otoliths, revealed that many elements were affected by environmental conditions. However, the elements magnesium and manganese reflected the origin of the

fish regardless of local conditions. Analysis of microsatellites indicated that there was significant divergence between cod from Iceland and the Irish Sea. This was the case whether the fish were transplanted or not.

Investigations into the size and shape of otoliths showed that the majority of transplanted fish were classed as coming from Iceland, rather than the Irish Sea. The otolith shape was influenced by environmental parameters, such as the conditions under which the cod were raised. The influence of the environment was found to be greater than had been previously believed.

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

<http://cordis.europa.eu/marketplace> > search > offers > 4805

Cod capture sites found by analysing parasites

Parasites found within cod were studied and the information applied to sophisticated computer models in order to identify the harvest location of the fish.

Researchers from the Codtrace project managed to use information about communities of parasites to identify where fish were caught. They were also able to discriminate between farmed and wild fish. Fish raised on artificial feed were seldom found to be infected with parasites transmitted via the food web. Altogether, 61 different species were found on the cod although 10 to 15 species were sufficient to allocate fish to five or six harvest locations.

The predictor parasites used varied between data sets. Eight particular species were used in all datasets and an additional species was selected in three of the four sets of data. All nine of the chosen species were parasitic worms known as helminths.

Analyses showed that when data taken from different seasons was compared separately the results were more accurate. This could be due to a wide variation in parasite abundance between seasons. However, no consistent pattern could be found to explain the phenomena. For this technique to be applied to fishery management, regular sampling in designated areas and

the continuous update of predictive models would be required.

Models were used to assign cod caught in the Baltic Sea and Icelandic and Norwegian waters to their respective harvest locations. Altogether 95 % of Baltic and Norwegian cod and 90 % of cod from Iceland were correctly identified. However, the same level of accuracy could not be achieved for fish from the Celtic, Irish and North Seas.

This was possibly due to similarities in the community of parasites found in fish harvested from these areas. But even if parasite assemblages cannot be used to distinguish between fish from these waters, the technique successfully identified harvest loca-

tions for Baltic, Icelandic and Norwegian cod. Furthermore, the methodology used can be invaluable when combined with other biomarkers developed through the Codtrace project.

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

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Cod with chips

The Codssey project developed a tagging system to investigate and understand the movements of cod in relation to their spawning grounds. This drive was ecologically motivated and aimed to improve the long-term sustainability of cod fisheries.



The long-term sustainability of cod fisheries is of concern not only to the industry, but also to ecologists. The principle aim of the Codssey research project was to improve the biological and ecological understanding of cod stocks in four ecosystems. These were the Barents, North and Baltic Seas and the Icelandic plateau.

Scientists set out to undertake a comprehensive data storage tagging programme in order to collect individual level behaviour. With the results collected, they were able to compile a geolocation database and to reconstruct movements of cod in relation to their spawning and feeding grounds.

The design and production of press and publicity materials for the project became an integral element to its success. A website was launched, which brought together comprehensive information relevant to the project's progress. It also acted as a forum for the members, nine fisheries research

institutes based across eight different European countries, to bring together their findings. It facilitated information exchange between the team members, the general public and fisheries scientists working on similar projects.

Further actions taken as part of building an effective communication strategy for the project included the design of a poster and a wide range of press material geared towards a non-specialist audience. The poster presented on the site details the appearance of the project tag and what to do in the case that a tagged fish is captured. It was distributed to fisheries offices, harbour masters, fish agencies and fish markets throughout the United Kingdom and Europe. The poster slogan reads 'Cod — amazing even without chips' and the illustrations draw attention to cod biology. This, and further information can be found on the website <http://www.codssey.co.uk>

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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Environmental change and cod stocks

Fish biologists have carried out studies into the environmental factors which affect cod stocks.

It was previously believed that cod were unable to tolerate large, abrupt changes in temperature. This would mean that a difference in only a few degrees between different water masses would represent an almost impenetrable barrier to the fish. However, observations made by the Codysey team revealed that thermal tolerance in wild cod is much greater than that suggested by laboratory studies. This finding represents a major advancement in understanding the biology of cod.

Researchers undertook simulation experiments to discover the extent to which the behaviour of

the fish can be explained by simple behavioural rules. In the Baltic Sea cod appear to adhere to these rules, which ensure that they stay within the chosen habitat. Depth or oxygen levels did not accurately account for the behaviour observed. In the North Sea, simulations of cod responses to water temperature suggested that optimal temperature was not the only factor influencing fish movements.

The Codysey study assessed cod's tolerance of temperature and oxygen levels, showing that the fish are tolerant to a wide range of environmental factors. This information has

helped to explain the widespread distribution of cod in the Atlantic. It also indicated that environmental changes resulting from human activities may also influence the distribution of cod stocks.

These new findings on the ability of both populations and individuals to tolerate thermal stress offers hope for the recovery of cod stocks. This is providing that over-fishing can be curtailed and that juvenile fish continue to be added to the population at the same rate as in the past.

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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Telling herring apart by their ears

New metrics developed by the Danish Institute for Fisheries Research proved extremely valuable for differentiating among herring caught in the open sea.

The EU-funded Hergen project sought to properly identify biodiversity in herring (*Clupea harengus*) fish stocks in order to enable its preservation. An investigation of new techniques to distinguish between different types of herring was led by the Hergen coordinator, the Danish Institute for Fisheries Research.

Earlier scale- and vertebra-based methods were passed over in favour of an approach targeting otoliths, small structures in the herring's inner ear, and other visually observable phenotypic characteristics. For example, samples collected from the North Sea, Skagerrak, Kattegat and Western Baltic were visually inspected for a range of physical characteristics. Instances of incorrect classification were reduced to just 2 % by employing experienced technicians.

With respect to otoliths, elliptic Fourier transformation (EFT) was used to analyse otolith shape in fish collected from the different regions at different times of the year. EFT proved effective in differentiating between individuals, while the aforementioned phenotypic technique was more appropriate as a population level diagnostic. The Danish Institute for Fisheries Research recommends the use of both methods to separate out different subspecies from mixed herring stocks.

Analysis of the herring caught during Hergen confirmed the existence of two distinct herring variants in the region: North Sea autumn spawners and Western Baltic spring spawners. In addition, genetic diversity was found to vary at finer scales along the salinity clines between the two seas. Differing migration

patterns are also thought to contribute to the diversity of herring inhabiting the area.

These findings will be exploited to guide regional fishery policy aimed at protecting herring biodiversity.

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

Collaboration sought: information exchange/training.

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Understanding transmissible spongiform encephalopathies in fish

Europe's leading scientists are taking steps to ensure that transmissible spongiform encephalopathy (TSE) never again reaches the dinner table.

TSEs have done serious damage to the reputation of the food industry in recent decades. The practice of feeding animal remains to livestock, which contributed to the spread of the disease, has since been revised.

Fish farms, however, still use bone meal and other animal products as sources of protein for their stocks. The 'TSE and fish' project aimed to assess the risk of TSE transmission to fish from contaminated feed. The Institute of Agrobiotechnology

of the Centre for Research and Technology Hellas (CERTH/INA), Greece, led a group of three other research institutes during the project.

CERTH/INA examined the fate of PrPSc, the abnormal version of the prion protein thought to cause TSE, when ingested by fish. They discovered that the length of time the PrPSc is retained in the fish's systems depends on the species and the type of TSE. It was later confirmed that some of the

harmful prions were able to cross the gastrointestinal barrier and infect other types of tissues.

Thus, the fish can be compromised by unsafe feed supplies, casting serious doubt on the use of fish by-products as animal feed. Consequently, CERTH/INA and its partners recommend that these findings be given serious consideration prior to any lifting of the current ban on the use of fishmeal in the diet of livestock across the EU.

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 > 4791

Self-movement perception in the elderly

Vision is a dominant source of information for the control of self-movement. Models that link the properties of neurons to the motion experienced as a result of walking or driving a car have been developed to elucidate possible underlying control mechanisms.

Movement towards a target in space requires a massive flow of sensory information that has to be analysed in order to avoid possible obstacles. This is not trivial given that visual information, before it reaches the visual centre in the brain, is encoded by the innermost layer of the eye.

During active exploration of an environment, eyes move constantly and each object's image on the retina shifts while the object might be stable. The question whether image motion on the retina alone allows the brain to estimate the direction of self-movement or an additional visual signal is needed was explored by the Eurokinesis project partners.

Research at the Philipps-Universität Marburg in Germany focused on the medial superior temporal (MST) area in the human brain, for which the main input is the middle temporal (MT) area. Furthermore, the

response properties of neurons sensitive to motion in the ventral intraparietal (VIP) area to visual stimuli were investigated by means of a neural network.

This network consisted of two layers of neuron-like elements and was trained to develop an accurate representation of the visual information flow. The output layer elements developed response properties that were similar to several properties of MST and VIP neurons. To find age-related changes in the perception of self-movement, extensive simulations were conducted with a varying loss rate of neural elements.

This biologically plausible assumption of age-related neuron loss led to a perfect agreement between the neural network output and the results of neurophysical and neuroanatomical experiments. The results



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will be used to attempt to remedy the decline in the ability of the elderly to make use of visual information by the development of complementary sensory enhancements. Moreover, they have been identified as the starting point for the development of cross-training programmes suitable for preventing falls and improving the driving skills of elderly.

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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Targeting eye deficiencies in senior citizens

It is well known that ageing has an effect on a number of motor and perceptual functions. Furthermore, research has found that these effects are often subtle. Therefore necessary measures for remedy have been taken.

Senior citizens are increasingly mainstreaming in everyday life and therefore mobility is equally important for this segment of the population as it is for the young. Mobility gives way to more independence and thus a higher quality of life. In light of this, the Eurokinesis project examined physiological, pathophysiological, behavioural and anatomical factors which may cause deficiencies in movement perception in the elderly. Experiments simulated the appearance of obstacles and driving scenarios containing the need for reaction in a certain amount of time.

In order to ultimately target deficiencies regarding visual attention of the elderly patients, eye movement parameters and self-motivation perception were specifically assessed in young, middle-aged and elderly subjects. It was concluded that rapid, jerky eye movement between positions of rest in the elderly was at 90 % which is comparable to the other two age categories. On the contrary, regarding convergence and divergence, there was evidence of a decrease of 60 % or more in the elderly patients. Likewise this was the case regarding vergence (simultaneous movement of both eyes in

opposite directions to obtain or maintain single binocular vision).

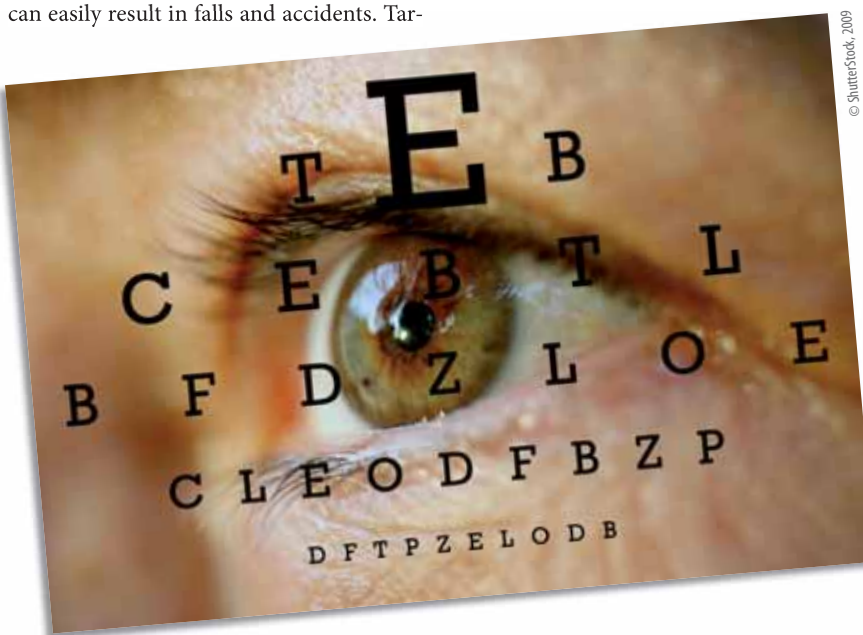
Slowed initiation and execution and inadequate accuracy of vergence could all be significant factors related to limited space perception, especially that of accurate determination of distance to an obstacle. This can easily result in falls and accidents. Tar-

geting such deficiencies through the aid of ergonomic training and rehabilitation may help prevent such occurrences, permitting Europe's senior citizens to continue an active and satisfactory life.

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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Supporting society's elderly through disability

The Infopark project has addressed the issue of health care and social needs of older people with disabilities. Its findings have made up the basis for policy recommendations.

The Infopark project conducted research into the personal experiences of 500 elderly people and their carers. The group studied all had differing physical, mental and social disabilities. They also differed in their cultural, social and economic backgrounds. The findings were compared with opinions of 700 professionals working across seven European countries.

Recommendations ensued from this research. The focus of the findings empha-

sised the need for more attention to be given to chronic conditions. It was suggested that this become a priority for health care professionals and that resources be allocated appropriately. Furthermore, the research highlighted the need for greater support of informal family carers' needs. The need to combat negative stereotyping of disability also needs to be given more attention in policy that it currently receives, say researchers. It was suggested that financial support

be more readily available for new initiatives which educate the patient and their carers. In such initiatives, organisations play an important role. Greater support should also be given to them.

These suggestions were included in a report recommending policy actions. This document was also used to develop educational materials for sufferers and their carers and to ensure that the care services provide more appropriate standards of support.

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

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New hope for patients with chronic or traumatic wounds

Patient recovery following a wound such as an ulcer, cancer wound or traumatic wounds such as burns are reliant on the care available. New products invented by scientists at Coloplast allow for advanced wound care which supports the natural regeneration process with living cells, growth factors and structural elements.

There exists an increased demand in the healthcare market for materials that can potentially replace, repair and regenerate injured bone, cartilage and skin tissues. Such innovation would drastically improve the quality of life of many people, especially the elderly members of society.

The EU-funded Intelliscaf project was set up to address this demand. The team's objectives were to produce 'scaffold' materials which can initially fill the tissue defect, provide equivalent function to the equivalent tissue and support the natural tissue regeneration process *in vivo*. Also, such a material

would ultimately degrade upon tissue differentiation and growth.

This was an ambitious project and therefore partners were called upon for their expertise. One of the partners was Coloplast, a company based in Denmark. It utilised its expert scientists to focus on the possibilities of creating the scaffold materials using two processes: lyophilisation and spinning of fibres.

The lyophilisation process as part of this research was concerned with understanding the dynamics of freezing for pore size control and drying for stability. The research-

ers also assessed concentration dependence, softness, flexibility and characterisation procedures of the resulting scaffolds.

Fibre production by the process of spinning was also assessed. A wet spinning process for natural water soluble polymers and a melt spinning process for thermoplastic synthetic biopolymers were developed.

Both tracks for processing were tested *in vitro* and *in vivo*. The scaffold prepared by lyophilisation and that prepared by fibre spinning showed attachment and ingrowth of skin cells.

