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Special feature



Let's get together — Infrastructure for research, science and collaboration

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Fax (352) 29 29-44090
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Editorial coordination
Evi Ford-Alexandraki

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It's research, but not as we know it

In this issue, we are launching a new series of special dossiers covering the essential and the esoteric of European research, innovation and technology. The 'specials', as we like to call them, start with a look at one of R & D's unsung heroes — infrastructure for research, science and collaboration.

We feature an interview with Stephen Benians, an expert in 'grid' computing, and we discover why this maturing technology is finding new fans outside the serious research labs, as industry picks up on the benefits of distributed computing and web services available in 'the cloud'.



A grid is a network of high-powered computing and storage resources which belong to separate organisations but are shared between them to perform 'virtual research' on problems ranging from the genetic origins of heart disease to the management of fish stocks and the reconstruction of ancient musical instruments.

In this March issue of the supplement, the biology and medicine theme headlines with patented new biotechnology, Naomi's Nucleants™, which harnesses the work of the EU-funded Opticryst on protein molecular structures.

The top story in our energy and transport section shows off a new routing and monitoring system for trucks carrying dangerous goods developed by the 'Good route' project.

In our environment section, we learn how plants can adapt to climate change. And, yes, it's all in the genes.

Meanwhile, the opening story of the IT and telecommunications section, part of this month's special dossier, makes a fair case for 'argumentative agents' being a good thing to have in your computer if you want the best online deals.

The industrial technologies section kicks off with the Scratchbot which takes inspiration from the way rats use their whiskers to discover the world. Applications could include aiding emergency search crews to locate victims of collapsed mines or buildings.

As usual, the events section offers you a selection of upcoming conferences, workshops and get-togethers in the field of research.

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

The editorial team

Corrections and amplifications

In our story on 'Markers for oestrogen in zebra fish' (November 2009 issue 19, p6), the associated photo should have been a zebra fish — *Danio rerio* — which belongs to the minnow family. A popular aquarium fish, it is also an important model organism in scientific research. Apologies for any confusion that this may have caused.

Want more information on the contents of this issue?

For online versions of the showcased offers, articles and features:
- Technology Marketplace: <http://cordis.europa.eu/marketplace>
- ICT Results: <http://cordis.europa.eu/ictresults>
- Research Information Centre: <http://ec.europa.eu/research/infocentre>
- Transport Research Knowledge Centre: <http://www.transport-research.info>
Thank you to Stephen Benians for his contribution to the 'special' dossier in this issue.



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Crystal gazing into protein molecular structures

Knowledge of protein structure down to the level of the individual atom is pivotal for biotechnological applications like tailored drug design. A new product Naomi's Nucleants™ has been launched to produce high-quality crystals in the quest to map the molecular structures of important proteins.

Specificity on a molecular level is a prerequisite of rational design of pharmaceutical products. For the drug to tinker successfully with cellular biochemical cascades, a specific functional group must lock on to the target protein. This way, an unwanted reaction can be negated, or conversely, a desired pathway can be switched on.

The best way to determine the atomic structure of many materials is to use X-ray crystallography to produce a three-dimensional picture of electrons. The stumbling block has always been how to obtain high-quality crystals, a process that starts with nucleation when stable nuclei are formed. The nuclei can then go on to grow into single diffracting crystals. As a result, the goal of many research groups was, and still is, to produce a universal nucleant.

Naomi's Nucleants™ represent the most successful development yet. With the support of the project Opticryst under the EU's Sixth Framework Programme for research, Prof. Naomi Chayen, Biomolecular Medicine, Imperial College London and her colleagues drew and expanded on two decades of multidisciplinary research to reach a formulation that induces nucleation in many proteins that have so far presented difficulties during crystallisation.

Materials previously tested on the way to this breakthrough included minerals, mica, pulverised seaweed and horsehair. Three main criteria found to stimulate nucleation are electrostatically charged surfaces, roughness and, perhaps most importantly, the presence of pores. Porous silicon proved to be a successful nucleant during trials for Prof. Chayen and her team and this encouraged them to explore this avenue further.

An amorphous mesoporous bioactive gel-glass known as bio-glass — the ingredient of Naomi's Nucleants™ — was used as the result of their research. In line with previous investigations, the material has a range of pore sizes, from two to ten nanometres wide, and a great variety of shapes. Pore size is crucial, being small enough to encourage the filling of the tiny hole, yet large enough to continue growth once the crystal emerges.

Amongst the proteins that can be crystallised by Naomi's Nucleants™ is a modulator of heart contraction and a peptide hormone that may be a candidate for controlling appetite. For possible application in the areas of ecology and conservation, crystals of the natural algal and lobster shell pigmented proteins that promise to replace toxic or carcinogenic pigments can be produced.



© Naomi Chayen, Imperial College, London

Naomi's Nucleants™ operate over a wide range of pH, avoid twinning whereby two separate crystals grow together on one plane, promote controlled nucleation and the resultant crystals are easy to detach. Perhaps the most important aspect is that the product represents a major move towards a universal nucleant, facilitating the crystallisation of 14 proteins, the highest number for a single nucleant yet recorded.

The role of this novel product in structural genomics and rational drug design cannot be overstated. Moreover, proteins are the cellular labourers of all life systems. As such, their molecular structure can turn the key to myriad life science applications.

Funded under the FP6 thematic area LIFESCIHEALTH (Life sciences, genomics and biotechnology for health).

Naomi's Nucleants™ are available from Molecular Dimensions Limited at:

<http://moleculardimensions.com>

<http://cordis.europa.eu/marketplace> > search > projects > 85043

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

Breeding tannins out of faba beans

Spanish scientists involved in the Eufaba project identified specific genetic markers that will enable the cultivation of tannin-free faba beans.

The faba bean (*Vicia faba*) has potential as an indigenous, protein-rich source of animal feed that could benefit the European livestock industry considerably. Unfortunately, the frequent presence of anti-nutritional tannins significantly reduces its value as a foodstuff.

In response, the EU-funded Eufaba research consortium researched ways of selectively breeding tannins, as well as other unwanted traits, out of the faba bean. The group focused on the *zt-2* gene, which is associated not only with zero tannin but also with increased protein and energy levels.

Bulked segregant analysis (BSA) was applied and succeeded in yielding five random amplified polymorphic DNA (RAPD) segments. These were subsequently converted into sequence characterised amplified regions (SCARs) and subjected to additional genetic analysis with the aim of producing specific markers. A technique using multiplex polymerase chain reaction (PCR) proved useful in this respect.

Experiments with an F2 (second filial) generation of faba beans confirmed the viability of the markers identified during Eufaba, paving the way for the development

of tannin-free cultivars. The results of the investigation have been published in a peer-reviewed agricultural periodical.

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

Collaboration sought: information exchange/training.
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Genomic identity parade for 'smear cheese' bacteria

The EU-funded project SCM has constructed a database to house details of newly characterised bacteria living on five of Europe's cheeses. The microbial ecology of cheeses determines not only the taste of a cheese but helps keep the food free of pathogenic bacteria.

The cocktail of bacteria on the surface of a smear cheese assists in the ripening process and is a determining factor in the taste and texture of the final product. Due to competition between microbes in the cheese, certain key strains also help to deter the development of organisms such as *Listeria* that can spoil the food.

To help cheesemakers choose the correct microbes, project partners at the University of Gent in Belgium set about identifying and detailing some 160 coccal bacteria. These were isolated from five different European

smear-ripened cheeses including Gubbeen and Tilsit. The samples also varied in respect to ripening time and batch.

Genetic fingerprinting using repetitive element-polymerase chain reaction (rep-PCR) helped to characterise the bacteria. This tried and tested analytical genomic tool has been shown to be highly reproducible and is able to demonstrate phylogenetic relationships between closely related strains.

A set of 60 reference strains was chosen from the most common microbes on red

smear cheeses. To analyse band patterns, the bioinformatics software platform, BioNumerics was used. The characterisation was very thorough. Even in the event of an isolate not fitting the cluster analysis, a sequence analysis was performed to place it in a species group.

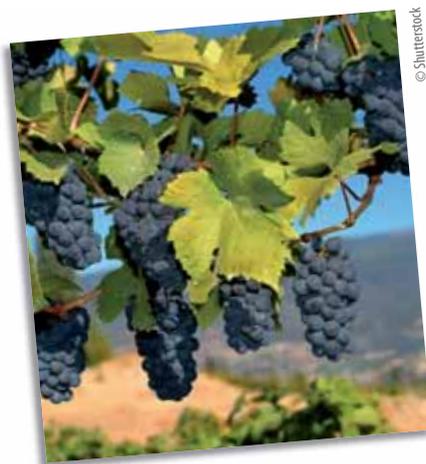
Two representatives of each of 51 staphylococcal and other coccus-shaped bacteria were included in the Laboratory of Microbiology Gent (LMG). Meanwhile, the Belgian Co-ordinated Collections of Micro-organisms, BCCM™, held at the university, can offer a comprehensive service for molecular characterisation of cocci and other types of bacteria isolated from cheese or other foods.

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

Collaboration sought: available for consultancy.
<http://cordis.europa.eu/marketplace> > search > offers > 5337

Mapping toxic fungi in grapes

Through the use of geographical maps, researchers were able to pinpoint sources of toxic fungi which attack grape berries at various growing stages.



Aspergillus Section Nigri, particularly the species *A. Carbonarius* is the toxic fungus commonly known as black mould. It is present in soil and is a common contaminant of food, attacking a variety of fruits and vegetables such as grapes, onions and peanuts as well as coffee beans. It is responsible for producing the mycotoxin OTA (*Ochratoxin A*) which is considered to be a human carcinogen.

The Wine-ochra risk project identified and characterised populations of OTA-producing fungi present in grapes and wine. The infection cycle of these strains, particularly

in relation to their ecological requirements, was closely examined. This way, sources of contamination could be pinpointed in the hope of formulating preventative action.

A significant correlation was found between geographical coordinates and the incidence of berries being infected by black mould at early stages as well as at the ripening stage.

Prediction maps were created for France, Greece, Israel, Italy, Portugal and Spain spanning the course of a few years. The findings could be useful for corrective action during grape storage and/or processing.

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 > 5214

Making Braille music universally accessible

Although music has been transcribed into Braille for nearly two centuries, it has been difficult for blind musicians to access scores because of national differences, lack of good teachers, and intrinsic limitations of the format. A new European system promises to make music for the blind far more accessible and useful.

The iconic image of the blind musician dates back at least to the time of Homer. It is a fitting image, since music is an art form to which blindness does not raise any intrinsic barriers.

Until the first quarter of the 19th century, however, blind musicians could learn music only by ear. Louis Braille changed that when he invented a system for transcribing musical scores into a tactile code.

Unfortunately, both transcribing — which had to be done by a sighted musician — and reading Braille music proved difficult. Braille's linear format makes it hard to decipher the many aspects of music that occur simultaneously, such as chords or multiple voices.

It is estimated that less than 15% of printed music has ever been transcribed into Braille, and much of that is only locally available.

The project 'Preservations and unification of new and existing Braille music digital sources for a new access methodology' (Contrapunctus) aimed to use digital technology to create an enriched and standardised digital format that would make it easier to transcribe music into Braille and make musical scores for the blind universally available and more useful.

Blind and visually impaired musicians worldwide can now enjoy the benefits of the Contrapunctus system. They can download enriched, multimedia scores from a growing digital library, study them with greatly enhanced flexibility, and add new scores to the library as well.

'The music page in Braille has been like a city with lots of blank walls and very few signs,' says Antonio Quatraro, the Contrapunctus project coordinator. 'Contrapunctus has enriched this page with all kinds of information concerning every musical element — a note, a rest, a tie, fingering, etc. It used to be a labyrinth where you could go in but might never come out. Now, with our system, you can always find your way around.'

A core feature of Contrapunctus is a new digital format for encoding all aspects of a musical score in a standardised and easily accessible way using a software package called Resonare. The resulting Braille music

markup language (BMML) reorganises written music into a highly structured, easily searchable database.

Blind musicians can read any BMML score by using another program, the Braille music reader (BMR). As opposed to painstakingly deciphering a traditional Braille score, a musician using BMR can dissect it like a skilled surgeon and study it in any number of ways.

First, Mr Quatraro explains, BMR can describe musical elements from individual notes to changes in tempo or dynamics in spoken form.

Next, BMR can play the music using a MIDI interface. 'As you read through the music on your computer, the notes are played to you as written,' says Mr Quatraro. 'That's important, since a commercial recording cannot be as accurate as the printed score, just as a spoken story cannot convey its spelling and punctuation.'

Crucially, BMR lets a blind musician add notations such as fingerings, breath marks or interpretive comments to the score, just as sighted musicians do.

In addition, the musician can analyse the score selectively, for example singling out only the left hand, or one measure, or one chord.

Users with access to a computerised Braille display can read any part of the enriched score by touch. Of course, the enriched Braille score can also be printed.

Combine all these features, Mr Quatraro says, and you get a system that makes a blind musician's life a lot easier. 'It's as if you had driven all your life on a bicycle, and now you have a car,' he says.