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

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

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Safer and more effective intelligent tissue engineering

An improved 'smart scaffold' has been engineered with the objective that it can be used to regenerate bone tissue. The scaffold could make a significant difference in present procedures, which are only partly successful in restoring all functions of the damaged tissues.

Intelliscaf is the name given to an EU-funded project with the purpose of designing intelligent tissue engineering of bone and skin cartilage. There is a big need for new methods which can potentially replace, repair or even regenerate injured bone, cartilage and skin tissues. This unique project set out to develop functional biomaterials and advanced nano-tailored materials via surface technologies and nanostructured particles. The engineered material would need to be capable of initially filling the

defect whilst also providing equivalent function to the equivalent tissue.

One approach to the research was to develop a method for producing three-dimensional (3-D) carbonated hydroxyapatite (HA) stages for bone with a high degree of porosity. The method involved optimising the synthesis process used to obtain calcium phosphate (Ca/P) derivatives powders. It also included the optimisation of the manufacturing process, to enable the reproduction of batches.

The result was a 3-D smart scaffold which could be used as a smart scaffold substitute for different surgical applications. The key innovative feature is the synthetic bone graft, which has no limitation on the quantity and repeatability of the performance.

Further analyses were carried out. These included assessments of strengths and weaknesses and a competitor's analysis. The 3-D smart scaffold is considered safer and more effective compared to other synthetic material.

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

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

<http://cordis.europa.eu/marketplace> > search > offers > 4873

Decoding neural signals

Mathematical models of oscillating neurons involved in processing the electrical activity generated by artificial stimulation of the skin have been developed. Aiming to shed light on how internal representations of real-world stimuli are created, the Rosana project partners have developed the essential tools to define the desired stimulation patterns.

The human central nervous system receives an excessively large amount of information from the external world. Coded and transmitted through the nerves as electrical pulses, it has to be analysed and processed to produce conscious perceptions of the external world.

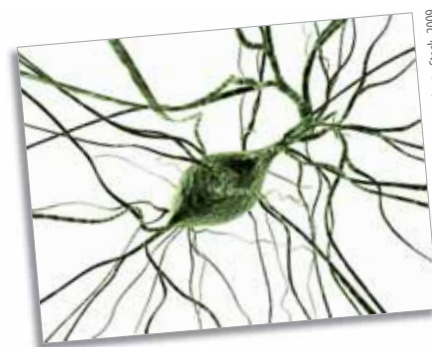
In the design of artificial devices to be directly connected to the peripheral nerves, it is thus of outmost importance to take into account the pathways along which information is conveyed. For such devices to transduce characteristics of the external world as bioelectrical signals, the interactions between incoming signals and neuroelectric activity along the sensory pathways also need to be considered.

The only way for artificially generated signals to be correctly interpreted and processed is to code and transmit sensory information in a similar manner to the central

nervous system. Research work conducted at the Universidad Complutense de Madrid, Spain, dedicated to providing an accurate mathematical description of the dynamics and architecture of networks of neurons.

Activity of individual neurons is not solely due to their intrinsic properties, but is mostly a result of the direct influence of a few to hundreds of thousands of neurons. On the other hand, any behaviour of a neural network depends on their morphology and the entire interconnection pattern. Researchers cannot usually record the activity of each neuron in the network but are rather restricted to a very limited number of neurons whose properties they seek to capture.

Within the framework of the Rosana project, a novel method for the identification of networks of more than four neurons and analysing experimental recordings of their activity was proposed. By means of



mathematical models of single neurons and descriptions of the effective connectivity between them, properties of the ensemble were inferred that can not be directly obtained from observations.

Once all the values of the equations' parameters had been finalised, the deterministic model of the whole neural network was mathematically investigated. Moreover, it was shown that the model describing the behaviour of the underlying biological neural network produced neuroelectrical signals with statistical properties similar to those of the experimental data.

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

Collaboration sought: further research or development support.

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Biodegradable bone forming material for in vivo tests

Various techniques were compared for in vivo evaluation to determine new bone formation and bioceramic degradation abilities of specially selected materials. These can be applied to products consisting of biodegradable bone forming materials for use in bone defect medical treatment.

Bone defects present a major concern for patients as well as for orthopaedic reconstructive surgeons. Standard medical treatments for bone defects do not always result in complete success, which can negatively affect the personal and social life of a patient.

In light of this, the Algisorb project created a biodegradable bone forming material using a form of hydroxyapatite (HA) derived from marine algae which can stimulate bone growth. The developed product, Algisorb® was obtained from the HA source *Corallina officinalis*, a coral weed.

In order to measure the growth of *Corallina*, various techniques were tried but none were completely satisfactory. What was clearly apparent was that the supply of nutrients stimulated growth; the more enriched the seawater, the more substantial were the increases in growth rate.

The product Algisorb, a pure HA granulate, was tested along with Algisorb® and

Cerasorb®. Algisorb is a biphasic granulate consisting of 70 % tricalcium phosphate (TCP) and 30 % HA whereas Cerasorb consists of pure TCP.

Algisorb was able to adsorb more protein than Algisorb and the results showed that Algisorb was also more favourable for bioceramic degradation and produced significantly higher amounts of new bone. Thus it was selected as the most favourable biomaterial for *in vivo* animal tests.

Algisorb was furthermore enriched with Laminarin (the principal storage product of brown algae) and bone morphogenetic protein-2 (BMP-2) or left untreated, and the treatments were then evaluated. BMP-2 showed higher mineral apposition rates with no differences in the amount of new bone formation and bioceramic degradation. Therefore, BMP-2 was employed in additional studies of the influence of various membranes on new bone formation and bioceramic degradation.



Tissue implants for knee injury

The menisci in the knee provide the structural integrity for the joint when it is under tension or torsion. Tissue regeneration of this vital part of the knee has been tested in an animal model in a bid to prevent the pain and deterioration commonly associated with injury.

Deterioration of the knee joint often involves one of the two menisci, cartilaginous structures that disperse the load imposed by the body during movement. Longer lifespan with increased use and sporting injuries often lead to damage. Chronic pain, osteo-arthritis and restriction of movement with resultant loss of life quality can be the result.

In order to find an alternative to resection of the damaged tissue, the EU-funded project Meniscus-regeneratio aimed to develop surgical protocols to replace the tissue with bio-engineered material. The meniscus would be constructed using a bioactive scaffold and autologous cells.

Biomaterial from project partners was used in implant trials on sheep. A pilot study using eight sheep gave promising results. The implants stayed in position and were integrated to the capsule. After six weeks, there was tissue formation with all types of cell and vascularisation. Moreover, there was no sign of allergic or immune response.

Based on this, the team at the Istituti Ortopedici Rizzoli in Italy expanded the tri-

als to incorporate two groups of a total of 64 sheep evaluated over a total of 12 months. Two surgical techniques were compared and implant scaffolds were either cell-free or seeded with articular chondrocytes.

Evaluation was based on scores specifically designed for the project, one for implant integration with nine categories and another for joint changes which assessed 12 different areas in the joint. The implants were also scored histologically for all cellular and tissue components, including the important factors of presence of residual scaffold and cells indicating an inflammatory response.

The extensive data collected suggested that the hydroxyapatite/polycaprolactone (HA-PCL) scaffold is a promising candidate as it displayed immunological tolerance and tissue growth was induced. However, problems were encountered with the mechanical properties and implant fixation technique, and further research was planned to eliminate these limitations.

The research has provided a basis for the development of an implant that could be



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applied surgically on damage to the knee menisci. The restoration of a healthy joint *in situ* without the need for a complete resection means much shorter recuperation time and greater chances of a complete recovery.

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

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

<http://cordis.europa.eu/marketplace> > search > offers > 4812

Predicting osseo-integration of dental implants

Researchers developed computer models to help create one-stage placements for dental implants. The methodologies developed were combined with results from guinea pig and human studies to predict integration between the living bone and the implant.

Problems arising from the permucosal fixation of oral prostheses are associated with an ageing population, such as in Europe. Standard dental practice has been to fit the prosthesis onto a supporting implant. This follows a period where the area surrounding the unloaded implant has been allowed to heal. However, one-stage placements of implants, which can accept immediate

loading, have been developed. These have improved patients' quality of life by enabling an earlier return to normality.

The Imload project studied the reaction of bone to the effects of controlled mechanical loading and the fixation of a dental implant. Models of the dental implant-bone complex were developed by the team. The aim of the models was to help improve the design of dental implants, facilitating the long-term connection between living bone and the surface of a load-bearing artificial implant. This process is known as osseo-integration. The extent of bone growth and resorption was predicted with a bone remodelling algorithm. Further research was planned to more successfully integrate the algorithm into a commercial finite element framework.

Researchers developed a methodology for producing three-dimensional (3-D) models of cancellous and cortical bone, bone marrow and artificial dental implants. Cancellous material has low density and strength but a large surface area, whereas cortical or compact bone material is dense and forms the surface of bone. A methodology was also developed for creating models for the analysis of artificial biomaterials and biological tissues and structures.

The team used these methodologies to build finite element models of guinea pigs and patients used in pilot studies. The algorithm used for bone remodelling was applied to the guinea pig results. The methodologies developed were then combined in order to predict osseo-integration in human patients.

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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Drugs that cut cholesterol also halt prion diseases

Scientists have researched the possibility of a treatment for prion diseases based on anti-cholesterol drugs.

Intense research into prion diseases has led the development of possible drug therapies down various pathways related to the pathogenesis involved. Based on this, the EU-funded project Stoptses formulated its objectives as the prevention of the development of the condition at key stages. Target events included the reduction of infectivity, inhibition of its replication in lymphoid tissue and prevention of the establishment of infection in the central nervous system.

The infectious agent behind prion diseases is a protein with a fibrillar structure. Consequently, most research to date had concentrated directly on the disruption of the structure of the protein. However, project partners based at the University of Glasgow, United Kingdom, investigated the potential of anti-cholesterol drugs as a means of treatment.

Their aim was to determine the action of anti-cholesterol drugs in controlling or preventing

the mechanisms by which the prion acts as an infective agent. Disruption of cellular trafficking was one possible mode of action. Also, the processing and formation of prions may be affected by anti-cholesterol drugs.

Positive control of these functions was demonstrated in tissue culture models and infected cell lines. The team planned to extend their trials to *in vivo* models. An alternative therapeutic strategy has been explored that may have potential as a block to the development of prion diseases within the host.

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

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Brain tissue characteristics diagnose prion diseases

The overall aim of the EU-funded PrionMRdiagnostics project was to improve the diagnosis and determination of the progression of human prion diseases. Non-invasive magnetic resonance (MR) imaging techniques were investigated as a means of achieving this goal.

The appearance of the variant form of Creutzfeld-Jakob disease (CJD) fuelled research into possible therapies. Essential for this is a comprehensive knowledge of the mechanisms and stages involved during disease progression. Partners in PrionMRdiagnostics sought to find non-invasive MR biomarkers for diagnostic criteria of human prion diseases.

Determination of tissue characteristics using MR is used in the diagnosis of many diseases including those of the central nervous system. Ideal candidate pathologies are effects of strokes, many psychiatric disorders and the various forms of transmissible spongiform encephalopathies (TSEs).

For this study, data was collected from patients and animal models with various forms of TSE. Specifically, individuals with sporadic or variant CJD, inherited forms of TSE and non-prion forms of dementia as well as two animal models were investigated using different modes of MR methodology.

The project team at the University of Bologna, Italy, focused on identifying new MR biomarkers that demonstrated the required specificity and sensitivity. Quantitative data from MR imaging (MRI) and MR spectroscopy (MRS) was collated and analysed statistically. Regional differences in brain tissue characteristics at various stages in the pathologies could then be determined.

The team found that diagnostic protocols could be improved by the inclusion of proton MRS (1H-MRS) applied to the thalamus. Diffusion-weighted magnetic resonance imaging (DWI) was also recommended as a promising tool for understanding changes in brain tissue in cases of TSE.

The findings of this research were disseminated through scientific journals. Direct application of MR indicators to patient care and further study through national CJD surveillance units was also planned through their inclusion in diagnostic procedures. Improved disease indicators mean that development and testing of novel therapies could also be facilitated.

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 > 4707

Rehabilitation for patients via tele-videoconferencing

A new approach to rehabilitation for people with spinal cord injuries has been developed, allowing patients to receive follow-up care from their home via a video-teleconference platform.

Patients with spinal cord injuries can be subjected to spending an extended period of time in rehabilitation facilities often far from their family setting. The Thrive project has found a means to improve their level of care through the use of information and communication technology (ICT) which brings specialised facilities closer to the patient's residence. The aim was earlier discharge, the possibility for closer follow-up care and closer collaboration among

patients, multidisciplinary teams, caregivers and home care staff.

The tele-rehabilitation approach was conducted in Belgium, Italy and the United Kingdom within the realms of both public and private care. The quality of care, the patient's overall quality of life and cost were all taken into consideration. Tele-rehabilitation was realised through the creation of the Thrive video-conferencing platform. It

consists of a purpose-designed PC-based box which connects to a TV monitor and to an ADSL or ISDN communication line. Furthermore the video-conference platform uses software which allows operation by people with limited manual skills and permits video messages to be sent and stored. As such, patients can be in the comforting surroundings of their home and loved ones while simultaneously receiving close follow-up care.

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

Collaboration sought: joint venture agreement; marketing agreement; financial support; available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4724

Replication for herpes virus made more efficient

Kaposi's sarcoma is caused by human herpes virus 8 (HHV-8). Scientists from the EU-funded project 'Anticancer retinoids' have developed a new protocol whereby a cell-free inoculum can be produced for this carcinogenic virus.

Members of the 'Anticancer retinoid' project aimed to investigate the action of retinoid



compounds against cancer. Past research has demonstrated that retinoids display very definite anti-cancer action favouring apoptosis or simply stopping tumourigenesis. Project objectives also included work on retinoid anti-viral action.

As part of the viral research, Italian-based project partners at the University of Ferrara developed a method to prepare cell-free inoculum using HHV-8. This virus causes Kaposi's sarcoma which results in tumours on the skin and digestive and respiratory tracts.

The initial step was to obtain the purified and concentrated virus from activated lymphoma cell lines followed by high-speed centrifugation. The next procedure was to find a cell line which would enable the virus to replicate at high efficiency. Vero cells were used, their source being kidney

epithelial cells. HHV-8 naturally targets primary endothelial cells. However, the team found that viral production was even more efficient in the Vero cell lines than in primary endothelial cells.

The incorporation of promoters of HHV-8 replication to speed up the process was the next phase. The trials used the open-reading frame 30 (ORF30) sequence in particular as an established promoter for the virus.

The efficient replication of viruses like HHV-8 represents a crucial part for understanding the repressive action of retinoids at different stages of the viral life cycle. The further elucidation of the biochemical processes involved may be used in the continuing fight against cancer.

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 > 4508

Extensive pan-European cardiovascular disease data

Researchers have investigated the possible links between lifestyle, family history and physiological variables and the development of atherosclerosis.

Carotid artery intima media thickness (IMT) is regarded as an indication of the progression of atherosclerotic disease. Commonly known as hardening of the arteries, atherosclerosis is a major cause of cardiovascular disease (CD). The social and economic costs of this disease run very high, particularly in developed countries. Globally, CD is responsible for 17 million deaths each year.

The Improve project aimed to provide a comprehensive and statistically significant account of risk factors for the increase of thickness of artery walls. Patients from seven centres throughout Europe, from Finland down to Umbria, Italy, were studied as an example of a high-risk group.

Using ultrasound to measure carotid IMT, the scientists determined if there were correlations between personal history of disease, lifestyle, physiological characteristics and thickening of the artery wall. The data was analysed by conventional statistical methods and neural networks and was also adjusted for appropriate confounders.

Among the physiological indicators, diastolic blood pressure, weight and body mass

index were found to be determinants of IMT. A range of aspects of blood count were studied. High- and low-density lipoproteins together with creatinine showed positive links with IMT and leucocytes were particularly strong determinants.

Not surprisingly, lifestyle, in particular smoking status, total alcohol consumed and coffee intake were linked directly to artery wall thickness. Physical activity, after adjustment for confounders and by centre, was shown to be negatively correlated with IMT although the data was not shown to be considerably significant.

Further data on personal history of disease revealed that gall stones, tuberculosis and allergy status are associated with IMT. From a family history point of view, cardiovascular dis-

ease and hypertension showed particular importance.

The collation of extensive data relating to physical, genetic and lifestyle markers can aid in the identification of asymptomatic atherosclerotic patients. Formulation of diagnostic protocols for the early identification of high-risk individuals can then follow. The data has been widely disseminated through meetings, scientific journals and the website at <http://users.unimi.it/improve/index.htm>

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

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4712



Portable test for food gluten

Coeliac disease (CD) is estimated to affect 1 % of the European population. The EU-funded CD-CHEF project researched into means by which CD toxic gluten can be extracted and detected in all food stuffs.

CD is an autoimmune disease of the small intestine. Symptoms include diarrhoea, fatigue and failure to thrive in children. The condition is due to the reaction to gluten proteins, gliadin and glutenin in wheat. Immuno-stimulatory peptides are found in both proteins. An inflammatory reaction leads to flattening of the villi in the lining of the small intestine which is responsible for non-absorption of nutrients.

Although research is ongoing to find alternative therapies, the main effective treatment to date is the imposition of a gluten-free diet. This provided the impetus for researchers within the EU-funded CD-CHEF project to investigate means by which gliadins and glutenins could be assayed in any type of food. The overall aim of the consortium was to develop a disposable microsystem to accurately and efficiently quantify the CD toxic gluten to which coeliacs show intolerance.

Project partners at the Universitat Rovira i Virgili Tarragona, Spain, concentrated their research effort on the development of a method for extraction of gliadins and glutenins from raw and cooked food. Tests available previous to this research were time-consuming and involved the use of noxious chemicals.

The novel protocol cut the extraction time from a lengthy 3 hours to only 10 minutes. From the point of view of cost efficiency, the new test is an improvement as the volume of extraction solvent is reduced as well as avoiding the use of toxic reagents.

In terms of the assay, the extraction process proved compatible with both enzyme-linked

immunosorbent assay (ELISA) and biosensor formats used. Project partners have therefore achieved the integration of extraction and detection in a disposable format. Altogether, total assay takes around 15 minutes at a much reduced cost.

The commercial exploitation of the novel protocol was envisaged involving its combination with an ELISA kit. End-users include industry and the individual consumer, whose interest was confirmed through a consumer survey. Dissemination of the microsystem technology has been widely achieved through the project website, scientific publications, trade fairs and conferences. Overall, this constitutes an efficient portable means to support the minimisation of the effects of CD for sufferers.

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

Collaboration sought: licence agreement; available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4760

Human biomonitoring linked to environment and health

Measures have been taken to examine the possibilities of linking human biomonitoring (HMB) with that of environmental and health monitoring and transferring the results through a response system.

In order to overcome deficiencies in HBM in Europe, the ESBIO project devised a coordinated approach which focuses on children. One added-value component of this effort involved a way to integrate biomonitoring with environmental and health monitoring followed by translating the results into a response system.

The data included pollutant concentrations in air, water and food. Also included in the overview were ways for HBM, environmental and health data to be all linked via two possible means. One of these is physiologically based pharmacokinetic (PBPK) modelling and the other is spatial epidemiological statistics methods such as geographical information systems (GIS).

Available data could be identified and the areas where there was none could also be pinpointed. The criteria taken into account in the overall assessment included availability, harmonisation, geographical context, quality control and policy development. These were useful in distinguishing availability and quality of data covering various

sources of information on environmental exposure and health responses.

Funded under the FP6 cross-cutting activity 'Research for policy support'.

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4759



Anti-allergy vaccinations

Allergic reactions in humans affect a great number of individuals and can often result in life-threatening situations. The EU-funded Allnavac project studied the vaccines developed to fight these allergies.

Developing vaccines against allergic conditions is a multifaceted challenge hampered by a number of obstacles. Past EU-funded studies developed early-stage DNA vaccine candidates, encoding for specific allergens. The aim of the EU-funded Allnavac project was to further the existing research on this topic and study the immunological modifications induced by this vaccine type.

Project partners used the allergic airway disease model to evaluate different vaccination approaches. Allergy was induced by the human allergen house-dust-mite-derived Der p1 gene gun vaccinations were carried out after sensitisation and before challenge with allergen. This was said to resemble a real-life situation where only those suffering with allergies would receive vaccinations to prevent symptom onset.

The studies showed that allergic reactions can be prevented by vaccination between the stages of sensitisation and allergen challenge. Specific immunological effects have been partly attributed to non-specific bacterial DNA effects on antigen presenting cells (APCs).

Further research is needed to validate this specific approach and to judge the suitability of alternatives.

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 > 4742

Improved conversion of lignocellulose to ethanol

A cost-effective and sustainable technology was developed to produce ethanol from forest and agricultural waste. The process was based on sulphur dioxide (SO₂) catalysed steam pretreatment of softwood, corn stover and willow (Salix), followed by simultaneous saccharification and fermentation (SSF).

Lignocellulose is the most abundant organic substance on earth and comprises cellulose, hemicellulose and lignin. The cellulose, which is enveloped in the lignin and hemicellulose, consists of tightly bound sugar chains harbouring thousands of glucose molecules. If access to the glucose can be gained, it can be fermented into the biofuel ethanol. Pretreatment separates the cellulose from hemicellulose and lignin, making the glucose more easily available.

The TIME project focused on ways of improving the conversion of lignocellulose into ethanol. The bottlenecks found in conventional lignocellulose-to-ethanol conversion technologies were overcome through the development of novel pretreatment and enzymatic hydrolysis techniques. These new methods increased ethanol yield and reduced the amount of energy used during the production process.



Researchers developed steam pretreatment of softwood in one or two stages through the addition of SO₂ or sulphuric acid. The overall yield of ethanol was 80 % following saccharification, which is the hydrolysis of the cellulose chains to glucose, and fermentation of the pretreated material. The two-step wet oxidation process was intended to extract most of the hemicellulose fraction under mild conditions during the first stage.

The subsequent second stage enhanced the digestibility of the cellulose and was carried out under more severe conditions. It was demonstrated that the two-stage pretreatment process significantly improved the hemicellulose yield of softwood and Salix. Hemicellulose is less resistant to hydrolysis than cellulose. A two-stage wet-oxidation pretreatment was also shown to improve sugar yield.

Corn stover comprises the leaves and stalks of maize which are left following harvest. Researchers from the TIME project carried out experiments on corn stover at the pilot scale. An increase from the laboratory scale did not result in a higher yield of hemicellulose but it did result in a significant rise in glucose yield. Under optimum conditions laboratory-scale experiments achieved a glucose yield of 63 %, whereas use of the pilot reactor resulted in a yield of 84 %. The final ethanol yield was around 70 % at the lab-scale and 76 % for the pilot-scale.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4945

Low-emissions engine designed by EU-led consortium

Cutting the environmental impact of heavy duty vehicles would be a significant move towards reaching low emission targets. The Afforhd project pioneered the use of dimethyl ether (DME), which is suitable for both diesel and fuel engines, as an alternative fuel for trucks.

This EU-funded project set the aim of developing alternative fuel for heavy duty trucks. The teams achieved this result by developing a DME fuel system. The use of DME has a number of advantages, including that it is clean-burning as it has no carbon-carbon bonds. The result of more than three years work was that the consortium involved developed an engine which utilises the low-emission and high-efficiency capabilities of the fuel. The research indicated that DME has the potential to become a highly competitive alternative to today's fossil fuels.

As part of this project, the VOLVO team set to work to develop a new generation fuel injection control system. New soft-

ware was developed and tested. Optimisation work was carried out, which involved the installation and running of new software and datasets on the engine. The idea was that this would later be used to operate within a vehicle. Tests were run in the engine control system and were carried out as the engine speed was changed. The functionality tests indicated that the engine worked well.

Following these trials, the engine was installed in the vehicle and was consistently found to work well. The hardware was also designed to meet industry requirements and by the end of the project, it was not far off from being ready for production.



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

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

<http://cordis.europa.eu/marketplace> > search > offers > 4927

Footprint algorithm detects photovoltaic malfunctions

A valuable new algorithm developed by scientists in Germany enables early notification of photovoltaic (PV) operators when their system is malfunctioning and informs them regarding the source of the fault.

The EU aims to produce at least 20 % of its power from renewable sources by the year 2020. In order for grid-connected PV installations to play their part, issues related to efficiency and reliability need to be resolved. To this end, the EESD programme funded a number of relevant research projects.

One such project, entitled PVSAT-2, sought to provide performance analysis and error detection tools to PV operators by exploiting irradiance data collected by satellites. The

Fraunhofer Gesellschaft zur Förderung der Angewandten Forschung e.V., a PVSAT-2 participant, contributed by developing software to improve error management.

The Fraunhofer institute initially performed a statistical analysis of modelled versus actual PV yields. This helped establish probabilities for a number of common problems, such as shading. This information was then used to construct a footprint algorithm that automatically detects and classifies different types of PV system malfunctions.

During the project, the footprint algorithm was integrated into the PVSAT-2 decision support system. The result was that PV operators received immediate feedback regarding the existence of a malfunction as well as information regarding its likely cause.

The hope of the PVSAT-2 consortium is that these tools will help PV operators reduce maintenance costs and system downtime while improving yields.

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

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

<http://cordis.europa.eu/marketplace> > search > offers > 4921

Reducing the cost of solar cells — it's no Fantasi

A new thin-film multicrystalline silicon (mc-Si) solar cell was developed during the Fantasi project that cuts costs without sacrificing performance.

Cost remains one the biggest obstacles impeding wider adoption of solar panels to produce electricity in a clean, sustainable manner. Substantial funding was made available through the Fifth Framework Programme (FP5) to encourage research into new technologies capable of driving production costs down.

The Fantasi project investigated the promising option of thin film solar cells, which require significantly less raw material for their manufacture. The challenge was to improve upon their less than competitive efficiency ratings. To achieve this end,

IMEC, a Belgian research centre with considerable experience in the fabrication of solar cells, integrated a number of advances made during Fantasi.

More specifically, the classical screen printing technique was enhanced with updated isotropic texturisation, shallow emitter diffusion, parasitic junction removal, dielectric anti-refractive coating (ARC) and passivation as well as screen printed metallisation. After each of the aforementioned processes had been optimised individually, IMEC attempted to combine them in such a way so as to produce the most effective overall result.

The Belgian engineers had to resolve issues related to dislocations as well as bending of the wafers, which were accomplished through the use of an aluminium-based paste. In addition, by adjusting the rate of phosphoryl chloride (POCl_3) diffusion and front metallisation, IMEC was able to boost the cell's blue response.

The end result was a thin film (200 μm) mc-Si solar cell with a very attractive efficiency rating of 16 %.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4936

A bottom-to-top approach to solar cell manufacturing

Aiming to maintain Europe's competitive position in the solar cell market, the Topsicle research consortium produced a new cell that is more efficient and less expensive than its predecessors.

Europe has set lofty goals with respect to expanding its capacity to produce electricity from solar power using photovoltaic panels. Success will be determined largely by being able to produce more efficient solar cells at a lower cost. To this end, FP5 funded a number of relevant RTD projects, including Topsicle.

Topsicle was coordinated by the Energy Research Centre of the Netherlands (ECN), an organisation with considerable experience in the manufacture of solar cells. In the course of the project, ECN, in collaboration with its partners, implemented a number

of improvements using a bottom-to-top approach involving screen printing.

For example, inline acidic etching was introduced to enhance the texture of the cell. Additional gains in efficiency were also achieved by applying an emitter, optimising the firing stage, employing an anti-reflection coating (ARC) composed of hydrogenated silicon nitride ($\text{SiN}_x\text{:H}$) as well as a layer of magnesium fluoride (MgF_2). Finally, the ECN managed to significantly improve the procedure through which the back surface field (BSF) is formed.

These advances were first applied to multicrystalline silicon (mc-Si) material produced during Topsicle and then tested out on commercially available mc-Si. The results, which were verified externally, were very encouraging with an efficiency of up to 17 %. The ECN and its Topsicle partners were also able to bring down production costs considerably.

Cell manufacturers involved in the project have begun the process of incorporating the new technologies and scaling them up for use in their production lines.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4971

New electrical equipment will improve power quality

The IELAS project consortium has taken a major step forward in replacing century-old technology behind current transformers, which will smooth out the uneven voltages that plague today's power grids.

After electricity is produced at electric power plants, it has to be transmitted over long distances to residential, commercial and industrial facilities. Transmission at high voltages up to 765 000 V reduces the fraction of electricity lost to heating. However, it is impractical for the complex and widespread distribution network.

Instrument transformers provide the crucial link between high-voltage transmission lines and the multiple outgoing lines of distribution systems. These devices are used to step down the voltage of electricity to the 240 V needed for consumers, but more importantly for the measurement of electrical currents. They provide the basic input signals for controlling the flow of electricity, from the electric power station right through to the point of use.

To reduce the size and manufacturing cost of current measurement transformers, the IELAS project partners started the development of a new class of current sensors based on 'active' materials. Magnetostrictive materials were proposed to generate mechan-

ical waves under the alternating magnetic field induced by the primary current to be measured. Magnetostriction describes the small changes in their physical dimensions that materials undergo when exposed to a magnetic field.

Low electrical conductivity and increased sensitivity to applied magnetic fields made ferrite materials and rare earth intermetallic compounds good candidates as magneto-mechanical sensor materials. A laser-based measurement system, developed by project partner Enterprise Ireland, was employed to measure the magnetostriction of samples of cobalt ferrite and terbium-dysprosium-iron (Tb-Dy-Fe) alloys to an accuracy of 1 μm . The measurement system comprises a solenoid coil capable of generating a maximum magnetic field intensity of up to 3 000 Oe and a laser displacement sensor.

Significant improvements in the magnetostrictive response of sample materials were observed as a result of magnetic annealing, as well as in prestressed samples. Furthermore, enhanced magnetostrictive prop-



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erties with increasing magnetic field have proven that the approach adopted by the IELAS project will lead to a technology suitable for precise measurement of electrical currents.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4883

Improving stability control in wind turbines

Instability in wind turbines can affect both their efficiency and their ability to operate safely. The problem was addressed by carrying out a stability analysis on the coupled rotor-tower-system, which resulted in technical improvements and economic optimisation.