In addition to creating a new way for musicians to read and learn music, the Contrapunctus team also wanted to make Braille music universally accessible.

Before Contrapunctus, musicians faced a Babel of languages because each transcription centre had its own production standards, suggests the project coordinator. 'Whatever transcriptions that were pro-

duced were difficult to access and readable only by a few experts.'

The group attacked those problems by creating a standardised format for Braille music based on XML, a widely used set of rules for digitising documents of all kinds and making them easily accessible on the internet.

They hope that, as more musicians, transcribers and libraries use Contrapunctus, the Braille music XML format they developed will become the de facto standard.

The suite of software they have produced and made available is already breaking down long-standing barriers. Contrapunctus has created an online portal as an access point to a Braille score library, compiling contributions from the most important European libraries for the blind. Musicians anywhere in the world can now download software for free from the Contrapunctus website and start to explore enriched, multimodal, and easily navigable musical scores.



'It's as if we had a hidden treasure which nobody could access,' says Mr Quatraro. 'But we found the key that unlocks the treasure created by generations of transcribers.'

James Risdon, Music Officer at the UK's Royal National Institute of Blind People, agrees. He has gathered feedback about Contrapunctus from blind musicians throughout England. According to him, they are thrilled to be able to download music instantly, find that they benefit greatly from the system's multimodal features, and very much like being able to annotate scores as they work on them.

'These three features make it a very exciting development,' he says.

The Contrapunctus project received funding from the Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91118>

See also page 12 'Eye-tracking software opens online worlds to people with disabilities'

Preserving audiovisual memories for posterity

Millions of hours of old TV and radio news bulletins, interviews and shows sit collecting dust in the basements of broadcasters and media archives. Digging through these audiovisual treasure troves is becoming faster and easier thanks to software developed by European researchers.

In recent years many public and private organisations have embarked on initiatives to digitise collections of recordings from decades past in an effort to gain new insights into history and preserve the audiovisual content for posterity.

Sifting through these collections of analogue magnetic tapes they have uncovered long-lost footage of historical events and interviews with historical figures. But they have also encountered numerous problems.

‘We don’t have the resources to digitise, describe and index all content in detail, so we need some sort of automated or semi-automated method,’ says Jean-François Cosandier, the head of the documentation and archive department at Radio Suisse Romande, a radio station in the French-speaking part of Switzerland.

Not least among the challenges these archival archaeologists face is identifying what is included in the content of an old recording and cataloguing the digital copy for easy access and retrieval in the future.

‘Some archives have collections of recordings that are well documented, but many do not,’ says Philippe Scohy, a project manager at Memnon Archiving Services in Brussels. Some even have hundreds of thousands of hours of content without even knowing what is in it.

Because of the lack of metadata information describing the content of old recordings it can take an archivist as long as five or six hours to catalogue a one-hour radio interview even though perhaps only a few minutes of that interview will be of interest.

‘Given the amount of old media being digitised and the problems of identifying and cataloguing it, any tool that makes the archivist’s job easier is a welcome development,’ Mr Scohy notes.

Memnon is currently marketing a set of tools, IPI©-Manager, intended to do just that. Developed in the EU-funded project ‘Design of an audio semantic indexation system allowing information retrieval for the access to archive content’ (Memories), the tools automate the more laborious aspects of the archiving process, helping archivists index and sort media collections faster and more easily. That in turn should lead to more historical content being made more accessible to more people, ensuring its preservation for future generations. For example, Radio Suisse Romande, a partner in the Memories project, plans to use the tools to help make its 80-year-old collection of audio recordings accessible and searchable online.

‘We have digitised a quarter of our old analogue archive, so there is still a lot more work to be done,’ Mr Cosandier says.

And, he adds, the development of new and more effective techniques is not justified solely by efforts to digitise old content. Nowadays archivists have to deal with a diverse range of audio documents, from radio programmes and speeches to conferences and university courses. With traditional methods of analysis and indexation it would be almost impossible to archive and make this content accessible.

By analysing audio content, the Memories tools are able to identify different features of a recording. Used to catalogue a radio interview, for example, they detect when a question is asked and an answer given by recognising the exchange between speakers. The system then automatically tags each question and answer pair to let future listeners jump to different parts of the interview at the click of a button. Similarly, the Memories

researchers developed a tool to automatically detect and tag the start, end and commercial breaks of different shows by recognising their trademark jingles.

‘An old tape might be labelled with the shows that are on it, but more often than not an archivist is given no clue as to what order they are in or how long they run without watching the whole thing,’ Mr Scohy says. ‘Our tools provide that information.’

In the case of recordings of a person or people speaking, voice recognition technology can also be applied, which, with training, can automatically identify speakers, while a speech-to-text application turns the spoken content into text.

To provide search functionality, the Memories team developed a sophisticated search tool adapted from information-gathering methods that have been tried and tested in genetic and genomic applications. It is based on the statistical association of the occurrences of words.

In the case of music, the Memories researchers in Mist Technologies/Audionamix and Technion (Haifa) developed a tool to ‘unmix’ the different channels that make up a song. Called single sensor source separation (SSSS), the software is able to differentiate between instruments, separating the sound of a trumpet from a piano, for example, and making it possible to identify different stages in a tune. The current version works best with mono recordings and can also be used to help digitally remaster them into stereo and surround sound, Mr Scohy notes.

The overall Memories architecture is based on the open archiving information system (OAIS) model, a standard originally developed by the Consultative Committee for Space Data Systems (CCSDS) with the aim of future proofing digital content by storing and cataloguing it in such a way that it does not become obsolete and inaccessible as a result of technological progress.

‘By adopting the OAIS approach we are trying to ensure that content is around for a very long time, not just years but thousands of years,’ Mr Scohy says.

With Memnon actively marketing products based on the work done in Memories and expecting its first sales imminently, preserving audiovisual memories for the future should be a little less of a challenge.

Memories project received funding from the Sixth Framework Programme for research.

Promoted through the ICT Results service.
<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91102>



Hearing assistance comes to the home

Social isolation is the biggest impact caused by hearing impairment. Now European researchers have developed technology to tackle the problem.

The number of people suffering from hearing impairment is increasing, and as the disability grows it spreads isolation in its wake. Vision is the primary sensory system for navigating the real world, but sound is the mainstay of our social sphere.

When people start to lose their hearing they slowly begin to withdraw from the world. Conversation becomes difficult and confusing, as sound begins to smudge in the auditory cortex, like ink blotting on a page.

Worse, it is one of the few disabilities that the victims can conceal successfully, and they do. Embarrassment typically causes people to delay seeking help, often for years.

'The average person who begins to lose their hearing typically waits seven years before seeking help,' explains Jochen Meyer, coordinator of the Hearing at Home project, alias HAH. 'We wanted to do something to help those people.'

'Doing something' consisted of combining some state-of-the-art technologies into a single system that can be easily integrated into the average home, where people, including the hearing impaired, spend most of their discretionary time.

This approach not only tackles some of the real and possibly life-threatening in-home difficulties experienced by the hearing impaired, it also introduces them to assistive technologies in a controlled environment.

'So our idea was to move the hearing aid closer to people's every day life,' Mr Meyer reveals. The HAH team hopes this will help overcome the typical resistance to technology like hearing aids; when users experience the power of a hearing aid they become much more open to it.

In the HAH system, the technology centred around the television, because it tends to be the most frequently used piece of technology in the house, and as the sound and vision centre of most homes, it lends itself to an assistive role.

The heart of the HAH platform is the set-top box (STB), which links hardware around the house, routing the assistive technologies through the TV. These include acoustic technologies, home automation and phone integration.

The system is easy and fast to set up. 'Typically, when you go to an acoustician for a hearing aid fitting, you go through a complex testing process to tune the hearing aid to your specific impairment,' Mr Meyer explains.

The acoustician is testing a wide range of frequencies to determine those that pose the greatest problem to the user. Tuning then consists of boosting some frequencies, and suppressing others, to maximise sound clarity.

'With our STB, the user can go through this test, by themselves, in 10 minutes,' he says. When the user watches TV, the sound is adjusted on the fly to match their needs. The STB can also suppress background noises from the audio stream.

'If you are watching a documentary about traffic, traffic noise could drown out the narrator. The HAH platform can suppress that traffic noise in real time,' says Mr Meyer.

If there is a phone call, an alert appears on the TV screen, and the conversation is routed to the handset via the STB, so the audio is optimised for the user. It can also handle video calls via voice-over IP (VOIP).

Similarly, there is an alert, and a CCTV picture, if a caller comes to the door. 'That's important, because you don't want to miss any visitors, it just adds to the isolation,' emphasises Mr Meyer.

The system also links to other parts of the house, such as the washing machine or microwave or the cooker. Any alarms, such as a fire alarm, appear instantly on the screen.

Finally, the team also created an avatar, an animated talking head, which accurately lip-syncs with any audio coming from the television, so users can lip read if necessary. 'This is processed locally, using the data coming from the audio signal to create the lip movements on the avatar.'

The project took a comprehensive approach to many of the

problems faced by the hard-of-hearing, dramatically extending the state of the art in several domains.

'Many of these technologies already existed, and we simply combined them into an integrated system that responds to real needs,' Mr Meyer notes, 'But many of them we extended, too.'

For example, research on acoustic tuning for hearing aids is very basic, and HAH worked on this so that users can now perform the tuning automatically.

The technology has drawn intense interest from industry and academic peers, but the greatest eagerness encountered by the team comes from the end-users.

'We spent a lot of time looking at these technologies, at how they could work together to help the hearing impaired with real-world problems,' stresses Mr Meyer. That careful groundwork paid off.

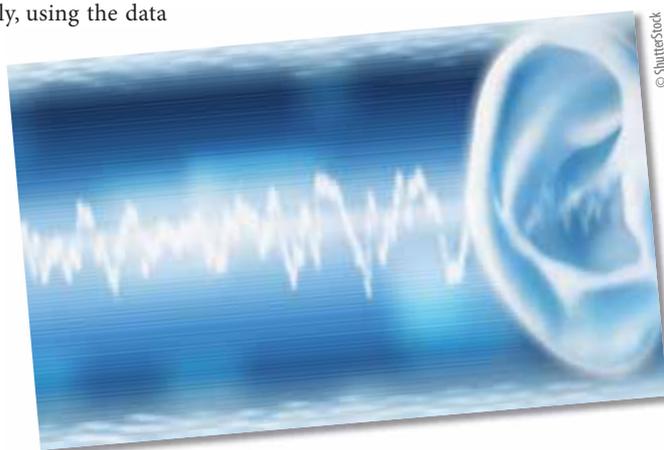
'We have two demonstration sites, in Oldenburg, Germany, and Madrid, Spain, and the feedback we get from the hearing impaired is very encouraging,' he explains. 'They are very excited by the technology, and they really want to get it for themselves or loved ones.'

Industrial contacts, too, are interested. 'But I think we could see a commercial version of this platform available in the next two to three years.'

In the meantime, the team is currently considering other areas where the technology could be applied and extended, and the partners are looking at new projects under the EU's current Seventh Framework Programme for research.

The HAH project received funding from the ICT strand of EU's Sixth Framework Programme for research.

Promoted through the ICT Results service.
<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=91081>



Staying mobile in old age with compact, smart sensor technology

A new range of smart sensing devices promise to boost mobility and quality of life for the elderly, reduce healthcare costs and even give sports people an edge through more effective training.

The wireless devices are currently being sold by McRoberts, a Netherlands-based company that developed them as part of the project 'Sensing and action to support mobility in ambient assisted living' (Sensation-AAL), an EU-funded initiative to create remote mobility monitoring solutions coordinated by the University of Bologna.

Unlike many health-monitoring systems that require multiple sensors as well as separate components for data storage and transmission, the DynaPort Hybrid device and MoveMonitor application developed by the Sensation-AAL researchers carry out movement sensing, data collection and data transmission in a single compact package. Worn on the user's waist in a special elastic belt, the devices monitor and record a person's physical movement and body posture, assist them in performing rehabilitation exercises, and can be configured to automatically alert emergency services in the event of a fall.

'These devices respond to a growing demand from the medical community for the long-term collection of data from people with mobility problems and motor disorders. The information they gather allows doctors to better understand a patient's symptoms and in turn treat them more effectively,' explains Rob van Lummel, the founder and president of McRoberts, whose devices are now sold in more than 20 countries.

Mr van Lummel points to the case of neurologists attempting to treat sufferers of Parkinson's disease. Until now they have had to mostly base their assessment of the severity of the patient's mobility problems on the patient's own descriptions. However, such

accounts often provide an incomplete picture as people vary in how they interpret events affecting their mobility, from falls to difficulty standing, and may not remember all of them. Objective information, gathered by sensors, fills the gaps, providing a more detailed picture and ultimately leading to more accurate diagnosis and more effective treatment.

'A key feature of our devices is that they allow data to be gathered over a longer period of time, from three to seven days. This is important because doctors need to see how mobility problems affect people during their daily lives and while performing different activities,' Mr Van Lummel says.

McRoberts' DynaPort Hybrid device runs for 75 hours on a single battery charge and, at just 14mm thick and weighing just 74 grams, it is light and comfortable to wear. Movement and posture data, gathered from internal gyroscopes and accelerometers, is stored on flash memory and can be transmitted to a doctor's or user's PC via the Bluetooth wireless protocol.

Besides improving the diagnosis of mobility problems, the devices can also greatly assist patient rehabilitation by translating movement data into audio and/or tactile signals that let a patient know if they are performing exercises correctly, thereby improving their motion and posture awareness. Used as part of a comprehensive rehabilitation programme, the application allows patients to carry out exercises at home with remote supervision rather than having to visit hospitals and rehabilitation centres.

'We are certain that, in the future, more and more healthcare services will be provided remotely in the home rather than in hospitals,' Mr Van Lummel says.

Such a shift seems inevitable in light of demographic changes. Today, nearly 14% of Europe's population is older than 65, but by 2050 that proportion is expected to double, necessitating dramatic changes in the way healthcare is provided if spiralling costs are to be avoided. And because mobility problems are more likely to occur in old age, whether as a result of deteriorating eyesight and balance or due to age-related diseases, such as Alzheimer's and Parkinson's, it is a field of research that is drawing increased interest from both public healthcare systems and private healthcare providers.

'We are seeing a lot of interest in remote monitoring solutions,' notes Lorenzo Chiari, the coordinator of the Sensation-AAL project at the University of Bologna in Italy. 'Patients like the sense of safety and reassurance they provide, while healthcare providers see the potential to provide better treatment at lower cost.'

Mr Van Lummel notes that the price of remote monitoring using McRoberts' products averages out to about EUR 25 per patient per week if they are used just 30 weeks a year, a relatively small sum compared to the time and financial cost of gathering mobility data in a hospital or having patients visit a clinic for rehabilitation sessions.

McRoberts is focusing on selling its products in the 'huge' healthcare market, although Mr Van Lummel and Mr Chiari note that they could equally be put to use in the sports world, in ergonomics or to monitor workers in hazardous environments.

'A similar application to that used for rehabilitation could be used for training athletes, or a gymnast or dancer could use it to improve balance,' Mr Chiari says.

One of the project partners, STMicroelectronics, is even incorporating research from the Sensation-AAL project into its Motion-Bee range of wireless sensors for remote motion recognition and tracking in many different application areas, including healthcare, security, industrial control and environmental monitoring.

Sensation-AAL was funded under the Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=91073>



Assistive technology helps dementia sufferers get through the day

Tens of millions of elderly people in the EU suffering from mild dementia may be able to look after themselves, and free up their carers, thanks to a new European-developed system.

One of the first and most debilitating symptoms of dementia is short-term memory loss, which means care is required for people who are otherwise quite capable of looking after themselves. They can perform tasks, but they forget them or how to do them.

Other symptoms of mild dementia can be linked to a loss of self-confidence — older people increasingly refraining from initiating social contact — and to a sense of insecurity.

How to address these concerns and enable mild dementia victims to continue to lead independent lives for an extended period of time has been researched, and possibly solved, by an EU-funded project.

The 'Helping people with mild dementia navigate their day' (Cogknow) project brought together some of the leading dementia specialists in Europe, doctors from the Netherlands, Sweden and Northern Ireland (UK) with teams of software researchers and developers. Their aim was to address a range of different needs of mild dementia patients and come up with a simple, user-friendly device to meet those.

'Separate devices and solutions exist for many of the needs, and if people learn how to use them early on, then they may be able to continue using them quite far into the disease,' says the project's scientific coordinator Johan E Bengtsson. 'But it then becomes a problem for the patient to remember where the devices are, and how each of them works,' he says.

Also, in later stages of the disease, simplified devices are needed, and at that stage it is usually too late to teach anybody how to use even the simpler devices and the person will then need to rely on a carer.

So the Cogknow project set out to create two very user-friendly devices, one home-based and one mobile, featuring all the high-priority and previously unmet needs, as identified by end-users and their carers, as well as the dementia experts.

They determined that touch-screen technology was the ideal interface between people with dementia and computer-based assistive functions. An added attraction was the fact that they could buy the needed hardware devices off the shelf and then

install the Cogknow Day Navigator software suite on them.

The end result was a flat-screen monitor for the home, which can be either wall mounted or standalone, and a mobile smart phone with a much simplified user interface installed.

Both devices are controlled solely by touch screen (the monitor does not even come with a keyboard) with the Cogknow application maintained on top of everything so nothing else is visible to the end-user. 'The application takes control of the device and makes it impossible for the user to activate the more difficult-to-use functions of these devices,' explains Mr Bengtsson.

All the user has to deal with are simple, self-explanatory icons on the touch screen. The in-home system can be set up to start issuing reminders from wake-up time in the morning until bed time. These can be recorded in a friend or relative's voice, and give instructions for all sorts of activities such as picking up the morning newspaper, brushing teeth, preparing or warming pre-prepared meals, laundry and dishwashing and myriad other daily activities.

They can also be linked to video presentations showing how to operate, for example, the stove, microwave oven or washing machine.

Many elderly people worry if the door is open or unlocked, and the Cogknow system monitors this so they do not keep on checking that during the day. On-screen icons in the form of photos help them to picture-dial friends and relatives, simply by touching a particular photo.

Most functions are also included on the mobile device, which comes with an im-

portant extra GPS-based feature. Dementia sufferers can get disoriented when out, and the device can guide them home whenever necessary.

The system was field-tested on user groups in three countries, and the majority of users and carers perceived significant improvement in their lives and their ability to get through the day.

Now some members of the project, which finished last August, are working to commercialise the system and market it around Europe. 'About 2% of the population of Europe suffers from mild dementia and it costs an estimated EUR 10,000 a year to provide care for each of them when they cannot cope anymore.'

'Our devices will cost a lot less than that, and can be used again by other people when the first owner progresses too far into the disease,' says Mr Bengtsson. 'If Cogknow only extends people's ability to look after themselves for an extra few months, then the savings are still potentially billions of euros.'

The Cogknow consortium is looking for new partners to help with commercialisation and marketing in the shape of an established software provider, preferably with experience in mobile applications, and companies specialising in reselling and providing solutions to the care and medical sectors in individual countries or groups of countries.

Cogknow was funded under the Sixth Framework Programme for research.

Promoted through the ICT Results service.
<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&BrowsingType=Features&ID=91139>



Eye-tracking software opens online worlds to people with disabilities

Technology that allows gamers to control game functions with only their eyes is helping to open virtual worlds such as Second Life and World of Warcraft to people with severe motor disabilities.

The gaming-with-gaze software — a first version of which has been made publicly available for free — is one of several applications to emerge from ‘Communication by gaze interaction’ (Cogain), an EU-funded network of excellence aimed at coordinating efforts from developers of new communications tools for people with disabilities using gaze and eye-tracking technology.

For people suffering from conditions such as cerebral palsy, motor neurone disease (MND) or so-called locked-in syndromes, being able to move around and interact in a virtual environment is a ‘truly liberating experience,’ says Howell Istance, a computer scientist who helped develop the software.

‘Until now, gaze-tracking technology has mainly been used for typing with visual keyboards, for browsing the web and other text-based applications. We have taken it to an entirely new level by using eye movements to control an avatar in a virtual environment, allowing people with disabilities to appear and interact just like able-bodied people if they wish,’ explains Mr Istance of De Montfort University in the United Kingdom.

The gaming-with-gaze software works in combination with commercially available eye-trackers that use cameras to monitor users’ eye movements as they gaze at a computer screen. The developers studied the eye movements of able-bodied gamers to create a visual heat map in order to trigger commands depending on where users look.

Different patterns of eye movements are translated into so-called gaze gestures that are used to trigger movement or action commands.

Glancing to the left or right will turn the virtual character in that direction, for example, while staring at the centre of the screen will make the avatar run forwards. Because the software is independent of the game itself, it can be used to play virtually any game that requires mouse and keyboard inputs.

Communicating with other players is made possible by gazing at letters on an onscreen visual keyboard, while different combinations of gestures can be used to perform different actions.

‘In the current set-up, we have programmed 12 gesture sequences to activate different keyboard or mouse events,’ Mr Istance says. ‘Many more commands are possible but the total number is limited by the users’ memory and the need to differentiate between when someone wants to input a command and when they are just looking at the screen.’

The approach contrasts with slower and more laborious gaze-based input techniques, which work sufficiently well for typing a message or surfing the internet but which are too slow and tiring to enable users to match the speed and accuracy needed to play real-time 3D games.

The gaming-with-gaze software should make the avatars of people with disabilities almost indistinguishable in their behaviour and abilities from those of able-bodied people in online games and environments.

‘It could be life changing for the large number of paralysed people whose only means of communicating is with their eyes. Second Life, for example, could really be a second life for them, providing not only entertainment but versatile electronic services, for example, education,’ says Aulikki Hyrskykari, a researcher at Tampere University.

‘Obviously there will be limitations to what users with disabilities can do — such as not being able to perform several actions simultaneously — but they can choose what activities they participate in. That is a choice they did not have before,’ Mr Istance adds.

The free software was made available to download last May, coinciding with an annual public conference in Copenhagen organised by participants in the Cogain network.

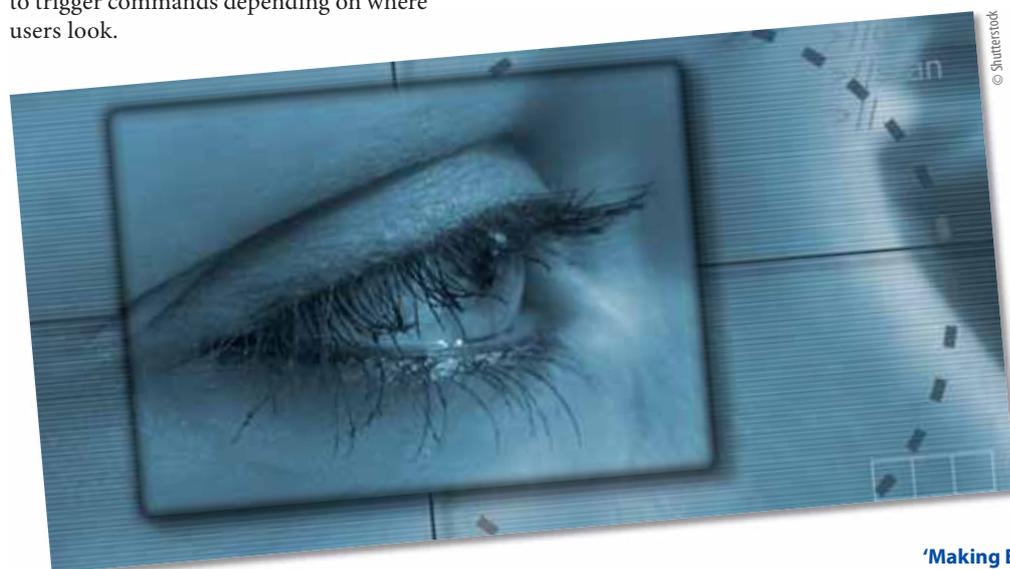
The researchers plan to encourage people with disabilities who are already using eye-tracking systems to install the software and use it with whatever online games they would like to play.

Another team of researchers working in the Cogain network developed free software to turn a high-definition video camera into an eye-tracker, providing a low-cost alternative to expensive commercial systems.

‘Based on the feedback we received, we will continue to develop the gaming software,’ Mr Istance says. ‘The goal is to have a single version of the software that is flexible enough to adapt to the interface of any online game and to the requirements and limitations of any user.’

The Cogain network received funding under the ICT strand of the EU’s Sixth Framework Programme for research.

Promoted through the ICT Results service.
<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90668>



See also page 7

‘Making Braille music universally accessible’

Mechanised molecules under load

A new class of molecules with mobile components have been processed during the Mechnol project into highly ordered thin films to be used for the future construction of synthetic molecular machines.

Machine parts, such as cogs, flywheels or pistons, do not move unless a force is applied to them. On the other hand, molecules are in constant motion. The Mechnol project partners have found a way to rectify random motion in the molecular world to generate a directional force and carry out macroscopic tasks.

Indeed, they did this so effectively that the synthetic molecular system developed is capable of transporting objects many times larger than itself. The relative movement of the constituents of rotaxanes and catenanes with respect to each other was holding the key to performing a well-defined task and measurable work with this molecular shuttle.

Rotaxanes and catenanes belong to a new class of molecules composed of smaller

molecules, which are not connected by chemical bonds and thus can move independently. More specifically, catenanes are fundamentally made from interlocked macrocycles. In the case of rotaxanes, the macrocycle is locked onto a linear thread with bulky stoppers on both ends.

The macrocycle of rotaxanes contain pyridine groups that allow grafting of the molecular shuttle on a well-ordered, self-assembled monolayer of 11-mercaptopundecanoic acid which is deposited on a gold substrate. The resulting ordered monolayer and multilayer films were characterised by X-ray photoemission spectroscopy and scanning tunnelling microscopy.