The Stabcon project developed reliable design tools for the analysis and optimisation of large wind turbines with regard to aeroelastic stability and active control. The project eliminated much of the uncertainty that can result from the design of wind turbines, thereby improving the reliability, durability and competitiveness of wind power. It is envisaged that a reduction in

the cost of wind energy and improved safety through active stability control will lead to greater social acceptance of wind energy.

Researchers from the Stabcon project adapted and refined the 'Aeroelastic analysis of rotating linear systems' (ARLIS) program. The program system was originally designed for the linear dynamic and aeroelastic analysis of horizontal axis wind turbines. Through the application of Floquet theory, it is capable of handling wind turbines operating with one, two and more blades. One limitation, however, is that ARLIS is restricted to a constant number of revolutions of the wind turbine per minute.

In order to carry out a dynamic analysis of the

coupled rotor-tower-system, the separated systems were described by finite element (FE) models. One assumption made was that the displacements were sufficiently small so that linear equations of motion could be used. Large stationary displacements were investigated by conducting an analysis around the equilibrium state of the deformed structure.

The tower and rotor were connected by one nodal (or coupling) point. Mass, stiffness as well as damping parameters were used in the definition of a simple FE model of the drive train with gearbox and high-speed generator. This enabled researchers to investigate both synchronous and asynchronous generators. Steady state and transient responses of the coupled system were calculated, taking into account loading as a result of dead-weight, wind shear and gust events. The results were fed into the FE system which then calculated nodal point displacements, stresses and forces.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4974



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Efficient conversion of wet biomass to hydrogen

Research performed by scientists in the Netherlands targeted the optimisation of transforming wet biomass to hydrogen gas at high temperatures and pressures.

Hydrogen, when produced from renewable energy sources such as biomass, constitutes a zero emission fuel and thus has been hailed as the fuel of the future. The conversion process also resolves the often difficult waste management issues associated with biomass.

To realise these benefits, the partners involved in the Superhydrogen project exploited supercritical water gasification (SWG). To improve the efficiency of SWG, the Netherlands Organisation for Applied Scientific Research (TNO) developed a procedure to transform wet biomass into a pumpable slurry.

One advantage of SWG is that the wet biomass, which was sourced from organic waste streams, does not need to be dried in order to extract its energy content. Following pilot tests performed during Superhydrogen, TNO determined that a pretreatment step

involving grinding helped to reduce particle size to optimal levels.

Another important achievement was the identification of plunger piston pumps as the most effective type of pump. Bioslurries containing particles as large as 7.5 mm with dry matter contents of 20 % were used during the trials.

Finally, TNO examined the relationship between production costs and energy output for the new process. Since not all wet biomass is suitable for SWG, the costs associated with producing a pumpable slurry ranged from as little as EUR 2 to as much as EUR 12 per thermal gigajoule (GJth).



The results were more encouraging with respect to sourcing the feedstock and its pretreatment, with costs reaching no more than EUR 3 per GJth.

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

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4959

Designing aero-elastic stability into wind turbines

A new software tool developed during the Stabcon project will help engineers design better wind turbines by eliminating the threat of system failure due to aero-elastic stress.

Aero-elastic instabilities can cause significant damage to wind turbines, especially large installations. The Stabcon project gathered together several leading research institutes in the field of wind energy with the aim of delivering aero-elastic stability to large wind turbines.

Dutch aerospace engineers with the Delft University of Technology were called upon to develop a piece of software to drive the design

process. The result was WOBBE, a non-linear tool capable of simulating the effects of aerodynamic load on complex multibody systems connected by hinges and springs.

The model incorporates boundary element methods to parameterise the effect of the inflow on the turbine's rotors and other essential components. Dynamic stall, a potentially destructive phenomenon, has been included as well as a Prandtl's tip cor-

rection. Built-in flexibility allows WOBBE users to easily adjust the level of model complexity as needed.

Model output can be fed to applications such as AerID. WOBBE was used during Stabcon to evaluate and compare the relative stability of several new turbine designs. It should be noted that WOBBE can also be used for helicopters, which are also subject to aero-elastic problems.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4947

Simulating the behaviour of environmental tracers

Novel software developed with Greek know-how will facilitate the ongoing search for less harmful environmental tracers while at the same time minimising research and development (R & D) costs.

Environmental tracers play an important role in the identification of underground reservoirs of hydrocarbons. Unfortunately, many of the tracer species used today have adverse side effects such as contributing to global warming, depleting stratospheric ozone or accumulating in the food chain.

The EESD programme funded a group of seven research organisations to develop a new generation of environmentally friendly tracers. The project, entitled Envitracer, was

coordinated by the National Centre for Scientific Research Demokritos (NCSR) in Greece.

The scientists at NCSR oversaw the creation of a software-based tool that simulates tracer release experiments in water. The aptly named digital core-tracer laboratory addresses the key physical phenomena, including tracer formation, dispersivity, permeability, interfacial transport and porous domains.

The software produces concentration profiles at the outlet and can be used to test the viability of new tracer species. Most importantly, the simulation results can be compared against experimental data and consequently provide insight into the complex aspects of tracer performance.

The digital core-tracer laboratory limits the need for expensive field experiments and will therefore help reduce development costs for new tracers. The research centre has protected the software with a copyright.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4957

The past sheds light on today's and tomorrow's climate

In addition to trying to forecast the future state of the climate, scientists must also establish an accurate record of past weather conditions. This was a primary objective of the EU-funded Pacliva project.

Deriving meteorological parameters prior to the introduction of meteorological instrumentation represents a unique challenge. Climate experts with the University of Bern in Switzerland used a number of advanced statistical tools to reconstruct gridded climate fields over Europe for the past 500 years.

Principal component regression, running correlations and scaled component analysis were applied to precipitation data. Two distinct regimes were identified that influence precipitation over the central and southern portions of the continent. This and other

investigations of regional features were made possible by the extensive spatial and temporal resolution of the dataset.

The winter season was also the focus of considerable research. Non-linear principal component analysis of surface temperature, geopotential height and precipitation data revealed three different winter regimes. One was closely related to the North Atlantic oscillation (NAO) while the others were associated with blocking.

Finally, the Swiss scientists fed the reconstructed gridded climate fields, in combination with available instrumental data, to global circulation models. Analysis of the simulations highlighted links between the NAO and other important global climate phenomena, such as El Niño, and the corresponding impacts on storm tracks over Europe.

Results from the Pacliva project have been published in relevant scientific journals. The University of Bern hopes to eventually extend climate reconstruction even further back into the past.



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

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4926

Applying community ecology to marine communities

The Mafcons project used an ecosystem approach to fisheries management (EAFM) to achieve a better understanding of the mechanisms linking biodiversity and fishing activities.

Community ecology studies have previously been directed mainly at terrestrial rather than marine communities. The research team at Swansea University, United Kingdom, reviewed the scientific literature to determine how it could be applied and made relevant to marine communities.

The structure and processes found within terrestrial communities result in patterns which were analysed by the Mafcons team. Examples were then taken from the marine community and studied. Some of the 44 differences found between marine and terrestrial communities were acute. The conclusion was that a theory which explains variation of structure in terrestrial communities may not be suitable for explaining that which exists in marine communities.

One particular difference is that terrestrial species are characterised by deterministic growth, whereas marine species display non-deterministic growth patterns. This suggested that the ecological functional unit for terrestrial organisms is the spe-

cies. However, in marine organisms non-deterministic growth results in considerable variation in niche growth between different-sized individuals from the same species. Mafcons scientists therefore used organism size classes as the basic ecological functional unit instead of species. Thus the project's study of biodiversity in marine communities took into account the size of the organisms concerned.

Furthermore, marine organisms do not demonstrate the Lotka-Volterra population dynamics usually found in terrestrial species, where annual per capita birth rates are constant. Results for marine organisms revealed that fecundity, the ability to reproduce, is proportional to body mass and continues to increase in non-deterministic growth. Thus the per capita fecundity also increases.

As a result, those individuals that remain following a reduction in

numbers through fishing activities continue to increase in body mass. This may maintain or even increase the potential for population growth. Annual recruitment survival can also vary significantly between different years, so much so that large cohorts can possibly arise from low stocks of reproductive fish.

These types of population dynamics were not well-suited to the dynamic equilibrium model (DEM). Therefore, an alternative-size structured, species-interactive model was proposed. This new model provided the basis for predicting the effect of fishing activities on the species diversity of marine fish and benthic invertebrates.

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

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Solar technology for drinking water decontamination

Porous silicone and Ru(II) photosensitisers have been combined to form a material which supports singlet oxygen photosensitising for water disinfection.

Access to clean safe drinking water is a vital part of everyday life. In developing countries, however, it is not always readily available. The Solwater project thus sought the

development and on site assessment of an autonomous solar reactor system for drinking water purification in remote areas without the addition of chemicals.

Through the use of sunlight, the developments were based on photocatalytic generation of hydroxyl radicals and singlet oxygen species to detoxify and disinfect contaminated drinking water. Disinfection systems were created with a polymer supported photosensitiser activated by solar light.

The use of singlet oxygen is key because it has the ability to inactivate bacteria since it can react with the proteins and lipids found in biological membranes. The Solwater project has developed a singlet oxygen photosensitising material comprised of porous silicone and an adsorbed polyazaheterocyclic Ru(II) coordination compound.

The advantages of porous silicone are many. It has high oxygen permeability; it allows for easy interaction with micro-organisms

to promote disinfection and possesses good mechanical, thermal and chemical stability as well as favourable optical properties. The use of Ru(II) photosensitisers also has many promising features. It possesses strong light absorption and long excited state lifetimes to allow deactivation through collision with molecular oxygen. Moreover, the photosensitising material itself can be produced at a large scale.

Successful disinfection of water was performed on a scale of 20 to 40 l per day using two solar photoreactors incorporating the photosensitising material. On site tests were started in Argentina, Peru and Mexico in order to demonstrate the applicability of this technology to water disinfection in rural communities. The distribution of the results among public institutions will assist the use of this technology and is likely to benefit public health and quality of life in developing countries.

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

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

<http://cordis.europa.eu/marketplace> > search > offers > 4789



Primary waste conversion processes in aquaculture

Modern western aquacultural techniques were combined with traditional Chinese methods in an innovative project which recycled fish effluent and minimised nutrient discharge to the environment. The study included an assessment of different waste conversion processes using both freshwater and marine fish.

Aquaculture has a valuable role to play in providing Europe with fresh fish and has become an increasingly important part of the fishing industry. One drawback, however, is the effluent produced by farmed fish. This can have a negative impact on local water quality, resulting in eutrophication. A project combining western know-how and traditional Chinese fish farming techniques developed processes that produce zero nutrient discharges. Data collected from nutrient balance and growth experiments was used to create a bioenergetic model of these processes for freshwater and marine systems.

Researchers from the Zafira project investigated ways of reducing nutrient discharge from aquaculture and increasing the retention of nutrients through harvestable products. The zero nutrient discharge aquaculture system was developed to study sustainable management of fish waste from aquacultural installations. This included several processes for converting waste from

the freshwater species African catfish and tilapia, and the marine species sea bass and Japanese flounder. Separation processes for freshwater systems have been studied thoroughly in the past. Therefore, the Zafira project concentrated on marine systems, using European sea bass as a model.

Four different primary waste conversion processes were studied. These included the conversion of waste from freshwater fish into heterotrophic bacteria. The bacteria produced were then fed to shrimp and fish. Two phototrophic processes involving seaweed and micro-algae in marine systems were also investigated. The seaweed was used as feed for sea urchins and the micro-algae were supplied as food to brine shrimps. The fourth study analysed the conversion of solid waste in marine systems by worms; the

worms became a valuable end product that could then be harvested.

Researchers calculated the nutrient balances involved in the four different conversion processes and integrated the results into a single model. The model revealed that the integration of multitrophic conversion processes increases the retention of nutrients in intensive aquacultural systems. The model enabled scientists to design integrated systems for intensive fish production, which can reduce nutrient discharge and increase nutrient retention in harvestable products.

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

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4872



Combined approach to wastewater treatment

An innovative approach combining solar with oxidation processes was designed. The system which resulted provided a successful approach to treating wastewater.

The Integrated Pollution Prevention Control (IPPC) Directive is designed to prevent, reduce and eliminate pollution at its source via the efficient use of natural resources. It called for the development of technologies which can lessen pollution as well as advance water recycling. Previous industrial actions were not sufficiently treating wastewater however because of shortage of on site technologies.

In light of this, the CADOX project has tackled these problems to streamline a hybrid technology which merges solar photocatalysis, ozone and bioprocesses. In this

way, wastewaters which contain priority hazardous substances can be treated allowing the water to be reused. The project targeted non-biodegradable chlorinated solvents and pesticides as well as the remediation of wastewaters with organic contaminants.

A two-step field treatment was used. One was the photochemical process which uses solar light and is better known as the photo-Fenton treatment. The other was the advanced oxidation process (AOP) biotreatment. The combined photocatalytic-biological system was then evaluated.

The results of the evaluation indicated that the photo-Fenton pretreatment eliminated the pollutants entirely. Furthermore biodegradability was enhanced, resulting in a bio-compatible effluent. In turn, this runoff was entirely mineralised through the biological system within an immobilised biomass reactor. The benefits of this two-step field treatment was verified at pilot scale showing that this is a successful approach which can be used to treat biorecalcitrant pollutants found in water.

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

Collaboration sought: further research or development support.

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Ecological theory aids North Sea conservation

In order for there to be a rich ecosystem in the North Sea, there must be adequate management strategies which the fisheries industry adheres to. The EU-funded Mafcon project used mathematical tools to quantify the effects of meeting particular fisheries' objectives, thereby aiding policy-makers to protect the marine environment agenda.

The North Sea contains a rich and important ecosystem, and the activities of the fishing industry have had a severe consequences and a severe impact on diversity. The Mafcon project addressed this problem, after the many efforts that have been made to address it: these are the 1992 Convention for the Protection of the Marine Environment of the North East Atlantic (OSPAR), the Rio Convention on Biological Diversity and the EU's Marine Strategy Directive.

The researchers, who took up the Mafcon project, provided the mathematical tools which allowed to quantify the consequences of meeting particular fisheries' objectives. These are the depletion of ground-fish and benthic invertebrate species. The underlying hypothesis was based on the ecological theory underpinning marine communities.

One part of this project focused on developing a fisheries management protocol. Data collected during the project had various uses. Firstly, it could be used to identify areas of particular ecological importance. This in turn could be used to assist EU policy-makers in setting total allowable catch quotas. The findings were also applicable to the identification of marine protected areas and could even

suggest appropriate areas for closure. Furthermore, from the findings of the Mafcon project it was also possible to quantify the fishing effort displaced by a marine protected area.

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

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Tracking ocean-atmosphere connections to the Antilles

A multivariate statistical analysis performed by the University of Göteborg in Sweden confirmed the important role that oceans play in modifying precipitation in faraway places like the Antilles.

The Earth's climate is moderated by interaction between the atmosphere and the oceans. Two phenomena, the North Atlantic oscillation (NAO) and the El Niño-southern oscillation (ENSO), are known to influence weather patterns at distances up to hundreds, even thousands of kilometres away.

The NAO and ENSO were the subject of intense study during the EU-funded Pacliva project. Work led by the University of Göteborg investigated the impact of NAO and ENSO on rainfall in the Antilles, a chain of islands in the Caribbean Sea.

Data from over 30 meteorological stations in the region was analysed for the period 1951–81. Common trends between stations, geographical connections and rainfall variability were identified using two-stage least squares (TSLS) factor analysis (FA). Information regarding occurrences of low and high NAO events as well as cold and warm ENSO events was incorporated in the analysis.

The TSLS FA yielded four distinct precipitation regimes, each associated with

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Past ocean chemistry tells the story of climate change

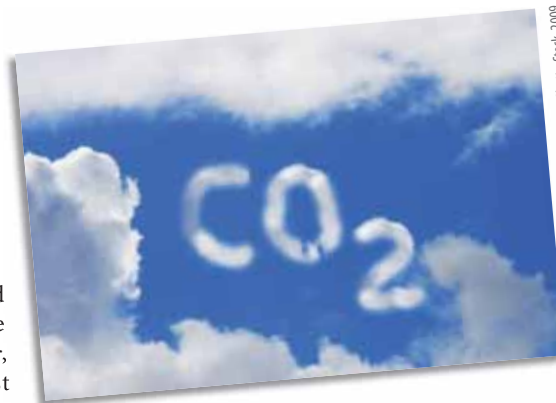
The analysis of multiple trace elements has enabled researchers to identify past ocean chemistry. One team of researchers has developed an innovative method enabling them to design a faster and more accurate analysis procedure.

The 6C consortium took up the challenge of reviewing climate change from a multi-disciplinary perspective, with a focus on carbonate chemistry and the carbon cycle. Research was based on the hypothesis that pore water driven calcite dissolution during glacial periods can account for most observed changes in partial pressure of atmospheric carbon dioxide. This hypothesis resulted from boron isotope studies and modelling carried out prior to the project's design.

The scientists used all available trace element proxies using biogenic carbonates in foraminifera to determine chemical and physical conditions in oceans in the past. It was therefore established that proxies based on trace element ratios can be used to reconstruct past environmental parameters. Certain conditions needed to be met however. Firstly, an estab-

lished connection was required between the elements and the feature under study. Moreover, the trace element ratios must have been preserved after burial, so that the biogenic carbonate could be measured.

The chemical properties of ocean waters successfully determined included anions such as carbonate and phosphate and alkalinity. For example, the ratio of cadmium to calcium in foraminifera can be used to derive and determine phosphate levels in deep water. These ratios were found to extend to other physical environmental parameters. An indicator of past ocean temperature is the relationship between magnesium and calcium in foraminiferal calcite. Moreover, the ratio of magnesium to calcium has also been established as a successful palaeotracer.



The study was able to take advantage of the fast scan methodology, which used a quadrupole inductively coupled plasma mass spectrometer (ICP-MS). Many universities worked in collaboration to validate the technique as well as to improve the consistency of results. This method was of particular value to researchers within the fields of geochemistry and palaeo-oceanography.

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

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

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Understanding management options for European lagoons

In order to ascertain how to best manage European lagoons under the influence of river basin runoff, a group of EU-led researchers set out to design an information technology tool. In order to successfully design this however, the team also had to carry out a socioeconomic analysis of management options.

The DITTY project focused on developing a sustained and rational utilisation of the available resources in lagoons found in Europe. Researchers examined all the relevant impacts on the aquatic environment, such as impacts from agriculture, urban and economic activities. They did this in order to develop information technology tools which were specifically designed for these types of ecosystems. In order to do this however, emphasis was given to producing a detailed and realistic socioeconomic assessment of man-

agement options through a close participation of economists and stakeholders.

The socioeconomic analysis was carried out as part of the project. It placed weight on gaining an overall understanding of the context within which the project would be taking place. Therefore the researchers went about analysing the interactions between the actors of sector development, identifying problems and conducting a cost/benefit analysis of proposed actions and strategies.

From these studies it was hoped that it would be possible to determine the relevant stakes by putting forward various solutions to the problems identified and integrating the analysis into the overall assessment.

Specific tasks which were performed included a monetary valuation of costs and benefits of environmental, social and cultural externalities and the use of modelling techniques in order to evaluate the induced effects of scenarios on employment and on the environment.

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

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

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different parts of the Antilles. The total annual rainfall, length of the rainy season and timing of maximum rainfall varied considerably between regimes. The effect of NAO events on these regimes ranged from negligible to severe, including up to 700 mm more rainfall in some cases. It is important to note that these findings remained unchanged even when the

analysis was extended beyond the initial 30-year period.

With respect to ENSO events, a significant impact was detected, especially in the first several months of the calendar year. Increases in rainfall totals followed warm ENSO events, though the effect was not consistent across months or regimes. On the

other hand, cold ENSO events modified fall precipitation patterns.

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

Collaboration sought: information exchange/training.

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IT AND TELECOMMUNICATIONS

Simulated feeling of a touch

A satisfactory simulation of the feeling experienced when touching an object and moving over its surface has been offered by the virtual environment designed within the Rosana project.

While moving the fingertip over a fine surface, one experiences a sensation that gives an idea of its roughness or softness, information that is not obtainable by other senses. Tactile perception is therefore considered crucial in complementing visual perception by confirming what is seen. However, understanding this interaction between visual and tactile perception still eludes scientists.

Experimental work within the Rosana project focused on the interactions between sensory input and the activity of the cen-

tral nervous system in the creation of internal representations of real-world stimuli. Visual information on surface textures were, for this purpose, transformed into tactile signals conveying equivalent perceptions created when touching those surface textures.

In order to evoke 'realistic' touch sensations — edges and corners of objects, as well as their surface texture — tactile stimulators were developed at the University of Exeter, United Kingdom. These incorporate pairs of vibrating contactors, designed to produce touch sensations on the tip of the index finger and the thumb.

With multiple contactors on the skin whose vibration pattern is under software control, appropriate variation of mechanical disturbances over various populations of tactile receptors was produced. These tactile stimulators offered the virtual environment needed for the neurophysiological investigation undertaken in other EU-funded projects.

With the use of these stimulators, Haptex project partners transformed visual information contained in surface textures into tactile signals conveying equivalent perceptions occurring when touching these surfaces. Further experimental validation is expected through additional EU-funded projects, especially in terms of the ability to produce realistic sensations derived from prior knowledge of the virtual surface under exploration.

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

Collaboration sought: further research or development support.

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Cricket inspired leap for bionic sensors

The Cicada project brought together scientists interested in bridging the gap between advanced engineering and complex biological systems. These were able to transfer the obtained knowledge from the cricket to create a prototype in sensor design — one which, in the future, may even provide a replacement for hair cells in human hearing.

The cricket has tiny hairs which are so sensitive that they alert the insect to the possibility of imminent danger. Inspired by the crickets, scientists at the University of Twente in the Netherlands have been able to create supersensitive sensor technology capable of detecting acoustic signals at thermal noise levels. Based on drag-force mediated rotations of membranes, the scientists created a prototype sensor, achieving a feat in mechanical design.

The project partners began by quantifying the chain of events in the cricket's response reaction. In particular they examined the way that crickets use hair-based sensors to measure small changes in air flow and detect approaching predators. In order to do this they mapped the motion of a single hair, as well as the array of hairs found on the cricket's cerci.

The next phase of the project, taken up by the scientists at Twente University, was to fabricate the flow sensing electromechanical elements. They achieved this by means of silicon micromachining technology. These sensors were integrated into arrays. An entire surface filled with these 'hairs' created the possibility of detecting patterns that come near to the 'sense of direction' the cricket has.

This innovative sensor, inspired by nature, may be applied to solving hearing problems in humans. It is the ageing and deteri-

oration of hair cells which cause bad hearing and these 'artificial hairs' may lead the way in designing replacement hair cells.

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

Collaboration sought: further research or development support; venture capital/spin-off funding; private-public partnership.

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Delivering politics to the people

A startling democratic participation service promoted by an EU-funded project is re-engaging and re-energising a formerly apathetic public. At the same time, it is reinventing the political process.



When the eTEN project 'eParticipate ID' decided to bring politics to the people, it set itself well-defined targets: it wanted to increase public participation in local politics by 25 %. It measured this figure both by physical attendance in a council chamber and online viewing of public proceedings.

The results exceeded the project's wildest expectations. After 'eParticipate ID' deployed its web services in 10 local authorities across Europe, chambers of participating local authorities were standing room only. At the same time, hundreds of citizens tuned into local debates via the web, using an innovative online service, called *Public-I*, originally developed in the United Kingdom. These are unheard of figures, especially in local politics, and they herald the potential for a complete renewal of the local political process.

The ID in eParticipate's name stands for 'initial deployment', a funding mechanism that uses a critical mass of reference deployments to promote a promising technology. Based on the results attained so far, online democratic participation is more than a promising technology; it is an idea whose time has come.

The project set itself another specific target for the impact of the initial deployment. It wanted to get 50 public authorities signed up for the service by 2009, and 100 the year after. The first 50 had signed up a year ahead of schedule.

The core of the 'eParticipate ID' project's success lies in the compelling services it is proposing for local authorities. Take the council meeting streaming service. Here, constituents can log on and watch democ-

racy in action via their computer. They see a live webcast of local authority meetings.

As the action unfolds, members of the public can access relevant documents, presentations used by the speakers and background information for the topic at hand. When the council meeting is over, viewers do not lose their opportunity to participate: they can consult the meeting video at any time via an archive.

'Some authorities have started providing online translation for those constituents who do not speak the official language. Journalists in some jurisdictions have stopped attending the meetings in person and use the webcast to cover council meetings,' explains John O'Flaherty, coordinator of the 'eParticipate ID' project.

'Different public authorities are using the services in original ways. In Ireland, Fingal County Council set up an online webcast for talks from parents whose children had committed suicide,' O'Flaherty tells ICT Results.

'Hundreds of people logged on. It was an enormous success, and it shows that these services are not only relevant for the political process, they can be powerful tools to engage with social issues.'

Local authorities are informing the public about the availability of the service in a variety of ways, too. In Bristol, the United Kingdom, the city council enlisted the help of the local paper;

the authority published a note of coming issues and online events in the paper, and the paper covered the debates and issues.

The suite of services extends way beyond webcasting. It offers e-petition services, discussion groups and web-based magazines, all of which local authorities can deploy with little expertise and at a low cost.

In the United States, most local politics initiatives of this sort have centred around cable television, which is an expensive undertaking. You need studio space and broadcast quality cameras. But the eTEN-funded eParticipate suite of services can use much cheaper equipment, with the result that it costs only in the tens of thousands per year, reveals O'Flaherty.

'The interesting thing is that the project did not receive a lot of funding, but getting the support of the European Commission, getting its endorsement, so to speak, via the eTEN funding, has proved an enormous benefit. Local authorities are really interested when they know the Commission supports these types of services,' he adds.

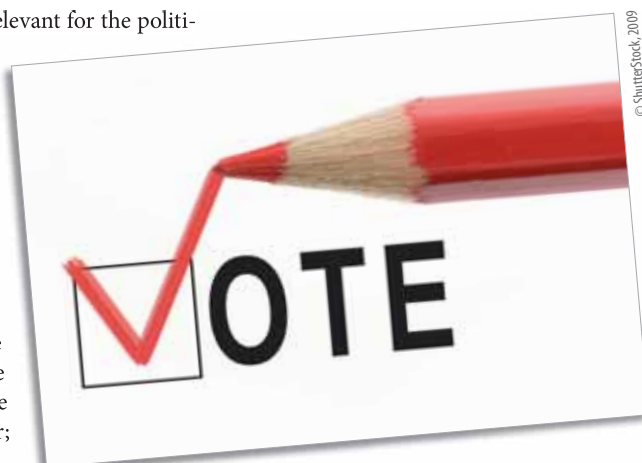
In the 'eParticipate ID' model, a business partner agrees to deploy and manage the service for a specific region, supplying the equipment and expertise to local authorities. This has led to some interesting variation.

'There are authorities with loads of money but no interest in these services, and then there are others who have enormous interest but no money. Some arrange to use the equipment for specific events; others share equipment between them. There's a lot of variety in the tools deployed, how they are used and how they are paid for.'

But one common, uniting theme in all the variation is the number of citizens who eagerly participate in democracy, online-style.

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<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90356>



Model support for field crop rotation

A novel computer-based decision support system was designed in order to improve efficiency of nitrogen (N) use in field crop rotations. The model can help optimise production and enhance economic stability while also being adaptable to different production systems and climatic regions of Europe.

In order for yield and quality of fresh vegetable production in Europe to be sustained, large volumes of fertiliser or organic N sources are applied. In regards to field vegetable crops, a problem arises with the inefficient use of N resulting in large amounts of damaging residues left in the soil. In light of this, the Eurotate_N project has endeavoured to assist growers as well as policy-makers via a decision support system for N management and rotational planning.

In the quest for the reduction of N losses, a computer-based decision support system known as the EU-Rotate_N model was developed. The model allows for the evaluation

of economic and environmental performance of crop rotation for a broad array of crops and growing conditions across Europe. Furthermore, it can be applied to conventional as well as organic cropping.

The model is comprised of novel functions which can simulate various actions. These include root development, the mineralisation and release of N from soil organic matter and crop residues as well as the effects of freezing conditions and water movement. Performance of the model was tested against experimental results and the patterns of growth N response and N losses were simulated. The scenarios show promise for improved N



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management in field vegetable rotations while increasing efficiency.

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; available for consultancy.

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Online evaluation of upper limb performance

Several tests were conducted using a haptic interface as part of an upper limb evaluation tool which can measure upper limb performance.



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When it comes to the use of assistive technology, elderly and disabled people can be at a disadvantage in terms of finding appropriate interface devices. Such items may include switches, joystick or haptic devices. Taking this issue into consideration, the I-MATCH project developed a system able to choose the best possible interface controller for people who use assistive technology. This allows for the assurance of end products meeting user's needs.

One of the main activities involved specifying and determining physical and functional features of existing interfaces. The data gathered was then placed into a database which is available to the public. Thus both providers and participants were able to gauge users' hand and arm skills. Following this stage, the creation of simulations of devices which are controllable such as powered

wheelchairs, rehabilitation robots and computers was put into place.

The system can be operated using any type of interface. Using a haptic interface with the system permits user skills to be identified as a result of more refined feedback. In fact, one of the milestones of the project was the development I-MATCH upper limb evaluation tool, a set of computer-based tests using a haptic interface. It consists of several different tests which are able to offer an objective measurement of the performance of the user's upper limbs. The tests are conducted in virtual reality, which allows for online recording of a group of parameters that are used to assess the upper limb ability.

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

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

<http://cordis.europa.eu/marketplace> > search > offers > 4935

Market-based coordination in computer grids

The design and implementation of a family of market mechanisms for allocating and scheduling computing resources in computational grids has been outlined by the Catnets project.