Each technique confirmed the complete and uniform coverage of the self-assembled

monolayer by thin films of rotaxane molecules with the long axis of their linear thread parallel to the gold substrate. The transport of small drops of liquid over the photo-responsive molecular surface, when exposed to ultraviolet light, provided evidence that the macrocycles of rotaxane molecules switched position.

Light was considered to fuel chemical reactions which in turn caused changes in the position of individual molecules. Their collective motion could ultimately lead to the transport of a small liquid drop over a length a million times larger than the initial change in the conformation of the rotaxane molecules.

In doing so, the photo-responsive surface of the switchable rotaxanes acted as a molecular shuttle that could be used in delivering analytes in a lab-on-a-chip environment and other applications.

Funded under the FP5 programme Information Society Technologies (FET-Open).

Collaboration sought: information exchange/training.
<http://cordis.europa.eu/marketplace> > search > offers > 5042

Premature return of infested sea trout to freshwater

Fish farming and angling can play an important role in the economies of the EU's peripheral regions by creating new opportunities for employment. The Sumbaws project was established to help develop both industries by determining sustainable levels of salmon and trout stocks.

The EU-funded consortium investigated the effect of stocked fish on wild populations. The work included a study into the physiological response of juvenile fish as they adapted to seawater and infestation by parasites. Scientists studied the susceptibility of wild juvenile sea trout, known as smolts, to sea lice (*Lepeophtheirus salmonis*), which feeds on the mucus, tissue and blood of its host. This can result in the death of the fish. A team at the University of St Andrews, Scotland, investigated the effect of the premature return to freshwater on smolts carrying *L. salmonis*.

The Scottish researchers infested seawater-acclimatised fish with the lice and studied their physiological response in the laboratory. The smolts were divided into two groups, one of which was kept in saltwater while the other was returned to freshwater 19 days after infestation. Following their

return to freshwater the level of infestation and number of deaths were significantly lower than for smolts kept in seawater. In addition, the team measured the concentrations of chloride and lactate, which were found to be higher in the seawater group.

Results indicated a significant decrease in liver glycogen content following infestation which remained at low levels for the seawater group. The data also showed some evidence for a recovery in the liver glycogen content after the smolts had returned to freshwater. The findings suggest that a pre-

mature return to freshwater can deliver significant benefits, which increases the likelihood of survival for juvenile fish previously infested with sea lice.

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 > 5311

See also page 22 'The ocean's role in feeding people worldwide'



Increasing the vitamin B content of yoghurt

Scientists in the Netherlands have discovered how to enrich the vitamin content and thus nutritional value of yoghurt using special bacteria.

In recent years, science has shed considerable light on the healthy and unhealthy aspects of the different foods we eat. Efforts to enhance the former and eliminate the latter in new food products have been undertaken by food engineers. Such was the aim of 'Nutra cells', a four-year research project funded in part by the 'Life quality' programme.

The 'Nutra cells' research consortium consisted of eight different organisations headed by NIZO Food Research. The approach involved coaxing bacteria used in food production to produce elevated amounts of nutraceuticals.

One of the experiments targeted the vitamin B family. Specifically, *Propionibacterium freudenreichii* (*P. freudenreichii*) bacteria were subjected to a number

of different treatments in an attempt to encourage the synthesis of different B vitamins. In fact, they managed to develop a strain of *P. freudenreichii* capable of delivering increased amounts of vitamin B2 (riboflavin), B11 (folate) and B12 (cobalamin).

The next challenge was to introduce these bacteria into a foodstuff, in this case yoghurt. The best result was obtained by pre-fermenting the *P. freudenreichii* by itself followed by a co-fermentation procedure with the live yoghurt culture. The sequential technique successfully boosted the yoghurt's vitamin B levels, including a doubling of the riboflavin content.



NIZO Food Research and its 'Nutra cells' partners looked to capitalise on their breakthrough and pursued the next phase of product development for the new yoghurt.

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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Improving human health with antioxidants from tomatoes

The experimental results of the Profood project suggest that selective breeding of tomato plants could greatly enhance the nutritional value of their fruit.

Diet is known to play an important role in regulating our health. In fact, some foods, such as tomatoes, have acquired a reputation for possessing numerous health benefits. However, only through a systematic assessment of specific properties can the truth be ascertained.

With the backing of the 'Life quality' programme, an investigation of flavonoids, a special class of beneficial secondary metabolites in plants, was undertaken. The project, entitled Profood, was coordinated by the Institute of Plant Genetics and Crop Plant

Research (IPK) in Germany.

The search for flavonoids began with IPK's extensive tomato germplasm collection and was subsequently extended to plants raised in the field and in greenhouses. high-performance liquid chromatography (HPLC) was

used to determine the amount and type of flavonoids as well as other phenylpropanoids in the fruit.

The results varied considerably from very low levels to elevated concentrations of flavonoids. The IPK scientists also discovered an important link between a specific flavonoid called rutin and antioxidant capacity.

Nonetheless, it was stressed that simply ingesting increased amounts of rutin may not translate into direct health benefits. It was hypothesised that the key may lie in the metabolites of rutin and other flavonoids, though further research is necessary to better understand the body's complex biochemistry.

A summary of the Profood research has been published in a relevant scientific journal by IPK and its partners.

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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A safer route for dangerous goods

A new routing and monitoring system developed by European researchers for trucks carrying dangerous goods promises to make Europe's roads safer while saving haulers time and money.

Millions of trucks carrying billions of tonnes of toxic chemicals, highly flammable fuel and radioactive waste travel European roads each year, frequently passing through densely populated areas and using critical infrastructure, such as bridges and tunnels, with little guidance or oversight as to the safest route.

An accident, a leak or a fire in any high-risk area could have catastrophic consequences, harming other road users and residents of nearby towns, as well as the environment and transport infrastructure.

'Dangerous goods often have to be transported by road for a variety of reasons, the most obvious example being the tanker trucks used to refill petrol stations. However, they often do not take the safest route to their destination,' explains Dimitrios Tzovaras, a researcher at the Informatics and Telematics Institute of the Centre for Research and Technology Hellas (CERTH) in Greece.

Working in the EU-funded 'Dangerous goods transportation routing and monitoring' (Good route) project, Mr Tzovaras led a team of researchers from six European countries in developing a routing, monitoring and safety enforcement system for dangerous goods vehicles.

The platform combines information about road infrastructure and populated areas with real-time weather and traffic data from transport authorities to plot the safest itinerary for truck drivers to follow.

While in transit, the truck's position is monitored by global positioning technology (GPS). A GPRS connection to a hand-held device like a PDA in the truck's cab allows transport company operators or traffic authorities to dynamically change routing information on the fly in the event of a traffic jam or deviation, always choosing the safest alternatives.

'Transport companies usually plan journeys around the fastest or shortest route. We created an algorithm that calculates the safest route as well as taking into account costs and efficiency,' Mr Tzovaras says. 'The goal is to minimise the consequences of a possible accident without excessively impacting journey times or transport costs.'

Though often the safest route will not be the shortest or fastest, in certain circumstances providing greater assurances that a hazardous cargo will reach its destination safely would save haulers time and money.

Like many European tunnel operators, authorities in charge of managing the Gotthard Tunnel in Switzerland, where the 'Good route' project conducted a trials last year, prohibit most dangerous goods vehicles from passing through it. The ban is intended to increase safety in the tunnel, but it forces vehicles carrying hazardous substances on to secondary roads which increases journey times, transport costs and can take them through populated areas.

'The 'Good route' system helps ensure that a truck makes it through the tunnel safely. Sensors fitted to the vehicle continually monitor its weight and the state of its cargo, and

this information is automatically sent to local control nodes at the tunnel entrance or at a toll station,' Mr Tzovaras says. 'In this way, trucks carrying cargo that does not constitute a serious danger to safety inside the tunnel would be let through while only those deemed high risk would be diverted.'

The technology was also tested by operators of the Fréjus Tunnel between Italy and France and on project partner Destia's bridges in Finland.

Information gathered by sensors onboard the truck could also be sent to police, allowing law-enforcement officers to know remotely which trucks have broken speed limits or restrictions on driving time, for example.

'This would cut down on the number of trucks that are pulled over by police to be inspected, something that would save transporters time and money, so long as their drivers follow the rules,' Mr Tzovaras says.

However, even though transport companies stand to benefit by implementing safety-orientated guidance, monitoring and enforcement systems in their vehicles, not least by being able to promote themselves as more socially and environmentally responsible, Mr Tzovaras believes that the technology will only be used extensively if it is mandated by public authorities.

'The cost and efficiency benefits for transporters are not great enough by themselves to offset the expense of implementation,' the project coordinator admits. 'Therefore, we think a top-down approach will be needed... and, for that, political will is required. Unfortunately, it will probably only happen after a serious accident.'

Should that time arrive, the 'Good route' partners will have a tried-and-tested solution to propose.

The 'Good route' project received funding from the ICT strand of the EU's Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90627>



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Cars can talk together — in private

As you cruise down the motorway listening to the radio it is easy to imagine that you are cut off from the rest of the world. But soon ICT will allow your car to 'chat' with the vehicle in front and behind. A European research project now proposes a way to keep this car-to-car chatter private and secure from malicious hackers.

You pull out to overtake a slow lorry. Suddenly the lorry swerves into your path. You hit the brakes hard and avert a full-on collision by a whisker.

Thanking your luck, you drive on. But little do you know that the crash was not prevented by your lightning reflexes. Instead it took clever collaboration between the lorry, your car and the cars behind.

While you were stuck behind the lorry, a communications system mounted on your car had connected with one on the lorry. When the lorry swerved, your car immediately knew that it was in your path and automatically applied the brakes. The extra fraction of a second's braking before you took over made all the difference.

And a multi-car pile up was prevented by similar messages as they were relayed from your car to the vehicles behind.

ICT is driving forward a new era of more efficient and safer road travel for European citizens. Just as anti-lock braking systems (ABS) dramatically cut accidents and fatalities in the 1980s, vehicle-to-vehicle and vehicle-to-infrastructure communication will make our roads safer still.

But there is a big question to answer before the technology becomes widely adopted: is the communication link secure?

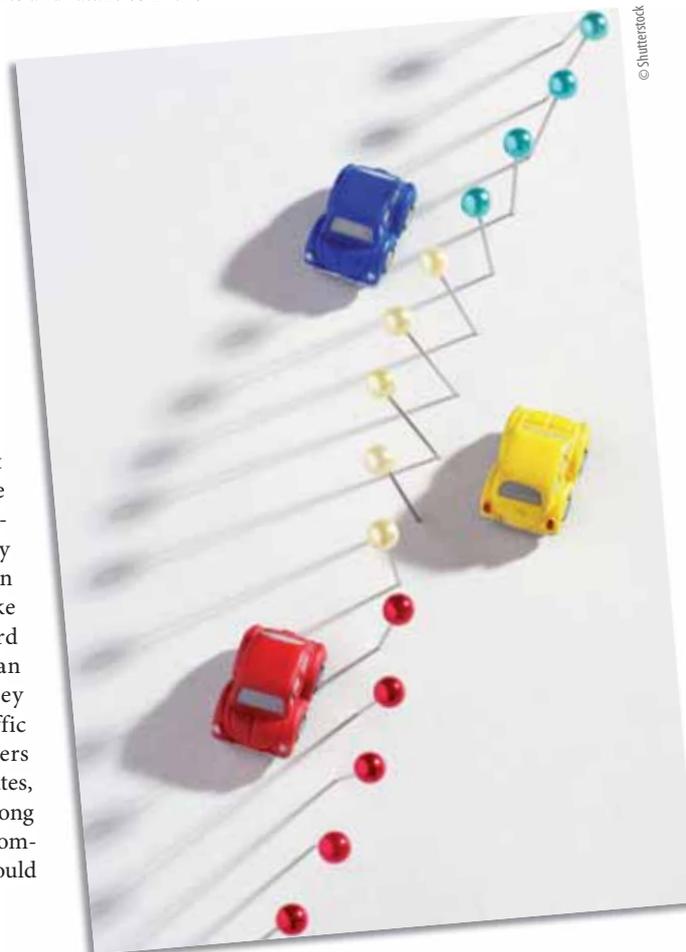
Imagine the chaos that a hacker could cause by sending bogus messages to vehicles. They could tell one car of an accident ahead, make the driver brake hard and actually cause an accident behind. They could invent fake traffic jams, encourage drivers to take alternative routes, then enjoy speeding along clear roads. Insecure communication systems could

also let criminals track individual cars (e.g. celebrities, politicians) or harass drivers with unwanted alerts or spam messages.

'Car-makers and equipment manufacturers have to be certain that communication channels between cars and roadside infrastructure are secure from hackers and criminals and that their privacy is maintained,' explains Trialog's Antonio Kung, coordinator of a European research project that has proposed a blueprint for secure car-to-car (C2C) connections.

The 'Secure vehicle communication' (Sevecom) project brought together leading car and equipment manufacturers and ICT research institutes to agree on security architecture that everyone could easily 'bolt on' to their proprietary C2C applications and ensure secure data transmission.

'The idea was to develop a general solution that conformed to all existing industry standards,' says Mr Kung. 'We have developed a way to add a security module to C2C systems.'