The increasing interconnection between computers through the internet has stimulated the creation of computational grids. Their users have access to a reliable virtual computer, which consists of many heterogeneous computing resources, including processors and hard disks. These computer resources are not visible to users, in a similar

way to power grids where consumers are unaware of how electric power is generated and transmitted to the socket.

Enabling the execution of computationally demanding applications, such as large-scale simulations or real-time risk analysis, computational grids are accepted to have a beneficial

impact on scientific research. Nonetheless, there are still barriers preventing computational grids from reaching their full potential. To determine which computing resources are allocated to which application and scheduled at what time is one of the key issues that was addressed by the Catnets project.

Project partners suggested the introduction of economic concepts and employment of market mechanisms. Two types of interrelated markets were defined: a market for trading application

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Star Wars to football scores, killer apps in a Telco 2.0 era

Software developed by European researchers will allow users to create compelling new software gadgets by mashing up web and telephone services. The system is so simple that anyone can make new mini-apps. It is only limited by imagination.

User-generated content is now, officially, old hat. We are entering into the era of user-generated services that converge internet and telecom technologies — a sort of Telco 2.0.

It is all thanks to the OPUCE project, an EU-funded project led by Telefonica I+D, which will create a platform that allows users to create combined telecom and web services even more easily than is possible on the internet. Users can create services that seamlessly mash together web and telecom functionality.

Mashups like this are a feature of the internet leading to a host of useful and compelling applications. And they are coming to a telecoms handset near you, very soon.

Mashups are small, software-driven services that combine data from two or more sources to create captivating new information. A classic example is the combination of Google maps and real estate data, to show you where to find new houses on the market.

In the OPUCE scenario, users — small and medium-sized enterprises (SMEs), regular surfers or any non-expert — will be able to quickly create a service that sends new real estate listings to their mobile phone or voicemail. Users can be instantly alerted to listings in an area that interests them, so there is no chance they miss a good opportunity, for example.

It is an attractive idea, but OPUCE will stand or fall solely on the value of the services the platform can create — in effect, the usefulness of the mashups. Luckily then,

the OPUCE platform can help users create a whole host of valuable, interesting or just plain bizarre services.

For example, users could create a mashup that captures an e-mail and then reads it out to voicemail, so people can listen to it on the run. Or users could develop an 'auto-conference' service. Once all the participants are online, the conference begins automatically.

Take *Star Wars* fans. They can create an alert that reaches them via instant messaging, which highlights new videos that appear on *YouTube*, say, every Sunday morning.

Other services can be automatically triggered by location, for example. If you are driving through a particular area, it can send you photographs from *Flickr* that relate to your location, or even send you restaurant listings in the vicinity at lunchtime.

There are fun services, too. When your favourite team scores a goal over your friend's favourite team, an OPUCE-created service could initiate a call, making sure you get to gloat. The service could even be designed, by a non-expert, to tell you if your friend is nearby so you can gloat in person.

Nearby pharmacies, newspaper headline translations read to your voicemail, services that tell people where

you are, or where they are, automatic keyword searches on RSS feeds that keep you up to date on topics that interest you — the list goes on and on.

'The only real limit to these applications is the imagination of the user,' explains Alberto Leon Martin, coordinator of OPUCE. 'And history shows, on the internet at least, that users are very, very imaginative.'

Users who have tried the OPUCE platform are excited about what it will allow them to do. 'We have had people who have no experience in programming tell us they are really excited about what the OPUCE platform has to offer. They are able to set up advanced services in minutes, and they learn how to do so very quickly, because the front end uses a visual service construction system,' explains the coordinator. It all means that the era of Telco 2.0 is around the corner.

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services and a market for trading computational and data resources. With this distinction, a given service could be priced based on the particular resources that are made available by the hosting environment and then negotiated.

The difficulty in designing such markets is that the underlying mechanism through which the participants act inevitably influences the results of trading services and resources. For instance, in a sealed bid auction the valuations of participants are not

made known as in an open cry auction. Information feedback may affect the bidding behaviour of the auction participants and could therefore lead to different outcomes.

The application of different market mechanisms to computational grids as an allocation and scheduling mechanism has been evaluated by researchers at the University of Karlsruhe, Germany. Mechanisms relying on the presence of centralised service and resource brokers have been compared to self-organised systems

consisting of autonomous agents who follow their own interest. Detailed information on the evaluation of different approaches to allocation and scheduling computing resources is available on the Catnets project website: <http://www.catnets.org>

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

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

<http://cordis.europa.eu/marketplace> > search > offers > 4877

A third dimension for mobile phones

Three-dimensional (3-D) viewing has not yet made it in a big way onto our television and cinema screens. According to European researchers, the story of 3-D TV is set to be quite different with mobile devices, as the right standards and technology fall into place.

Simulating the third dimension is something of a Holy Grail for cinema and television. The key advantage of 3-D film over the conventional two dimensions is the illusion of depth and the sense of 'body' the viewer experiences — as if the action is leaping out of the screen rather than occurring within it.

Despite the images it evokes of high-tech wizardry, rudimentary 3-D technologies have been around practically since the dawn of filmmaking. The first ever attempt came in 1890, when the British film pioneer William Friese-Greene invented a process in which two films were projected side by side on screen, and the viewer looked through a stereoscope to converge the two images.

We've come a long way since this bulky and impractical solution, yet 3-D film and television is still some way from becoming an everyday reality, partly due to cost. But that looks set to change, and mobile devices — with simpler and hence cheaper 3-D technology — could well lead the charge.

'The mobile market has always been much more dynamic and receptive to new technologies than the television market, as the whole idea of mobility is based on dynamism,' explains Atanas Gotchev, the scientific coordinator of the EU-funded Mobile3DTV project.

Mr Gotchev also points out that the viewing conditions, and hence technical require-

ments, for mobile devices are not as exacting as they are for cinema, which targets a mass audience who expect a thrilling experience, and television, which needs to be of 'home entertainment' quality. 'In mobile 3-D technology, the viewing mode is personal, the required display size is small and the user is expected to adjust the display position for the best viewing experience,' he notes.

The story of 3-D television for mobile phones has been one punctuated by stops and starts. As early as 2003, Sharp launched a 3-D mobile phone in Japan and Korea's SK Telecom launched a 3-D phone — from Samsung — in 2007, and Japan's Hitachi just launched one in 2009. But the big challenges have been the paucity of content and coming up with a profitable business model. Apple's iPhone also supports 3-D television, but can currently only be viewed with special glasses.

Mobile3DTV is developing the core elements of the next generation of 3-D television for mobile devices. 'One major challenge is choosing the optimal format for representing 3-D video for mobile delivery,' Mr Gotchev points out. The format should be adopted ideally by all industrial players to avoid a 'formats war,' he suggests. For that reason, the project decided to build its system around the EU standard known as Digital Video Broadcasting — Handheld (DVB-H).

'Another challenge is to ensure a comfortable and enjoyable 3-D viewing experience,' adds the scientific coordinator. Mobile3DTV is employing so-called auto-stereoscopic displays, which produce 3-D images that do not require those awkward glasses to view them — which is good news for people who want to be incognito about their mobile viewing.

'Auto-stereoscopic displays use additional optical elements aligned on the surface of an LCD [liquid crystal display], to ensure that the observer sees different images with each eye,' explains Mr Gotchev. 'As mobile devices are normally watched by a single observer, two independent views are sufficient for satisfactory 3-D perception.'

The project has been working on specifications for how mobile 3-D content should be created, coded



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and transmitted over DVB-H in order to be visualised on a portable display with satisfactory quality for the user. 'We have access to probably the most advanced 3-D portable display — one delivered by the Japanese giant NEC LCD,' says Mr Gotchev. Mobile3DTV has already demonstrated these technologies at a number of trade fairs.

Content is, as it has long been, the major obstacle on the road to the widespread take-up of 3-D mobile TV. 'A major market challenge is to convince content providers and operators to start producing and distributing 3-D content,' observes Mr Gotchev. 'With our project, we try to provide the necessary technical evidence of the technology's potential.'

And their efforts are paying off. Mr Gotchev is quietly confident that the Mobile3DTV project can help prod the rollout of 3-D television in the mobile market. 'Just one year ago, operators and providers did not really buy into the market benefits of producing and broadcasting stereo-video, largely because of the slow take-off of the mobile TV services in some European countries,' he says. 'The situation now seems to be changing as the same players are looking for new opportunities, and 3-D looks like just such an opportunity.'

In addition, the take-off of 3-D for mobiles could accelerate the take-up of other 3-D technologies. 'The rapidly-evolving mobile TV market could serve as a "bandwagon" for introducing 3-D TV broadcast to the general public,' emphasises Mr Gotchev.

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Brain on a chip?

How does the human brain run itself without any software? Find that out, say European researchers, and a whole new field of neural computing will open up. A prototype 'brain on a chip' is already working.

'We know that the brain has amazing computational capabilities,' remarks Karlheinz Meier, a physicist at Heidelberg University, Germany. 'Clearly there is something to learn from biology. I believe that the systems we are going to develop could form part of a new revolution in information technology.'

It's a strong claim, but Mr Meier is coordinating the EU-funded Facets project which brings together scientists from 15 institutions in 7 countries to do just that. Inspired by research in neuroscience, they are building a 'neural' computer that will work just like the brain but on a much smaller scale.

The human brain is often likened to a computer, but it differs from everyday computers in three important ways: it consumes very little power, it works well even if components fail, and it seems to work without any software.

How does it do that? Nobody yet knows, but a team within Facets is completing an exhaustive study of brain cells — neurons — to find out exactly how they work, how they connect to each other and how the network can 'learn' to do new things.

'We are now in a situation like molecular biology was a few years ago, when people started to map the human genome and make the data available,' the physicist says. 'Our colleagues are recording data from neural tissues describing the neurons and synapses and their connectivity. This is being done almost on an industrial scale, recording data from many, many neural cells and putting them in databases.'

Meanwhile, another Facets group is developing simplified mathematical models that will accurately describe the complex behaviour that is being uncovered. Although the neurons could be modelled in detail, they would be far too complicated to implement either in software or hardware.

The goal is to use these models to build a 'neural computer' which emulates the brain. The first effort is a network of 300 neurons and half a million synapses on a single chip. The team used analogue electronics to represent the neurons and digital electronics to represent communications between them. It's a unique combination.

Since the neurons are so small, the system runs 100 000 times faster than the biological

equivalent and 10 million times faster than a software simulation. 'We can simulate a day in one second,' Mr Meier notes. The network is already being used by Facets researchers to do experiments over the internet without needing to travel to Heidelberg.

But this 'stage 1' network was designed before the results came in from the mapping and modelling work. Now the team are working on 'stage 2', a network of 200 000 neurons and 50 million synapses that will incorporate all the neuroscience discoveries made so far.

To build it, the team is creating its network on a single 20 cm silicon disk, a 'wafer', of the type normally used to mass-produce chips before they are cut out of the wafer and packaged. This approach will make for a more compact device.

So called 'wafer-scale integration' has not been used much before for this, as such a large circuit will certainly have manufacturing flaws. 'Our chips will have faults but they are each likely to affect only a single synapse or a single connection in the network,' Mr Meier points out. 'We can easily live with that. So we exploit the fault tolerance and use the entire wafer as a neural network.'

How could we use a neural computer? Mr Meier stresses that digital computers are built on principles that simply do not apply to devices modelled on the brain. To make them work requires a completely new theory of computing. Yet another Facets group is already on the case. 'Once you understand the basic principles you may hope to develop the hardware further, because biology has not necessarily found the best solution.'

Practical neural computers could be only five years away. 'The first step could be a little add-on to your computer at home, a device to handle very complex input data and to provide a simple decision,' Mr Meier says. 'A typical thing could be an internet search.'

In the longer term, he sees applications for neural computers wherever there are complex and difficult decisions to be made. Companies could use them, for example, to explore the consequences of critical business decisions before they are taken. In today's gloomy economic climate, many companies will wish they already had one!

The Facets project is due to end in August 2009 but the partners have agreed to continue working together for another year. They eventually hope to secure a follow-on project with support from both the European Commission and national agencies.

Meanwhile, the consortium has just obtained funding from the EU's 'Marie Curie' initiative to set up a four-year initial training network to train PhD students in the interdisciplinary skills needed for research in this area.

Where could this go? Mr Meier points out that neural computing, with its low-power demands and tolerance of faults, may make it possible to reduce components to molecular size. 'We may then be able to make computing devices which are radically different and have amazing performance which, at some point, may approach the performance of the human brain — or even go beyond it!'

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<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90451>



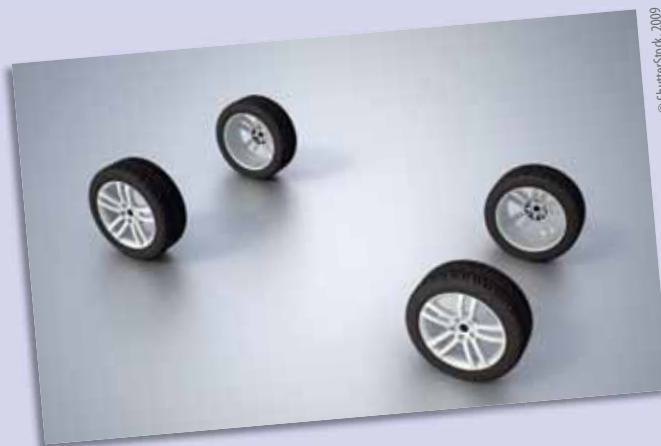
Lightweight vehicle design with maximised performance

A novel lightweight vehicle has been designed sporting the attributes that make it low in energy consumption, exhaust and noise emissions.

The rise in public mobility has had a negative impact on the environment. Hence there is a critical need for new vehicle solutions as well as environmentally friendly technologies.

In accordance with this, the Clever project has developed a small vehicle for clean urban transport. This vehicle has the fewest requirements on urban space in terms of traffic as well as parking. Additionally, it has the advantage of low energy consumption as well as low exhaust and noise emissions. Low energy consumption is possible thanks to its lightweight material and design comprised of an aluminium space frame which consists of aluminium profiles joined by cast aluminium connection nodes.

A prototype vehicle was used in order to exhibit the energy-saving potential of the novel design which can be applied to passenger cars



as well as motorcycles. The increased need for aluminium in the automotive industry may be good news for the aluminium industry as well.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4955

Improving design of child restraint in vehicles

Optimising child vehicle safety is a top priority, yet remains under-researched. The CHILd project created a prototype dummy which can be applied to improving upon child restraint design and regulation.

This project addressed a gap which exists in vehicle safety knowledge. Although comprehensive tests have been carried out on adult safety in vehicles, there is not nearly as much knowledge available on child safety. The objective was to use the findings from the project so that they may be applied to child restraint design, evaluation testing and regulation.

The analysis and tests which were carried out throughout the project's lifespan included analysis of real-world crash injury

data and reconstructions (real and virtual). One such analysis dealt with the optimisation of dummies used in reconstructions.

A prototype dummy of a child's abdomen was produced in stages. The first prototype fixed FlexiForce sensors with tape on the surface of the dummy abdomen. Every sensor was assigned to a small area on the dummy abdomen's surface. A series of tests with different child restraint systems was carried out to assess the reliability of the measured signals from the abdomen.

This first design was however very delicate because of the low durability of the connection of sensor and wires.

A new approach was then taken. The new prototype was used to measure abdominal loads applied directly on the surface of the abdomen, using a series of single sensors. The effective local force could be calculated using the measured pressure and the area. The new approach with sensors protected by latex layers was, by the end point of the project, very close to commercial use.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4845

Nanomaterials provide novel engineering solutions

With fuel prices soaring to unprecedented levels, the need to address all sources of energy losses in a vehicle's engine has never been more urgent. An emerging new class of nanostructured coatings offers a most promising approach to reducing the engine's fuel consumption, while improving its overall performance.

Motivated by the importance of fuel economy for the automotive industry, the Nanocoat project explored new ways to improve the performance of automotive engines. Effective control of the friction forces developed between reciprocating components can result in significant improvements in the engine's efficiency.

To overcome friction forces that inhibit the smooth motion of the engine's components, nanostructured coatings have been proposed by the Nanocoat project partners. By engineering composite materials whose building

blocks have dimensions as small as 1 nm, it was possible to prepare coatings with superior mechanical properties when compared to their conventional counterparts.

Research work conducted at Hauzer Techno Coating BV in the Netherlands concentrated on coatings consisting of alternating layers of chromium, amorphous hydrogenated carbon and diamond-like carbon. When properly tailored, these multilayer coatings

combined a low coefficient of friction with the ability to resist abrasive wear.

Low-friction coatings were found to have a decisive influence on the prolonging of components' service life, besides reducing the need for lubricants in hydraulic components, such as the valves and cylinders. A series of tests on the friction coefficient, toughness and adhesion of the coatings to the substrate produced encouraging findings. Moreover, hardness measurements revealed that selectively doping of individual layers with silicon resulted in surprising results, while surface roughness is reduced.

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

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 4968

Your robotic friend, the humanoid robot

Robots can take any shape or form and with the explosion in European R & D for every imaginable robot application, there are dozens of completely different designs. Why, then, do we remain fascinated by humanoid robots?

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 2008.

It was an important network. Observers like Bill Gates believe that there will be a robot in every home by 2025, and they compare the current state of play to the early days of the personal computer in the 1970s. The dozens of research programmes united by EURON represent the state-of-the-art in robotics, and a glimpse of the future.

At first blush, the humanoid robots in the EURON network do not necessarily make a lot of sense. They are seriously difficult to design and implement. For robots with legs, for example, there are enormous problems with balance, movement and safety.

And some would argue they are even an extravagance, given that a robot can be any shape that will allow it to best perform its function. Yet researchers and designers remain fascinated by the allure of the mechanical friend, the humanoid robot.

It is also surprising for cultural reasons. 'Generally speaking, Europeans and Americans prefer their robots to look like machines, they do not like the ambiguity of a robot that looks like a person,' explains Bruno Siciliano, a robotics researcher.

'The Japanese, on the other hand, are very comfortable with humanoid robots, and I think it is something to do with the Shinto religion that believes machines can have a soul,' he says.

But for all the cultural resistance, humanoid robotics do play an important role in European research, and not just because they look cute. 'Humanoid designs, especially ones that walk, pose enormous design and engineering challenges — and that in itself is a good reason to develop them, because they advance the field as a whole,' suggests Mr Siciliano, who is dissemination officer of EURON.

Even better, a robust and reliable humanoid design would find it much easier to operate in a world designed for humans, where steps, gradients, variable terrain and corners abound.

Reem-A, a life-size humanoid robot, can recognise casual questions and commands,

hold simple objects and stop for obstacles in its path during a leisurely stroll. It has sturdy legs, designed for stability, and it won a race at 'RoboCup 2006', a sort of robot Olympics. It can even play chess.

ARMAR is more of a geeky housemate, working in the kitchen at tasks like opening the dishwasher door, filling it with dirty dishes and then closing the door before turning the machine on. Granted, this is something humans can do much easier, but it is a significant step on the road to complete automation of daily and, in many cases, disagreeable chores.

Maggie was designed by the University Carlos III in Madrid, Spain, to be a sociable robot. It has a friendly, almost cartoon frog-like appearance and can talk and recognise speech. It tries to understand gestures and touch through a touch screen on its chest. With a little prompting, it will even dance.

The same research team is also responsible for RH1, a rather chubby precursor to C-3PO, the robot made famous by *Star Wars*. RH1 can change its gait to adapt to walking indoors or outside, and it can cooperate with people and other robots in real collaborative environments.

Casimiro is another robot, though not mobile, designed for social interactions. Here, the researchers have focused on the face, teaching the robot to respond to people with a range of expressions. It is a fascinating area of research because engineers at the University of Las Palmas in Gran Canaria, Spain, have found that they can get realistic interactions in the testing and teaching phase. But reliability over time is a challenge.

Because what is easy for people, like social intelligence, is hard for robots. Research-

ers at Las Palmas believe it is because we acquire social intelligence unconsciously, as children, that we find it very hard to create a series of protocols or algorithms that can be easily applied to a robot.

Physical manipulation is something we do consciously, however, so that is easy to translate into robotic terms. It is just one of the fascinating insights into both human and robotic intelligence that this research reveals.

The obvious, immediate applications for friendly robots are still evolving, but it is already clear that they have enormous implications for the future acceptance of humanoid machines in the home. 'There is a huge amount of research on social robots currently underway in Japan and even in the United States,' notes Mr Siciliano. Ultimately, with enough sophistication, social robots will be able to act as a comforting, animated presence for children or the elderly, combining the roles of companion with that of assistant.

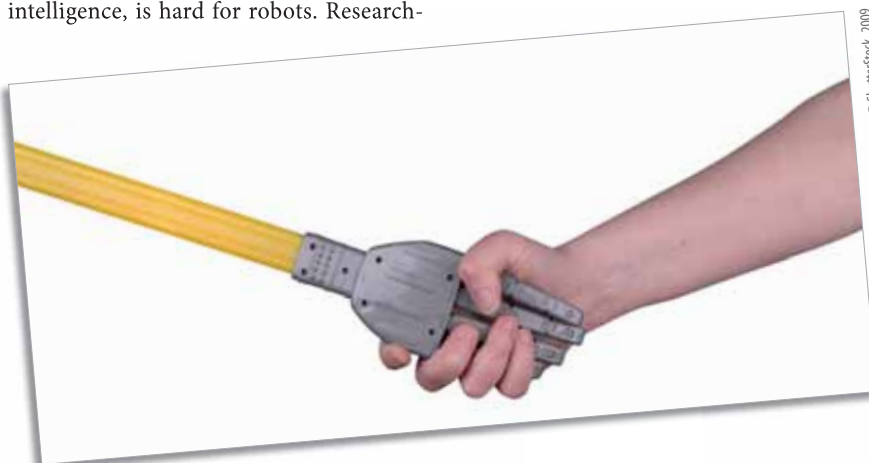
Another robot, Justin, may be an early precursor of that type of robot. It is an incredibly sophisticated platform with enormous dexterity and it is even capable of making coffee. 'Japanese researchers familiar with Justin believe it is the most sophisticated European platform to date,' remarks Mr Siciliano. 'It shows what Europe is capable of in this domain.'

Many of these robots have been funded through a variety of EU programmes. All of them benefited from networking.

This is the second of a four-part special series of features exploring European robotics research. You can read part 3 in the next issue of the research*eu results supplement.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90036>



Active materials for current measurement devices

A new class of devices for the measurement of electrical currents has been developed with the use of active materials, rather than copper coils and magnetic cores. They can provide the basic input required for controlling the flow of electricity in contemporary complex electrical power networks.

Due to the deregulation of the electrical power market, the need for tighter and precise control is even higher. However, conventional devices for the measurement of electrical currents, built with almost the same technology of decades ago, carry a significant risk of fire and explosion. The IELAS project partners worked on an alternative system that would be based on the propagation of elastic waves through dielectric media.

The electrical current to be measured induces a magnetic field in the system's emitter which consists of a magnetostrictive material. Fifty or sixty hertz (Hz) electrical signals are converted into mechanical waves that are transmitted through a dielectric structure and ultimately reach the receiver. Piezoelectric materials in the latter convert the elastic waves back into electrical

currents that are amplified and processed to produce an accurate reading of the original current's strength.

Morgan Electro Ceramics, with extensive material and engineering expertise, assisted the IELAS project partners in tailoring piezoelectric materials towards the requirements of the sensor's receiver. A dramatic improvement in their physical, chemical and piezoelectric characteristics was achieved with the use of polycrystalline ceramics instead of natural piezoelectric crystals.

The dense piezoelectric ceramics can be manufactured in almost any given shape or size, opening the way for more compact designs for the current sensor. Moreover, they are chemically inert and therefore immune to moisture and other atmospheric conditions. As active materials technologies

mature, IELAS project partners' hope is to phase out conventional current sensors with significant savings in equipment weight and volume, but more importantly in manufacturing costs.

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

Collaboration sought: information exchange/training.

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Stretching the boundaries of steel powder metallurgy

The compaction and sintering of fine metal powders into near net-shaped parts has become the preferred route of the automotive industry to minimise wastage of raw materials. In an attempt to optimise this process, the PM-MACH project focused on controlling the deformation of powder particles under selected pressure and temperature conditions.

Powder metallurgy is a precision manufacturing technique for the mass production of metal automotive components, such as gears from iron and carbon steel powders. First, the fine metal powders are pressed inside a rigid die to obtain a porous, slightly cohesive material, the so-called green material. The second step consists of a thermal treatment below the melting point of the green material, during which the powder compact is transformed into a coherent solid.

The hardness of the heat-treated materials that result from the formation of strong bonds between individual powder particles is highly desired. However, it is crucial to control it in order to reduce the need for expensive finishing operations. Aiming to address the lack of comprehensive information on sintering of steel powder compacts, engineers at the Institut National Polytechnique de Grenoble, France, adopted an innovative approach.

A thorough analysis of the macroscopic deformation of steel powder compacts during the sintering cycle was coupled with three-dimensional (3-D) observations of the microstructural changes. Conventional dilatometric tests were performed on cubic specimens taken out of test bars to follow the evolution strains in either the press-

ing direction or a transverse one. A better understanding of the main phenomena responsible for the deformation of the steel powder compact was provided by means of X-ray absorption microtomography.

Two different types of pores were present in the steel powder compact: cusped and elongated pores. Elongated pores were detected at the contact area between powder particles, which were mostly perpendicular to the direction of compaction. These contact pores were attributed to microdamage and lubricant particles crushed between steel particles during unloading and ejection of the compact out of the die. While contact pores open up, the powder compact is swelling and shrinks when sintering starts and they get closer.

Future studies will aim to investigate the effect of the material composition on the deformation of metal powder compacts. The hope of the PM-MACH project partners is to use the information collected to develop effective techniques for machining powder compacts before sintering, and therefore reduce manufacturing costs.

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

Collaboration sought: further research or development support.

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Tiny lasers plug the 'green gap'

Compact lasers which can work in formerly inaccessible parts of the spectrum and are suitable for mass production are now within reach, thanks to pioneering work by a European consortium.

Digital projectors use a variety of technologies to throw an image onto a screen. But existing projectors are bulky and there is a growing commercial interest in using new laser technology to make a projector small enough to build into a laptop computer or even a mobile phone.

'Such devices would have extremely high market potential,' says Mircea Guina of the Optoelectronics Research Centre at Tampere University, Finland. 'But so far the development has been technologically hindered by the "green gap" — the lack of green laser diodes.'

Laser diodes are very compact, mass producible and relatively cheap. They are widely used in such common devices as barcode readers, CD players and laser pointers. The standard approach uses so-called 'edge-emitting' diodes that offer a restricted range of visible wavelengths, which has proven to be technologically difficult to expand. They are also unsuitable where high brightness is required. Digital projectors require powerful sources of red, green and blue light. Without a novel green laser, in particular, compact projectors are not yet practicable.

'Using traditional laser diode technology, it is still difficult to produce high-brightness radiation at the wavelengths preferred for laser projection applications,' Mr Guina says. 'In particular, the emission from typical direct-emitting red laser diodes is limited to about 640 to 650 nm while the eye is most sensitive to 620 to 640 nm. They are also affected by changes in temperature and require high working voltages. Even worse, there is still no suitable commercial solution for the green colour.'

Mr Guina was project manager of the EU-funded NATAL project, which set out to develop new laser technologies that would not only plug the green gap but also make possible a host of other applications that require high-brightness miniature lasers tuned to very specific wavelengths.

The breakthrough results of the project closely relate to developments in novel semiconductor gain materials and the demonstration of new lasers. 'The key technology is the optically pumped Vecsel [vertical external-cavity surface emitting laser], which resembles the geometry of a solid-state laser while retaining the wavelength versatility offered by semiconductor gain media,' says Mr Guina.

A Vecsel is a kind of semiconductor laser that produces a high-quality beam of light perpendicular to the surface of the chip. The geometry also makes it easier to dissipate waste heat and so work at higher power.

Research in NATAL has focused on producing red, green and blue wavelengths by developing new nanomaterials to provide gain in a Vecsel — including 'quantum dot' structures that have not been used in a Vecsel before — and using 'frequency doubling'.

Among the highlights from the project are high-power Vecsels operating directly in red light and frequency doubled infrared Vecsels that can emit in the sought-after green gap, as well as in the amber-orange-red part of the spectrum. The red lasers can themselves be frequency doubled to emit ultraviolet light.

'One of the partners, the Institute of Photonics at the University of Strathclyde, has for the first time demonstrated direct-emission red Vecsels pumped with commercially available blue diode lasers,' Mr Guina adds. 'Another significant outcome of the project was a full 3-D [three-dimensional] Vecsel simulation software that takes into account the laser geometry as well as optical and thermal properties of the laser.'

Industrial uses for compact, mass-produced lasers are likely to be numerous. Two NATAL partners, OSRAM Opto Semiconductors and EpiCrystals, are in the midst of developing the green laser for projection technologies.

The third industrial partner, Toptica Photonics, is working on scientific applications. 'Using all semiconductor Vecsel technology, we have new opportunities for customised and wavelength-tailored solutions in the near infrared,' says Wilhelm Kaenders, President of Toptica Photonics and NATAL project dissemination manager. 'Combining this with our established frequency conversion modules, we can finally plug the

spectral niche between green and red. We can now supply spectroscopists with diode-based single frequency, fixed frequency and tunable lasers from 375 to 3 000 nm.'

Many other applications of the new lasers are possible, such as materials processing, ultraviolet (UV) lithography and in medicine. The amber-orange-red lasers, for example, could be used for photodynamic therapy and to make artificial guide stars for telescopes by exciting sodium atoms high in the atmosphere, supporting long-term goals of the European astronomical community.

There are also a number of scientific and medical applications where compact, reasonably high-power visible and UV lasers would be preferred over the existing high-cost, high-maintenance gas and ion lasers.

NATAL, which was funded through the Sixth Framework Programme (FP6), ended in August 2008 but the work is being carried on in several other projects. Some of these aim to develop Vecsels emitting at longer infrared wavelengths which could be used in distance sensing, environmental monitoring of gases and tissue-welding in surgery. Lasers emitting ultra-short optical pulses are also in development.