'We are interested in the communication "tube" used to exchange messages among cars and between cars and infrastructure. Our project has looked at technologies and policies that will make the tube secure. We have not developed any new encryption systems,' Mr Kung stresses.

'There's plenty of secure encryption methodologies, but what doesn't exist is the architecture. Sevecom brought together stakeholders to agree what building blocks to use, where they should go and when they should be used.'

One of the project's most important proposals is that car communication should not use a fixed identification (ID) tag in its transmissions, which would open up the potential for cars to be tracked.

'Instead,' says the project coordinator, 'we think that cars should use pseudonyms which get changed several times, for example every time the ignition is turned on or at regular times during a trip. This would make malicious wireless communication tracking of individual vehicles almost impossible.'

The project was made more complicated because an international standard protocol for C2C communication has still not been agreed.

'We had to design a flexible architecture so that it could easily be adapted to conform to a standard once it has been agreed,' explains Mr Kung. 'The security module had to be independent of all the other communication technology and protocols involved in transmitting data.'

Sevecom is keen to promote its architecture to other EU-funded projects working in car-to-car and car-to-infrastructure communication systems, like CVIS. CVIS is developing integrated solutions for installation in the vehicle and roadside equipment to allow vehicles to interact with each other and with operators of road infrastructure. CVIS will use Sevecom's architecture to provide security in its applications.

Sevecom received funding from the ICT strand of the EU's Sixth Framework Programme for research.

Promoted through the ICT Results service.
<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90862>

See also page 17 'Smarter cars and trucks are just down the road'

Improved characterisation of hydrocarbon reservoirs

Gas and oil prospecting in the 21st century will benefit from a new scheme developed in the UK that combines both seismic and non-seismic parameters.

The ever-increasing demand for gas and oil has intensified the search for underground hydrocarbon reservoirs. As the easily accessible reserves become depleted, exploration has inevitably shifted to reservoirs located in more complex bedrock. Given the high cost of such ventures, accuracy is of the utmost importance.

The EU-funded 'Integrating geological and geophysical methods for characterisation of reservoirs in complex areas' (SIMBA) project, which included experts from both industry and academia, worked on advanced methods to characterise underground hydrocarbon reservoirs.

Pioneering research at Ark Geophysics Limited in the United Kingdom sought to

extend upon the conventional approach, which is based solely on seismic data. Using an empirical approach, they incorporated two additional geophysical parameters, density and electrical resistivity, to combine with the seismic velocity data. The work was facilitated by the existence of the SIMBA Rock Property Database.

The major advantage is that the density data provides important insight into the features of basalt layers. This is complemented by feedback for the layers above and below the basalt formation from the electrical resistivity data, which is determined using magnetotellurics (MT).

The team at Ark Geophysics Limited combined these elements into a two-dimensional joint inversion scheme. Tests of the scheme during SIMBA indicated that the level of uncertainty in the inversion of the complete dataset could be significantly reduced.

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 > 5312



Techniques to monitor radionuclides in the general public

European experts have identified the fastest, safest, most accurate and least costly methods of internal dosimetry with the aim of protecting the public from ionising radiation.

Radionuclides can enter the human body through a number of different pathways, including, but not limited to, inhalation and ingestion. Only periodic monitoring can ensure that exposure to radiation from such sources does not pose a threat to human health. This is particularly relevant for members of the nuclear industry workforce.

Four research centres spread throughout Europe gathered forces during the project 'Methodology for integrated interpretation of seismic and non-seismic data' (IDEA) to investigate new techniques in internal dosimetry. Support was provided by the Euratom Programme. The findings have

been summarised by the KFKI Atomic Energy Research Institute associated with the Hungarian Academy of Sciences.

With respect to *in vivo* monitoring, high purity germanium (HPGe) detectors were the best solution for low photon energy emitters like plutonium-239 (²³⁹Pu). Use of silicon-based detectors helped overcome temperature limitations. To keep costs to a minimum, it is possible to substitute thallium-activated sodium iodide (NaI(Tl)) scintillation detectors when spectral resolution requirements can be relaxed. Numerical calibration of these instruments is strongly recommended since several

distinct advantages over calibration with physical phantoms were identified during IDEA.

In vivo monitoring can also be complemented by bioassay methods. In this domain, inductively coupled plasma mass spectroscopy (ICP-MS) has emerged to take the place of older techniques like beta counting. In the context of IDEA, guidance was established for the application of ICP-MS to measure uranium, thorium and other elements.

In fact, by employing high-resolution sector field ICP-MS, it was possible to reduce time and cost requirements without sacrificing accuracy. This approach is therefore advocated for use with the general public.

Funded under the FP5 programme EAECTP C (Euratom research and training programme in the field of nuclear energy).
Collaboration sought: further research or development support; information exchange/training; available for consultancy.
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Smarter cars and trucks are just down the road

Alert drivers note and adapt to changing road surface conditions, but their vehicles do not. European researchers are poised to make cars and trucks safer through a suite of smart sensors that detect and react to icy, wet or snow-covered surfaces and can predict traction as well as an experienced driver.

You are heading into a curve at highway speed when you spot a suspicious patch of road just ahead. You have a few tenths of a second to guess if it is wet, snow-packed or icy and adjust your speed accordingly.

Today you are on your own, but within a few years your car might detect that water, ice or snow before you do, calculate how much traction your car could lose, and flash you a warning or even apply the brakes and stabilise the car as much as is physically possible.

With tens of thousands of deaths per year from traffic accidents in Europe alone, up to 20% of which involve a driver misjudging the safe speed, vehicles that can sense and react to friction-reducing road conditions could save thousands of lives every year.

Until very recently, cars and trucks have been totally 'blind'. Today, a few high-end vehicles feature radar or laser systems that can detect large objects just ahead — such as a rapidly braking car — and can warn the driver or slow the vehicle. However, cars and trucks remain



blind to road conditions like water, snow or ice that can cause a driver to lose control.

Two years ago, the EU-funded research project 'On-board measurement of friction and road slipperiness to enhance the performance of integrated and cooperative safety systems' (Friction) set out to remedy that problem. They have now designed and tested a suite of smart sensors that let vehicles 'see' the road ahead, determine its condition, and calculate the maximum amount of friction available for braking or steering.

Existing anti-lock braking systems (ABS) can determine the maximum friction available between a vehicle's tyres and the road once slipping has begun. But predicting the maximum possible friction before braking has proven to be far more difficult.

'Friction is easy enough to measure once you start slipping,' says Pertti Peussa, the Friction project coordinator. 'But our aim was to have a good estimate of the maximum friction even when driving steadily on a straight road. That's a very difficult problem.'

The Friction researchers realised that they would need to combine information from several different kinds of sensors in order to accurately determine road and weather conditions and estimate available friction.

One device that proved useful was the Road Eye sensor, developed by a small Swedish company, Optical Sensors. The Road Eye uses lasers to illuminate a spot on the road just ahead of the vehicle with two wavelengths of infrared light. A light-sensitive diode measures the amount of light reflected back at each wavelength.

Tests showed that the Road Eye was good at discriminating between dry asphalt and asphalt covered with snow, ice or water. It had a harder time telling the difference between ice and water, although a modified system using a particular orientation of polarised light may do better.

The team also studied the kind of laser scanners that are already being used on some cars to measure the distance to nearby vehicles. They found that the same lasers can be used to tell whether it is raining or snowing, and to track a car's speed even if it's in a skid or a slide.

A camera that detects polarised light reflected from the road about 25 metres ahead also proved useful. It can see farther than the Road Eye, but because it relies on ambient illumination, it does not work as well under low light conditions. Still, tests showed that it can detect a wet or icy road with up to 80% accuracy.

The group also experimented with a radar system operating at 24 gigahertz. They found that by comparing the amount of energy reflected back from the road at two different polarisation angles, they could tell the difference between a dry, wet, icy or snowy surface up to 30 metres ahead.

Another area the researchers explored was an optical sensor built into each tyre whose output could be used to determine front-to-back and side-to-side forces, and also to detect the onset of aquaplaning. The researchers found this system useful for research, but too complex and costly to appear in cars or trucks any time soon.

Although they had identified several promising sensor systems, the engineers still faced the challenge of integrating several streams of environmental and on-board information to calculate the traction available for a particular manoeuvre.

They chose a data fusion approach which combines information from different sensors to produce an accurate and reliable friction estimate.

The first step is to use information from available sensors to generate several independent estimates of friction, plus detect the presence of specific conditions such as aquaplaning.

Previous research has shown that a car on dry asphalt can grip the road with a force close to its weight. In contrast, packed snow might provide 20 to 40% of that traction, and ice just 5 to 25%.

A car on dry asphalt can grip the road with a force close to its weight. In contrast, packed snow might provide 20 to 40% of that traction, and ice just 5 to 25%.

These first, provisional estimates are then combined into a final determination of road conditions and friction, plus a value for its certainty.

'If the environmental sensors give us a range of 0.7 to 0.9, for example, and chassis measurements give us 0.75, we can combine them to make the final estimate more accurate,' says Mr Peussa.

The processing hardware they used makes hundreds of estimates per second — far faster than any driver, and fast enough to provide useful information to existing and future automatic safety systems. It also learns to make better estimates by comparing its predictions with measurements from actual manoeuvres.

Extensive testing showed that the system can predict available traction as well as an alert driver with experience on a wide range of surfaces. The difference, of course, is that many drivers lack experience, and even experienced drivers are not always alert.

Mr Peussa expects that Friction's automotive partners, Fiat and Volvo, and other manufacturers as well, will introduce friction-sensing features to their safety packages in the near future.

'Collision avoidance or mitigation systems that use this kind of environmental information may come fairly soon, maybe within a couple of years,' he says.

Friction received funding from the EU's Sixth Framework Programme for research.

Promoted through the ICT Results service.
<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=91069>

See also page 16 'Cars can talk together — in private'



Intelligent vehicles put to the test on Europe's roads

The automotive industry has joined forces with researchers and stakeholders in a smart drive to test 'intelligent', in-vehicle technologies on real roads, with real drivers.

The project puts eight new technologies through their paces, including lateral and longitudinal control systems which warn drivers of potential side- and front-end collisions. Other advanced in-vehicle systems, such as a curve-speed warning, fuel-efficiency adviser and the human-machine interaction with navigation systems are part of the testing.

The 'European field operational test on active safety functions in vehicles' (euroFOT) project is enlisting the services of up to 1,000 vehicles — all from European makers — equipped with various intelligent, in-vehicle systems which are being road tested Europe-wide throughout 2010. These smart vehicles are collecting data on the impact of these systems on safety, efficiency and driver comfort.

This is the first large-scale field operational test carried out across brands in Europe, according to Aria Etemad of Ford who is coordinator of the EU-funded euroFOT whose 28 partners are looking to raise awareness and provide scientifically sound feedback about the real benefits of these intelligent systems.

The project supports the EU's wider ambition to make Europe's roads safer and better to drive on with the help of ICTs — a goal brought to life by the 'Intelligent car' initiative which has identified road safety, energy efficiency and traffic congestion as key challenges to the transportation sector.

Drivers are probably already familiar with a few existing in-vehicle intelligent features

like anti-lock braking systems (ABS), electronic stability control (ESC) and adaptive headlights. But this EU initiative also explores a raft of new and exciting possibilities, such as wireless local danger warnings and the so-called 'intersection assistant'.

euroFOT is supported under the EU's Seventh Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91016>



Tooling up for tomorrow's clever cars

Cars are becoming more complex, with a range of advanced features we could hardly have imagined a few years ago made possible by sophisticated software-driven electronics. The downside is, with more to go wrong, more is going wrong, but European researchers have developed an antidote: a new computer language.

The average new car coming off the production line today has the same amount of electronic systems as a commercial airliner did two decades ago. Hard to accept perhaps, but true if auto-makers are to be believed.

Growth in automotive embedded systems (software and electronics) has been exponential since the early 1990s and the trend is predicted to continue. In 2002, electronic parts comprised 25% of a vehicle's value — by 2015, car manufacturers predict this will hit 40%.

But the more electronic systems are added, the more they contribute to vehicle breakdowns and recalls. Researchers on the project 'Advancing traffic efficiency and safety through software technology' (Ateest) say a substantial share of vehicle failures today can be directly attributed to embedded systems, and field data indicates this share is increasing by several percent a year. This will reach unacceptable levels if no preventative action plan is put in place.

However, the two-year EU-funded project developed an architecture description language (ADL) aimed at improving methodology to handle component failures and avoid design flaws.

'New tools are needed to do a job which is becoming ever more complex,' says project

coordinator Henrik Lönn. 'The many components which go into vehicles are being made by a host of manufacturers, often using different processes and working to different standards.'

A common language at the top level is needed to bind them together, he says.

There have been a number of important initiatives, including the European-developed Autosar standard, which is used by many



component suppliers and is on its way to becoming a de facto international standard. Also in common usage are off-the-shelf UML2 modelling tools which are not specific to the auto industry.

'But this is still not enough,' he stresses. 'What we have developed is an industry-specific system which works with these other standards and dictates what part of the system is performing what function, and makes sure the different components will work together.'