'NATAL has helped to generate a significant amount of knowledge and new technologies in this field,' Mr Guina says. 'Much of what we have done with Vecsels is now regarded as state of the art in the world.'

The work on quantum-dot Vecsels is being continued in the FastDot project funded under the Seventh Framework Programme (FP7). Other spin-out projects are expected to be generated in due course.

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<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90534>



Solutions for singlet molecular oxygen production

Research has been conducted on material used for photosensitised singlet molecular oxygen production measurement to determine its appropriateness for use in solid phase.

In an effort to improve social and environmental measures in developing countries, an on site assessment of an autonomous solar reactor system for drinking water purification has been created. The scientific and technological developments were based on photocatalytic generation of hydroxyl radicals and singlet oxygen species via the use of sunlight and without adding chemicals.

Singlet molecular oxygen is a reactive oxygen type which can be used in applications such as organic synthesis, dye bleaching,

disinfection processes and photodynamic therapy. Its advantage is that it can be expeditiously rendered by quenching of the excited state of a sensitizer by ground state molecular oxygen. Furthermore, it can be easily removed at the end of the process.

Conducting a precise quantification of the singlet oxygen production is key in order to create the most suitable method for each application. This entails measuring the singlet oxygen production quantum yields (PHIdelta), a process that has not been fully established in hetero-

geneous systems. What has been proposed therefore is methylene blue (MB) dyed Nafion films as a means to quantify singlet oxygen production in solid samples.

The production of singlet oxygen generated by MB photosensitisation in films of Nafion ionomer was characterised and results were compared. Following this, it was found that Nafion films containing MB are homogeneous, reproducible and stable systems which make for appropriate references for PHIdelta determination in solid phase.

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

Collaboration sought: information exchange/training.

<http://cordis.europa.eu/marketplace> > search > offers > 4661

Assay for identifying tainted corks

An investigation was done into the tainting of the natural cork used as stoppers for wine bottles. As a result, a highly reliable and cost-effective technique was developed that could rapidly detect tainted material.

Europe's wine and cork industries incur losses of almost EUR 1 000 million a year as a result of corks becoming tainted. Cork taint causes the undesirable smells or tastes found in a bottle of wine. Unfortunately, this spoilage can usually only be detected following the bottling, ageing and opening of the wine.

In response to this challenge, the Innocuous project was set up to enable the cork sector protect its market share and to promote a mainly European natural product. The consortium developed new techniques, including on-the-line quality control with immunosensors to make the production of stopper corks taint free.

The main cause of cork taint is the presence of 2,4,6-trichloroanisole (TCA) in the wine. The Innocuous team developed an enzyme-linked immunosorbent assay (ELISA) methodology for TCA detection of the water used for boiling corks. The ELISA technique had a 1 to 10 parts per trillion detection limit and a shelf life of three months. The period of time which elapsed between introducing the water sample to establishing a result was 80 minutes.

No interference of trichlorophenol was found in concentrations up to four parts per million. The implementation of the method-

ology would result in a cost of EUR 0.0003 per stopper for the cork industry, and prevent 100 % of cases of contamination.

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; venture capital/spin-off funding;
available for consultancy.

<http://cordis.europa.eu/marketplace> > search > offers > 4900



Reducing mushroom industry waste

A machine which is capable of recycling casing soil used to grow mushrooms has been created by scientists at Limbraco B. V. in the Netherlands. Its use will not only limit the waste that occurs by having to transport the new soil to the site, it will also reduce costs for producers who have been hit by lower prices in an ever competitive industry.

The mushroom industry represents big business. For Northern Ireland, France and much of eastern Europe in particular, it makes up



an important part of the rural economy. The industry creates jobs and produces thousands of tonnes of mushrooms a year, which are then shipped to suppliers across Europe.

Casing soil is used in large amounts by the mushroom industry, based mainly on peat moss. This natural resource is a special soil used for growing the mushrooms and peat soil reserves have been depleted. As a result, prices of peat moss casing soil are increasing, which represents a big barrier to entry into the industry, decreasing its competitiveness — which is not in the interest of consumers.

The EU-funded SMS project has supported research into a new machine which will allow for the recycling of the soil once the yield of mushrooms has been harvested. The separator machine divides the casing soil from the spent mushroom substrate (used soil). What is left is the upper layer casing soil, which is further treated to be acceptable as casing soil again, and the lower layer compost, which can be reused.

The use of such a machine by the industry will also keep down transportation costs. This also reduces the environmental impact of the industry.

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 > 4859

New research*eu focus publications

CORDIS has recently published a series of supplements covering a wide range of research-related topics. These publications are designed to inform researchers looking for financial support on the various sources of funding available in the EU. They also showcase the numerous breakthroughs achieved by teams working in EU-funded research projects and illustrate how research and innovation improves the daily lives of Europeans.



A COMPETITIVE EUROPE: RESEARCH REGIONALLY, DEVELOP GLOBALLY

The March 2009 edition of the *research*eu focus* supplement is dedicated to the regional dimension of FP7. It features the EU's regional research policy, funding opportunities for knowledge-intensive, convergence and outermost regions, as well as success stories from the first projects funded by the relevant EU budget.

Regions are the crossing point of the EU's regional, research and enterprise policies. The magazine explains the rationale for bringing these EU policies closer to the funding schemes and highlights the two FP7 programmes which cover the EU regional research activities: 'Regions of Knowledge' and 'Research Potential'.

It also features dedicated sections on a unique European research-driven cluster — the Food Cluster initiative — interviews and examples of best practice.

The publication is available in Czech, German, English and French.



EUROPEAN RESEARCH COUNCIL: BRINGING GREAT IDEAS TO LIFE

This *research*eu focus* supplement is devoted to the European Research Council (ERC), the first European funding body designed to support investigator-driven frontier research through open and direct competition. The ERC funds research carried out in the EU through two funding schemes: the Starting Grants and the Advanced Grants.

The first few sections of the supplement give an overview of the recent history and organisation of this young institution. They

also present the two grant schemes and how researchers can apply for them.

The central chapter of the publication highlights the work accomplished by some of the researchers who were selected to benefit from the ERC's first round of funding.

The supplement concludes with various topics ranging from the ERC's future to important information for those wanting to apply for ERC funding.

The publication is available in Spanish, Czech, German, English and French.



MEASURING PERFORMANCE: THE CZECH REPUBLIC IN THE ERA

Issue No. 4 of the *research*eu focus* series offers an overview of the Czech Republic's R & D activities as well as its priorities during its first Presidency of the EU Council.

The publication includes an assessment of the country's participation in the Sixth Framework Programme (FP6) and FP6-Euratom and presents more than 20 examples of research projects jointly achieved by Czech researchers and other European and international partners. These examples give an insight into the project ambitions and research potential of the Czech Republic.

Furthermore, the supplement provides a general introduction to the Czech system for R & D and innovation as well as a presentation of the national network for EU framework programmes on research.

The publication is available in Czech and English.

Practical guide to EU funding opportunities for research and innovation

This guide seeks to help potential beneficiaries of EU funding programmes find their way through three possible instruments: the 'Cohesion policy', the 'Research framework programme' and the 'Competitiveness and innovation framework programme' (CIP). This Commission publication is available on the CORDIS website.



is most appropriate for a given activity. Furthermore, the implementation of the three funding instruments usually involves different administrative levels and authorities.

Given the wide range of activities that can be funded, the text of the guide cannot itself answer every question. However, it will direct the reader straight to the relevant source of information.

Although plenty of information is available on the different EU funding sources, potential beneficiaries are often still confused, in particular when it comes to deciding which source of funding

The publication is available online in Spanish, German, English, French, Italian and Polish.

**The *research*eu focus* editions presented on this page are available at:
<http://cordis.europa.eu/news/research-eu> where paper copies can also be ordered.**

**The *Practical guide to EU funding opportunities for research and innovation* is available at:
<http://cordis.europa.eu/eu-funding-guide>**

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>

Summer school on bioactive natural compounds in soil

Receto, an interdisciplinary research school of environmental chemistry, microbiology and toxicology, is organising a PhD summer school on bioactive natural compounds in soil from 26 to 31 July 2009 in Slagelse, Denmark.

Bioactive natural compounds from plants have been the focus of research for decades, firstly due to their pharmacological effects, and secondly due to their defence properties against arthropods, nematodes, plants and diseases.

This course will cover the chemistry of selected groups of bioactive natural compounds from agricultural crops and wild plants, their sorption, degradation and leaching in soils, chemical analytical techniques and their suppressive effects on plants and arthropods.

For further information, please visit:
http://www.life.ku.dk/English/Aktiviteter/2009/972_receto.aspx

Summer school on diversity

The Eurosphere project is organising a summer school entitled 'Diversity and the European public sphere' in Tallinn, Estonia, from 27 to 31 July 2009.

The course is intended for PhD students involved in the Eurosphere project, and for students who share a more general interest in issues related to the connections between diversity and citizenship in the expanding EU.

Teachers and lecturers are internationally renowned scholars from both the Eurosphere project and from outside. Students will also have the possibility of participating in lectures and seminars organised by Tallinn University in the framework of its own annual doctoral school.

For further information, please visit:
<http://www.tlu.ee/?LangID=2&CatID=3680>

Conference on astronomy and civilisation

A conference entitled 'Astronomy and civilisation' will be held from 10 to 13 August 2009 in Budapest, Hungary.

As part of the 'International year of astronomy 2009', the goal of the conference is to call attention to the close ties between astronomy, natural sciences and civilisation. This is because astronomical insights can have profound implications for the development of science, philosophy, culture and the general conception of the universe.

The conference will combine plenary sessions with mini-symposia on research in physics, astrobiology, biosemiotics, complexity and cognitive sciences, as well as on social sciences, art, religion and astronomy.

For further information, please visit:
<http://www.konkoly.hu/AC2009>

Conference on aquaculture

The international conference 'Aquaculture Europe 2009' will take place from 14 to 17 August 2009 in Trondheim, Norway.

Research has been crucial to the development of aquaculture over the last three decades, and Europe has been a leader. European research has focused primarily on the validation of new species' production; breeding, nutrition and health management. As aquaculture continues to develop, though, research will undergo fundamental change. Current technologies have potentially reached their limits and require rethinking.

'Aquaculture Europe 2009' will address this challenge and provide an international forum to discuss the latest research initiatives.

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

Workshop on genomics in cancer risk assessment

A workshop on genomics in cancer risk assessment will take place on 27 and 28 August 2009 in Venice, Italy.

The event will address emerging genomics-based approaches applicable to toxicity and cancer hazard identification and risk assessment. Special emphasis will be given to the development and evaluation of alternative in vitro models that have the potential to significantly reduce the use of laboratory animals.

Participants will interact with experts from academia, industry, public research and regulatory agencies. The goal is to identify promising avenues and identify gaps that need to be addressed in order to develop genomic approaches into a new safety evaluation strategy for drugs and chemicals which can meet current and future demand.

The workshop is co-organised by the EU-funded Carcinogenomics project, the European Centre for the Validation of Alternative Methods (ECVAM), the Health and Environmental Sciences Institute (HESI) and the Netherlands Genomics Initiative.

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

Congress on alternatives to animal use in life sciences

The 'World congress on alternatives and animal use in the life sciences' will take place in Rome, Italy, from 30 August to 3 September 2009.

Under the motto 'Calling on science', this seventh edition of the congress highlights that scientific progress today has to go hand in hand with the reduction, refinement and replacement of experimental animals (the three Rs).

The first three days will address alternatives and the use of animals, including:

- day 1: innovative technologies, concepts and approaches;
- day 2: areas of animal use;
- day 3: progress in life science domains.

The fourth day of the conference will be dedicated to scientific developments relevant to the three Rs, with an emphasis on recent progress and implications for science, public health, animal use and animal welfare.

For further information, please visit:
<http://www.aimgroup.eu/2009/WC7>

Conference on advanced model measurement technology for the maritime industry

The first 'International conference on advanced model measurement technology for the EU maritime industry' (AMT '09) will be held on 1 and 2 September 2009 in Nantes, France.

The AMT '09 conference is an opportunity for industry and academia to learn about the newest model and full-scale testing techniques for the maritime industry. The conference will include expert presentations on advanced measurement technology and present the initial results from the 'Hydro-testing alliance' (HTA) project.

The topics for the conference are in line with the work performed in HTA's joint research programmes and are:

- PIV operation in hydrodynamic experimental facilities;
- flow data analysis and visualisation;
- 3-D wave field measurements;
- POD/dynamic forces;
- wireless data transmission;
- high-speed video;
- intelligent materials and production methods;
- wetted surface;
- free-running model technologies;
- advanced measurement techniques;
- benchmarking and validation.

For further information, please visit:
<http://www.amt09.eu>

Conference on land and water degradation

The Helmholtz Centre for Environmental Research (UFZ) is organising an international conference on land and water degradation from 6 to 9 September 2009 in Magdeburg, Germany.

This conference will address the need to improve the practical and theoretical understanding of land and water degradation processes, in particular the physical, chemical and biological deterioration of soils and water bodies in various regions of the world. This event will also bring together scientists from various disciplines with different methodological backgrounds.

Topics on the agenda include:

- nutrient dynamics in the land-sediment-water system;
- buffer strip and floodplain functions for catchment health;
- physical, chemical and biological processes of soil degradation;
- methodological approaches to estimate and regionalise nonpointsource pollution;
- spatial heterogeneity, variation and prediction of land degradation;
- methods to review outcomes of mitigation strategies and catchment management;
- regional studies of land and water degradation, especially in industrialised and urbanised areas, cold climates and Mediterranean regions.

For further information, please visit:
<http://www.ufz.de/index.php?en=16521>

Atmospheric science conference

The European Space Agency (ESA) will host the 'Atmospheric science conference' in Barcelona, Spain, from 7 to 11 September 2009.

In the framework of the event, scientists and data users will have the opportunity to present first-hand and up-to-date results from their ongoing research activities on the atmospheric payload of the satellites ERS-2 and Envisat, as well as ESA third-party missions on board the EOS-AURA, ACE, Odin and GOSAT satellites.

The conference will also include discussions on applications, data quality, the development of new algorithms/data products, and studies on future atmospheric missions.

For further information, please visit:
<http://earth.esa.int/workshops/atmos2009>

Conference on spacecraft structures

The 'European conference on spacecraft structures, materials and mechanical testing' (ECSSMMT) will be held in Toulouse, France, from 15 to 17 September 2009.

The conference is intended for all members of relevant mechanical engineering disciplines and will be a chance to exchange experience and information, especially related to spacecraft vehicle development, materials applications and mechanical testing.

Major topics to be addressed during the event include:

- mechanical architecture, design and engineering;
- structural dynamics and microvibrations;
- mechanical testing;
- acoustics;
- structural materials applications;
- thermo-elastically stable structures;
- active structures;
- inflatable/deployable structures;
- stochastic analysis;
- shock;
- composite structures.

The event is organised by the French Space Agency (CNES) in collaboration with the European Space Agency (ESA) and the German Aerospace Center (DLR).

For further information, please visit:
<http://www.ecssmmt.com>

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