The problem is, despite the huge strides in electronics, until now not enough attention has been paid to the big picture. When the manufacturer gets a component from a supplier, no matter how sophisticated it might be, it comes with a text file which describes the system for the manufacturer's engineers.

The EAST-ADL2 language the Ateest project has been developing enables the computer modelling of systems. Instead of the old-fashioned text file, a supplier can now provide a computer model of his system to the manufacturer who can then immediately integrate it into the overall design.

'What this does is to give the manufacturer a complete picture at a much earlier point in proceedings than is possible at the moment,' says Mr Lönn. 'You don't have to wait for all the electronics and software to be ready and assembled, but can do your analysis at a much earlier stage.'

With a holistic view available much earlier than was previously possible,



late-phase integration — where failure is both common and costly — is avoided and the chance of design errors, which are felt by car buyers, is minimised.

‘Complex programs, like active safety functions, involve many systems and components. But we are at the stage now where it is becoming difficult to improve them without first improving our methodology, which is the purpose of EAST-ADL2.’

As well as the economic imperative to develop the new methodology, pressure will also come in the form of a new standard,

ISO26262, controlling improvements in all the safety aspects of vehicles.

‘This standard will put stringent requirements on the development of safety systems which means manufacturers will have to be more rigorous. Having the EAST-ADL2 language to work with will make this possible,’ says Mr Lönn.

‘There is also pressure to build more environmentally friendly cars and, to get the best environmental performance, optimised systems which are integrated and work properly together are needed,’ he says.

With the development work over, the challenge now is to get the auto industry to accept EAST-ADL2 as a de facto standard. But the advantages to everybody are so obvious Mr Lönn feels they will be adopted in one form or another. Indeed, he believes concepts from the project provide the basis for vehicles that are safer, greener, more fuel efficient, more reliable and more intelligent than would have been thought possible just a few short years ago.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=89579>

Transport and urban planning... Siamese twins?

Transport and land use are like conjoined twins linked at the hip. Whichever direction one takes, the other is sure to follow, whether it wants to or not.

European research on these twin issues shows how to make this relationship work better and improve quality of life for all citizens.

European cities, large and small, are striving to achieve a sustainable balance between the needs of mobile citizens and urban development. Urban planners know that, if they get the mix right, the city thrives and quality of life (QoL) improves as a result. But transport and land-use planning is a very complex task.

This complexity is compounded by the fact that, in most member states, long distance corridors and the entrance to cities are not managed by the same entities, nor covered by the same regulations. Similarly, while main highway networks can be revised at European level, urban networks remain a local competency.

‘To have an efficient and effective transport system implies getting the land use planning right, and planning urban development implies getting the transport access right,’ according to a new report published by the Transport Research Knowledge Centre (TRKC).

Urban sprawl, poor town planning and a lack of integrated public transport can translate into traffic jams, longer commutes, pollution, and discourage people from walking, cycling or even wanting to live in the city. But it does not have to be this way, according to the TRKC paper, which presents European and regional efforts to make our cities more pleasant places to live.

To improve the efficiency of information transport management systems (ITS), it is important to improve synergies and harmonisation between European, national, regional and local/urban ITS.

The ASI project, for instance, has taken a close look at ‘quality of life’ issues in the context of traffic and urban planning, and how it is dealt with in projects aiming to promote sustainable transportation. And one of ASI’s conclusions is that such projects include too few social scientists in their teams.

‘As sustainable development implies balancing economic, environmental and social costs and benefits, it is recommended to create multidisciplinary teams including social scientists,’ according to the TRKC.

ASI came up with a comprehensive and handy support toolkit and guidelines to help decision-makers

better address QoL issues in land use and transport planning, while raising awareness and acceptance among the public that behavioural changes are necessary. The Artists project, meanwhile, developed guidelines for the redesign of arterial roads — main streets that serve as thoroughfares but also as shopping and residential streets — to make them more people-centric.

In a related activity, the Prompt project investigated pedestrian safety, accessibility and comfort in 22 cases located in 16 cities in order to develop integrated mobility solutions. Partners in the six participating countries also reviewed how well walking zones are linked with other transport modes in the test areas, and studied the effectiveness of strategies employed by planners in these cases.

Related projects reported on what is needed to encourage more bicycle use in cities, including dedicated lanes and the installation of bike rental stations, such as in Paris, Brussels and elsewhere.

The TRKC report also introduces regional cases and benchmarks, including several from Finland, the Netherlands and Switzerland which show how joined-up research and policy-making can improve land-use planning.

‘It is also necessary to consider transport and land-use planning in wider contexts, for example the regional context, so that transport investment can be used effectively to support regional development,’ it concludes.

For more coverage of the projects mentioned here and all related transport research, please consult the TRKC portal.

Created with the Transport Research Knowledge Centre.

Projects funded under the FP5 programme EESD

(Energy, environment and sustainable development).

<http://www.transport-research.info> > Thematic Research Summary on ‘Land use planning’



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Key gene helps plants adapt to climate change

Researchers have discovered by means of genetic experiments how plants control their development through their response to changing temperatures.

The research team, which received funding from the European Research Council (ERC) and the UK's John Innes Centre, studied genes from the *Arabidopsis* plant to ascertain which genes regulate temperature response and how they can be adapted to increasing temperatures due to climate change.

Their findings, published in the journal *Cell*, reveal that plants have a built-in 'thermometer gene' that they use to control their growth and development. This discovery could lead to new ways of breeding crops that are more resistant to climate change.

Many plant growth cycles are already being greatly affected by climate change, which is causing redistribution of species throughout the world and worrying changes of traditional growth and flowering patterns.

Plants are extremely sensitive to temperature, which controls their growth, flowering and fruiting cycles. They can sense temperature differences of only 1°C and are subject to many changes and extremes of temperature throughout the seasons, from night to day and from spring to winter. To decide when they need to grow and when they need to conserve energy, they sense the air temperature around them and control their growth accordingly. How they do this has always been a mystery.

Now a team of researchers from the John Innes Centre, part of the Biotechnology and Biological Sciences Research Council (BBSRC) in the UK, has lifted the lid on this mystery and found the reasons for plants' ability to control their growth: they have a built-in temperature thermometer that helps them regulate their growth levels.

The researchers studied all the genes in a variety of the plant *Arabidopsis* (a type of cress) to find out which genes are turned on by warmer temperatures. They then connected one of these genes to a luminescence gene from another plant to create a plant that gives

off light when the temperature rises. They did this to screen the plants for mutants that no longer sense temperature fluctuations. One mutant plant lost its ability to sense the correct temperature, giving off luminescence even when the temperature was cold.

'It was amazing to see the plants,' says Dr Vinod Kumar, a member of the research team. 'They grew like plants at high temperatures even when we turned the temperature right down.'

The defect in this mutant plant allows it to affect the way that a variant of a histone protein works. Histones are the structural proteins of chromosomes that bind to DNA, help give chromosomes their shape, and help control which genes are 'switched on'. When the histone is no longer incorporated into plant DNA, the plant expresses all its genes as if the temperature were high even if it is not. This proved to the research team that histone is the main temperature regulator of plants. The histone variant controls a gene that has helped plant species adapt to climate change by speeding up their flowering pattern.

The results of the research will help scientists to predict how different plants will adapt and respond to further climate change patterns. 'We may be able to use these genes to change how crops sense temperature,' says co-researcher Dr Phil Wigge. 'If we can do that, then we may be able to breed crops that are resistant to climate change.'

Promoted through the Research Information Centre.

<http://ec.europa.eu/research/infocentre> > search > 14633

See also page 23 'Climate change early-warning system on the cards'



Insect sex pheromones protect olive trees

The olive tree has been valued since antiquity and is an intrinsic part of the landscape and culture of the Mediterranean region. These iconic trees and their crops now receive better protection from pests, thanks to the efforts of the Triphelio project.

Olive trees throughout the Mediterranean are subject to attack by insects which include *Prays oleae* (*P. oleae*), more commonly known as the olive moth. Moth damage can adversely affect olive oil, giving it a rancid taste. Pest activity during the spring also causes extensive flower drop and in the summer the larvae attack the olives themselves.

The EU-funded Triphelio project was set up to address this challenge through the creation of a scientific network. The consortium, which included partners from southern Europe and North Africa, searched for a sustainable way to control *P. oleae*. Sex pheromones, chemicals that indicate the females' availability for mating, were used to protect the olive trees.

The project scientists disrupted the breeding of the olive moths by inundating olive groves with (Z)-7-tetradecanal, the main component of the sex pheromone. In the form of a powder, the compound interfered with the ability of male moths to find a mate. The chemical was contained in polypropylene tubes which were placed around the olive grove gradually releasing their contents over a period of up to two months. Results from the tests undertaken in Egypt, Greece, Portugal and Tunisia showed that use of (Z)-7-tetradecanal led to a significant reduction in the level of infestation by *P. oleae*.

The development of a cost-effective pest management system helps to remove the

need for repeated application of conventional insecticides. Use of such insecticides can cause pollution to the environment and contamination of olive products, reducing their nutritional value. The consortium also assisted the exchange of expertise and knowledge between project partners.

The work undertaken by the Triphelio group attracted considerable interest throughout the Mediterranean region from olive growers seeking to protect their crops. This included a desire for information and training in the use of biological control techniques. Furthermore, the project presented local industry with the opportunity to manufacture biotechnical equipment helping the regional economy by increasing olive yields and boosting local manufacturing.

Funded under the FP5 programme INCO 2

(Confirming the international role of Community research).

Collaboration sought: further research or development support;

joint venture agreement.

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Mapping and reducing pollution from chemical factories

A novel computer-based tool has been designed to identify and reduce pollution sources at industrial chemical plants without sacrificing their safety or economic viability.

Chemical factories operating in countries of the former Soviet Union have come under increasing scrutiny in recent years. Lack of enforcement of environmental standards on a par with those of Europe resulted in the degradation of large areas of forest. Efforts are now being made to reverse this trend.

A research project funded in part by the INCO 2 programme sought to develop soft-

ware to help plant owners and local authorities assess environmental impacts. The decision-support tool, entitled Demacsys, not only generates pollution maps but also evaluates the effectiveness of different emission reduction measures.

During the course of the project, Demacsys was implemented by Shchekinoazot OAO, a large chemical producer located in the Rus-

sian Federation. A dataset was produced that indexed the local forest resources according to the level of damage caused by the pollution emitted from Shchekinoazot OAO's facilities.

Close collaboration with local government officials was established to review the Demacsys output and decide the best way forward. It will also be necessary to take into account the contribution from other factories in the region. Initiatives such as Shchekinoazot OAO's are helping to raise awareness at the corporate level about this important subject.

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 > 5309

The ocean's role in feeding people worldwide

New EU-funded research shows that marine aquaculture (mariculture) may play a key role in human consumption in the years to come.

According to United Nations' estimates, the world population will grow to 9.2 billion by 2050. The question is how can we increase food production to meet the growing demands of the growing population? Studies show that lack of available water and land resources are playing havoc with the agriculture sector, and fisheries landings worldwide have been shrinking for the last two decades.

The findings of the 'Synthesis of aquaculture and marine ecosystems interactions' (SAMI) project, published in the journal *BioScience*, indicate that changes will be needed to ease our dependence on terrestrial agriculture and other external feed subsidies. SAMI received almost EUR 164,000 under the 'Research for policy support' cross-cutting activity of the EU's Sixth Framework Programme (FP6).



The SAMI study investigated how mariculture, which is the food-producing sector least dependent on freshwater availability, can support human consumption. Current statistics show that marine food contributes only 2% to the human food supply despite the fact that magnitude-wise, terrestrial and marine primary productions are more or less on an even scale.

The project partners examined the prospects for mariculture becoming a force to be reck-

oned with, particularly in terms of meeting growing human food demands. The consortium, led by the University of Southern Denmark, also assessed the challenges and obstacles that mariculture must overcome.

The SAMI researchers noted that mariculture is probably the ace in our sleeve, despite the potential recovery researchers see from conservation measures and a shift in consumption patterns.

Mariculture production has increased by up to 10 times since the late 1970s, and experts believe it will exceed fisheries catches by 2030. However, the study's authors contend that 'its continued growth will depend on adapting current techniques so that the food needed to feed marine animals is itself derived from marine aquaculture, rather than harvested from the wild or derived from agriculture'.

It is not an impossible goal, the SAMI team says. Cultivating more animals low on the food

chain would make this a reality. Novel technology would also contribute to the objective; mariculture operations would be expanded into more exposed, offshore locations, according to the researchers. While the potential for environmental impacts exists, these impacts are modest when compared with those generated by food production on land.

Mariculture has the potential to help correct these problems and produce some positive effects for the environment.

'Promoting the growth of mariculture is the responsibility of all of society. Society must therefore be prepared to face the major social changes that will be required to adapt to the forthcoming major evolution in food production: transferring the production of animal protein from land to the ocean,' the authors note.

'In parallel, actions to restore declining fisheries yields should be adopted if we are to reap the benefits bestowed by the harvesting of wild stocks. These changes cannot be left to market self-regulation, which is flawed by hidden subsidies such as the costs of water use to agriculture and the costs of agriculture's adverse effects on the environment; instead, such changes depend on social and political leadership, informed by the best available independent scientific knowledge and prospective analyses.'

Ultimately, oceans should 'become the next revolution in human food provision,' the researchers emphasise.

SAMI partners are from Denmark, Greece, Spain and the UK.

Promoted through the Research Information Centre.
<http://ec.europa.eu/research/infocentre> > search > 14253

See also page 13 'Premature return of infested sea trout to freshwater'

Electronic atlas responds to trawling controversy

A new electronic atlas promises to better illustrate the effects of varying levels of fishing intensity by trawling on the marine environment.

Trawling is a popular yet controversial method of commercial fishing. While effective in producing large catches, some types of trawling can also severely disturb the seabed. Resuspended particulate matter can threaten the health of the benthic community as well as marine organisms higher up in the food chain.

A systematic assessment of the ecological impact of trawling was undertaken in the context of the Response project, which was sponsored by the 'Life quality' programme. Appropriate study areas

(ASAs) were identified in the North, Irish and Mediterranean Seas. Data collection involved interviews with fishermen, reviews of ship logs, a vessel monitoring system (VMS) and aerial photographs, where available.

Information regarding the intensity level of fishing was extracted and converted into map format to produce an electronic atlas. The work was overseen by researchers with the Consejo Superior de Investigaciones Científicas (CSIC) in Spain.

The electronic atlas is available in CD format and includes free map viewing software, namely TNTAtlas. Extensive functionality has been incorporated, such as zooming, layer selection, database links and basic calculations. Navigation of the maps is driven by selection of the desired ASA.

Installation of the atlas on the user's computer is straightforward and helpful documentation further ensures a user-friendly experience. In addition, compatibility issues were addressed by using the latest World geodetic system coordinate system: WGS84 Datum.

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 > 5344

Climate change early-warning system on the cards

Researchers have developed a new way to measure the absorption of carbon dioxide (CO₂) by oceans, and have successfully mapped the CO₂ uptake of the North Atlantic.

The study's results are part of the EU-funded 'Marine carbon sources and sinks assessment' (Carboocean) project, which received EUR 14.5 million in support under the 'Sustainable development, global change and ecosystems' thematic area of the EU's Sixth Framework Programme (FP6). The findings were published in the journal *Science*.

The results of this research, led by the University of East Anglia (UEA) in the UK, will raise awareness of the natural ocean 'sinks' and give scientists the tools they need to make more accurate predictions about the effects of climate change on our planet.

'The oceans are a major sink for atmospheric [CO₂]. Historically, observations have been too sparse to allow accurate tracking of changes in rates of CO₂ uptake over ocean basins, so little is known about how these vary,' the authors note.

'Here, we show observations indicating substantial variability in the CO₂ uptake by the North Atlantic on time scales of a few years. Further, we use measurements from a coordinated network of instrumented commercial ships to define the annual flux into the North Atlantic, for the year 2005, to a precision of about 10%.'

According to the researchers, this approach will help intensify accurate monitoring of the changing CO₂ ocean sink for ocean basins that have high shipping traffic activity.

This latest innovative approach could fuel development of an 'early-warning system' with the capacity to detect any weakening of the ocean sinks, the first hint that climate change is making its presence felt more significantly, according to a number of researchers' speculations.

The researchers used a network of commercial ships carrying chemical sensors in their engine rooms. Satellite observations of sea surface temperature were also used in combination with the sensors to map the uptake of atmospheric CO₂ throughout the North Atlantic.

The study's findings showed considerable differences in the North Atlantic absorption of CO₂ over many years. This absorption is sensitive to regional changes in climate, according to the team.

'These exciting results from our new coordinated network represent the first time scientists have observed CO₂ uptake over any large region of the world — either land or ocean — with such accuracy,' explains Professor Andrew Watson of the UEA's School of Environmental Sciences.

'Our new method estimates the flux and how it varies from year to

year and season to season, showing patterns of uptake with a detail never before realised.'

The researchers are confident that comparable networks can be set up in other major ocean basins that are covered by shipping. These networks would allow scientists to observe carbon uptake over the majority of the planet's oceans.

Scientists say the uptake of CO₂ is crucial in decelerating the rise of CO₂ in the atmosphere. The researchers are from Bermuda, France, Germany, Iceland, Norway, Spain, Sweden, the UK and the US.

The Carboocean partners say fuelling human knowledge about how anthropogenic emissions affect the climate by warming up the atmosphere is important. CO₂ is the most significant and manageable agent for climate change, the researchers say.



Promoted through the Research Information Centre.

<http://ec.europa.eu/research/infocentre> > search > 14413

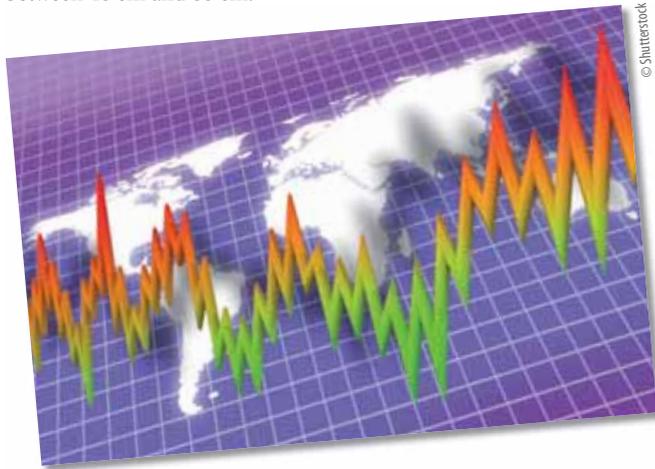
See also page 21 'Key gene helps plants adapt to climate change'

Europe to feel economic crunch from climate change

The European Commission's Joint Research Centre (JRC) has issued a report outlining how the EU would lose between EUR 20 billion and EUR 65 billion if we were to experience the climate projected for the 2080s today, with a temperature rise of between 2.5° and 5.4°C.

The detailed study presented diverse regional impacts of climate change across the EU: southern and central Europe would sustain diverse damages, while northern Europe would be the only region to benefit from climate change, especially in terms of the economy and the four elements.

Besides the increase in temperature, the report predicted that the sea level will rise between 48 cm and 88 cm.



The study, entitled 'Projection of economic impacts of climate change in sectors of the European Union based on bottom-up analysis' (Peseta), evaluated the annual economic impacts of climate change in Europe in coastal systems, river flooding, agriculture and tourism — four elements that are sensitive to climate change. Adaptation policies were not considered in the assessment.

On the whole, the EU's economy would contract substantially each year, according to the study. And global warming would have an adverse impact on the level of economic growth for Europeans. It should be noted, however, that the overall cost of global warming could be higher since the Peseta study did not take into account non-market variables including natural disasters or biodiversity. The report suggested that

welfare could drop by 0.2% if the temperature increases by 2.5°C. However, a 5.4°C increase could slash EU welfare growth by half.

Impacts on coastal systems (sea floods and migration costs) would decrease annual welfare by 0.46% and affect up to 5.5 million people.

River flooding would decrease annual welfare by 0.24% and affect up to 400,000 people. Agriculture would sustain 10% losses in crop yields each year. Tourism is considered the only sector that would not really be affected, but officials speculate variances across the regions will emerge.

From a regional perspective, southern Europe — in particular Bulgaria, Greece,

Spain, Italy and Portugal — is expected to sustain the biggest welfare losses (between 0.3% and 1.6% per year), and agriculture could post a 25% loss in yields. The tourism sector in this region could lose up to EUR 5 billion each year.

Central Europe's northern countries, such as Belgium, Germany, the Netherlands and Poland would report around 0.3% and 0.7% welfare losses. The region's coastal systems would sustain damage, with up to 2.4 million people affected by rising seas, and river flooding costing up to EUR 5 billion. The tourism sector, on the other hand, would be expected to report growth (up to EUR 4 billion in extra revenue).

Central Europe's more southern members, including the Czech Republic, France, Hungary, Austria, Romania and Slovakia, would sustain between 0.1% and 0.6% in welfare losses, and its coastal and river systems would feel a considerable crunch due to flooding. Tourism, on the other hand, would not; experts speculate that this sector would post EUR 10 billion in additional revenues.

Meanwhile, northern Europe — Denmark, Estonia, Latvia, Lithuania, Finland and Sweden — would be the only region to profit from these changes, according to the report, with its agricultural sector posting the most positive results. The only sour point is that sea floods could potentially affect over 250,000 people each year.

The European Commission has used the Peseta project's preliminary results for the White paper 'Adapting to climate change: towards a European framework for action'.

Promoted through the Research Information Centre.
<http://ec.europa.eu/research/infocentre> > search > 14273

Restoring Nabatean monuments to their former glory

Special mortar mixtures have been developed to facilitate the restoration of monuments built by the Nabateans nearly two millennia ago.

Europe and the Middle East are home to a number of ancient structures that constitute an important part of the cultural heritage of all humanity. Unfortunately, natural disasters, wars and simply the passage of time have all taken their toll on these monuments.

Restoring a building to its original appearance and structural integrity while maintaining its aesthetics often proves to be a difficult challenge. In the context of the

'Nabatean mortars - technology and application' (NAMO) project, European and Middle Eastern experts came together to develop restoration techniques for Nabatean mortars.

One of the project participants, the Institute for Restoration and Conservation Techniques in the Czech Republic, investigated repair mortars, sacrificial plasters and grouting mortars. Experiments in the laboratory and field were followed by tests on actual

Nabatean monuments located in the ancient cities of Petra and Bosra, both of which are UNESCO World Heritage Sites.

The modified mortar mixtures exhibited improved characteristics. For example, aggregate particle size was successfully manipulated to reduce crack formation. The mortar formulas and experience gained during NAMO will be of considerable value to museums, public institutes and engineers engaged in restoration projects.

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 > 5310



Argumentative agents for online deal-making

Software agents that play devil's advocate and quarrel with each other may not sound like something you would want in your computer. But, say a team of European researchers, argumentative agents promise to greatly improve the way companies and people do business online.

Argumentative agent technology relies on software imbued with artificial intelligence that is able to make reasoned decisions by weighing up the pros and cons of different options.

Just as a human shopper might browse different online stores in search of a certain product, evaluating prices, quality and shipping times, a smart software agent representing a company or individual in an electronic marketplace carries out a similar reasoning process autonomously. When it comes to striking a deal, the agent enters into negotiations with other agents representing one or more counterparties in the market place, in effect haggling with them to obtain the best deal for the company or person it represents.

'In a grid environment in which services and resources are distributed... agents function as intelligent entities that represent sellers and buyers. You might describe them as proxies for companies and people in electronic market places,' says Francesca Toni, a computer scientist at Imperial College London.

Though software agents are not new, argumentative ones represent a key innovation that addresses a very real need for faster, cheaper and more efficient electronic market place solutions. Because of their human-like ability to reason, negotiate and make decisions, argumentative agents have the potential to greatly reduce the need for humans to trawl through listings of products, providers and potential buyers, while also reducing or even eliminating the need for human input in negotiating a deal.

'Say you want to buy a book. You could tell the agent to find it for you at the best price and with the fastest shipping time. It would then provide you with the best offer it has found based on those criteria, even negotiating with the seller to secure a better price or other benefits,' explains Ms Toni.

She has spent the last three years coordinating the 'Argumentation as a foundation for the semantic grid' (Argugrid) project, a pioneering EU-funded initiative to develop argumentative agents for grid computing environments. Within the project, the team developed and implemented a broad array of technologies to build a comprehensive argumentative agent system with a near infinite range of applications.

The system uses a peer-to-peer (P2P) infrastructure known as Platon which makes it possible for users to search for and identify other users, each hosted by peers in the network. It is integrated with a distributed platform called GOLEM that supports the software agents, whose artificial intelligence is in turn powered by the MARGO argumentation engine. An interface for human users, along with a workflow engine and semantic engine, is powered by a KDE system, while agents and services are hosted on the European grid infrastructures (GRIA) sites.

Though the underlying architecture is a complex mesh of different technologies, the argumentative processes themselves are designed to be simple for human users to understand. Instead of using mathematics and numbers to evaluate products and services, as is common with agent technology, the Argugrid team used text-based arguments, making them intelligible to human users.



'People can follow and understand what is going on at any stage of the process... If they wanted to it would also be possible for them to intervene and provide their own input to the decision-making and negotiating processes,' Ms Toni says.

As well as making decisions themselves and carrying out negotiations, additional software, which also uses argumentation, helps the agents evaluate the trustworthiness of potential business partners and even mediate in contract disputes.

The Argugrid team developed demonstrators to highlight one potential application for the technology: Earth observation. They showed how, in the event of a wild fire or oil spill, Argugrid agents operated by emergency services, local authorities, interested parties or the media could be used to rapidly and cost-effectively obtain accurate satellite imagery of the affected area.

In a different use case studied by the researchers, argumentative agents were envisioned as being modelled on procurement experts specialised in matching customer needs for electronic ordering systems with the offers currently on the market. By using a specialised agent, preloaded with the knowledge of a human expert, a buyer of such a system would avoid the need to turn to costly consultants for advice before deciding which system to purchase.

'The demonstrators and use cases showed what the technology can do but they are just a fraction of the potential applications. In fact, Argugrid technology could be put to use in any sector where goods and services are sold or traded online, from books and holidays to energy contracts and data storage,' Ms Toni says.

Several of the project's industrial partners are planning to incorporate components of the Argugrid system into their own products, while some of the academic partners have not ruled out setting up a spin-off firm to commercially exploit the project results in the mid to long term.

Argugrid received funding under the ICT strand of the EU's Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91094>

See also page 32 'Getting a FEEL for friendly computing environments'

Grid computing, the new commodity

European researchers have created a platform for trading computing resources that allows the selling and buying of standardised computing resources and, almost consequently, revolutionise how computing power is made available.

Grids are not new. They have been around for quite a while, made famous by the SETI@HOME network, a charitable effort where ordinary computer users 'volunteered' their unused computer processing power to analyse signals from space. SETI hoped to find patterns in the signals revealing extra-terrestrial intelligence.

That aim may not have been achieved yet, but the effort brought the power of grid computing to the attention of the general public. Still this is not news.

What is new, is that the EU-funded 'Grid economics and business models' (Gridecon) project has created a commodity market platform that enables users to bid on available computing capacity, or put out a tender for a specific computing time slot.

This spot and future market mechanism is enabled by a computing platform developed by the Gridecon project.

This is a big idea. It is true that organisations can already rent 'cloud' computing capacity from companies like Amazon, Hewlett-Packard and others, but they generally only offer their spare capacity.

The beauty of Gridecon's platform is that it is open — users can buy and sell computing capacity on their own terms. And buyers can also be sellers. If a company has a large computer park it can offer its spare capacity, but if it has a temporary need for much greater capacity it can bid for it on the marketplace.

Gridecon built a virtual trading floor for computing resources, a platform for validating new market-based services, published extensive studies on the economics and mechanics of computing resource marketplaces, and generated a buzz around the concept.

The project received queries from companies interested in launching the world's first open marketplace for computing capacity as a commercial venture.

The platform is Gridecon's second key result. It consists of a marketplace, the interface and a fundamental market mechanism, which focuses on spots (or bids for immediate capacity) and future markets, where capacity is required at some later date. It comprises a set of prototype implementations of market-based services.

Underlying this is the workflow engine, middleware that routes inputs from the market place to the components that execute the task. 'One of our key goals with the platform was to make it easy to use and set up,' explains Prof. Dr Jörn Altmann, technical director of the Gridecon project.

'So this workflow engine hides the underlying complexity of the system, because we did not want the user to have to deal with that.'

Various services complete the system; some integral to its operation, like the execution engine and the monitoring and history services; and some as stand-alone services that significantly increase the value of the platform, like capacity planning and an insurance broker.

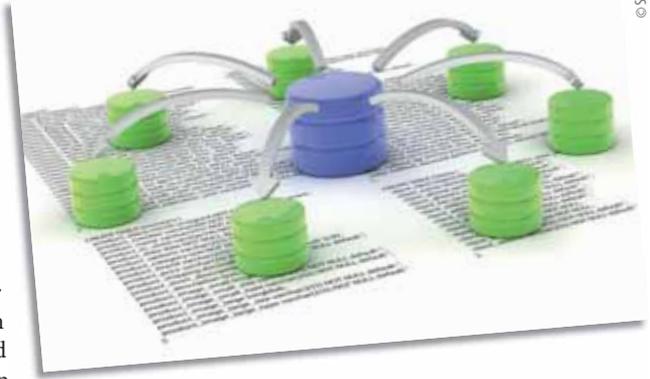
Gridecon designed and tested one market mechanism, but if a company wants to develop some other market mechanism, then they can easily plug new functionality into the platform. It means Gridecon is enormously flexible and could be used for a wide variety of potential market types. The platform is available under open source license terms and the entire code is available at the Gridecon website.

The project is really on top of the real needs faced by users. 'We started developing a fixed price quotation broker, which can give users an indication of price at a future date as a backbone for their bidding on the futures market,' explains Sonja Klingert, project coordinator at the International University in Germany.

Amazon brought out some 'futures' functionality on their elastic computer cloud platform (EC2). 'It was encouraging, because it showed we were going in the right direction,' she comments.

'Our role was to build the platform and test it — and the results of our testing phase were indeed positive with respect to functionality and response times. But it is there for somebody else to turn it into a commercial venture,' notes Ms Klingert.

'We are making the website more attractive to business people, so they can see its potential and go live with it.'



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Some consortium partners were approached by people interested in creating a business around this paradigm, and the number of visitors looking at the website rose dramatically and that trend is increasing.

The platform is the most visible of the project's results, but the consortium also produced an astonishing amount of research on the mechanisms, market types, pricing issues and economics of cloud computing.

It is perhaps a little less tangible, but the team's original research represents a thorough and profound review of the market potential of grid- and cloud computing, and as such it represents commercial gold dust.

One paper, the 'Taxonomy of Grid Business Models', systematically outlines all the various roles and services in grid computing, revealing 17 commercial niches that companies could occupy.

And it is just one of dozens of papers produced by the consortium. The team gathered all the key texts in a 150-page book, which is freely available to download from their website.

Finally, the project organised a series of workshops around the topic of grid computing marketplaces and the economics of cloud computing.

In all, the work of the Gridecon project represents an all-points effort to establish successful and open grid computing markets, and it has the potential to revolutionise the use of computing resources in small- and medium-sized enterprises.

The Gridecon project received funding from the ICT strand of the EU's Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&BrowsingType=Features&ID=90835>



Linked European and Chinese research grids demonstrate their clout

Grids that let many computers work together efficiently have proven their worth in many areas of research and business. A European initiative to link European and Chinese grids has fostered intense collaboration and generated exciting findings in three computationally demanding fields.

In 2007, the EU-funded project 'Bilateral research and industrial development enhancing and integrating grid enabled technologies' (Bridge), set out to link European and Chinese computing grids and enable researchers to carry out joint research.

The project was inspired by the realisation that China is rapidly becoming a world leader in research and development, as well as a booming market for European products. Developing the infrastructure to link computing grids was seen as a key step towards future scientific and industrial cooperation.

'If Europe does not want to lose ground, the response can only be to synchronise with these developments,' says Gilbert Kalb, Bridge project coordinator.

The Bridge team's first challenge was to make the software systems that manage the European and Chinese grids compatible. The European grid infrastructure, GRIA, and the Chinese system, CNGrid GOS, provide comparable services, but are organised differently.

The team were able to get GRIA and GOS to work together by building a new software superstructure to access them and tap their capabilities. The system included new gateways into the two grids, plus a shared platform to manage overall workflow, access needed applications, and translate higher-level commands into steps that each grid could carry out.

Not surprisingly, security was an important consideration on both sides. Mr Kalb says that many of the scientific and industrial problems that Bridge was developed to address require intensive cooperation, yet involve highly sensitive information.

Bridge resolved this issue by letting selected processes remain private. That allows one group to contribute data or results to all collaborating parties without having to share proprietary software or analytic tools.

'You can interface in terms of the input and the output, while the algorithms remain hidden,' says Mr Kalb.

The Bridge team tested the intercontinental grid they built by attacking three problems, each of which made different demands on the system.

Discovering new drugs remains an extremely costly process. One way to speed research is to use computers to simulate the chemical fit between millions of small molecules and proteins that play vital roles in disease-causing organisms. A molecule that binds strongly to a key protein has the potential to be turned into a potent new drug. This kind of research demands enormous computing power.

Researchers in Europe and China contributed four different docking tools — programs that calculate bonding between a small molecule and a particular protein. Each program used a different approach and produced somewhat different results.

The researchers then examined millions of molecules to see if they held promise against malaria or the H5N1 bird flu virus. By combining the results of the four different simulations, they were able to identify promising molecules more efficiently.

'Making the outcomes of these different docking tools comparable is very new,' says the project coordinator.

The four-pronged approach produced promising results. The Bridge infrastructure has already been adopted in Egypt to target the malaria parasite.

Bridge was also used to solve a complex aeronautic problem — designing and positioning wing flaps to maximise lift and minimise noise as an aircraft lands.

Like drug-discovery, these aerodynamic simulations required huge computational resources. In addition, because different parts of each simulation took place in different research centres, optimising the flow of work from centre to centre was also challenging.

The Bridge team was able to meet these challenges, carry out intensive distributed computations, and determine optimal wing flap parameters.

'It proved to be an effective method for solving multi-objective and multi-disciplinary optimisation in aircraft design,' Mr Kalb says.

Weather and climate represent a third area where international cooperation is vital.

The Bridge researchers set out to link three large meteorological databases located in Europe, North America and Asia. The key challenge they faced with this project was to handle enormous volumes of data efficiently.

'You could do a calculation in the United States and transfer the results to Europe, or you could fetch the data from the USA and do the calculations here,' says Mr Kalb. 'The best way to do it depends on what calculation and what data and what's the best available way to transfer the data from place to place. Bridge does all this on the fly.'

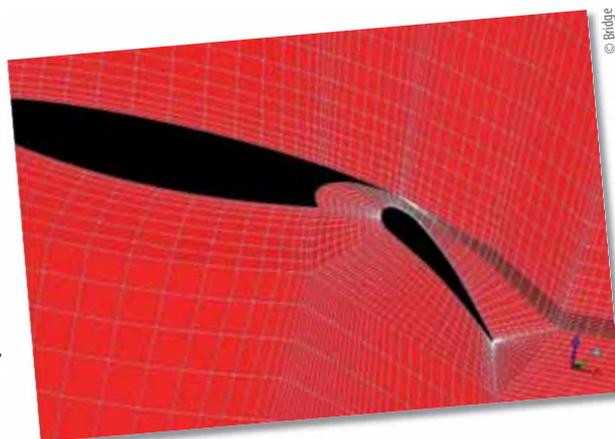
'Because there was a big organisation behind it, and our work fits very well, it was taken up right away,' he adds. 'I believe that meteorologists are already using it to access data and perform certain calculations.'

To Mr Kalb, the importance of what Bridge accomplished goes far beyond any single piece of research. He feels that the project has built the foundation for the kind of multinational collaboration that is needed to tackle global problems.

'Problems like energy and climate change can only be attacked or really solved with efforts from different players around the world, and we've built a platform to do that,' he says. 'We proved that this is feasible and useful. Now it's time for other people to jump on this, develop it further, and use it.'

The Bridge project received funding from the Sixth Framework Programme for research.

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<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&id=91110>



INTERVIEW

Bringing Europe's e(lectronic)-Infrastructures to expanding frontiers

Our discussion with Stephen Alexander Benians is a first in a series of in-depth interviews with leading experts and personalities for *research*eu results supplement*. And with any first, there is always a sense of excitement. For Mr Benians, that means talking about and working on e-Infrastructures and the emerging global virtual research communities at the project 'Bringing Europe's electronic infrastructures to expanding frontiers II' (Belief-II).

'My sense of excitement is increasing over time,' he told us. He's been working on the Belief project since 2006. Four years later and the virtual world of research has suddenly become a lot larger — and has brought people a lot closer.

'Belief empowers people,' he added. As project coordinator, he gets to spread the word, to talk about Belief and how it brings scientists and their research together.

Mr Benians has also coordinated projects at the United Nations and the British Council in Brussels. Fluent in Italian, he graduated with a Masters in Management of Innovation from the Scuola Superiore Sant'Anna in Pisa, Italy. In Edinburgh, he received a Masters degree in European Union Studies.

And today, he is seeing the world of virtual research as a new frontier with vast potential for the future of science.

• What is virtual research?

Virtual research is a completely new way of doing research. We could in fact say it is a whole new paradigm for science that is already having a huge impact.

Essentially, virtual research consists of researchers, in different locations throughout the world, but working together as if they were sharing the same lab. For instance, there may be one instrument in a fixed place such as a telescope in south Argentina, but the data generated by it is accessed and analysed readily by scientists across the world.

Likewise, the researchers simply join forces to take the experiment out of the 'physical lab' and place it in the virtual space, by sharing data to model, simulate and analyse experiments. All this can be done by researchers across the world virtually from their desktops.

Now, the most important dimension of this is the unprecedented computing power that is brought together in virtual research, and which generates dramatic new discoveries.

• How does e-Infrastructure make it happen?

By connecting a range of ICT-based tools, known together as e-Infrastructures. These consist of high-speed backbone connectivity for research and education, linking researchers' computers across the world, such as the EU-supported GÉANT network. GÉANT connects many 'computer clusters' around the world to create massive computing power. This allows complex calculations to be carried out in a fraction of the time they could otherwise be done on a single lab's computer. Likewise, supercomputers can be linked up to create a grid of supercomputers. This layer of grid computing is made easy to use by middleware — essentially, software that allows for the reliable, easy and open access of data between researchers. This easy sharing of research data across 'the grid', connected by a dedicated high-speed network, altogether comprises e-infrastructures, and is gradually building global virtual research communities.

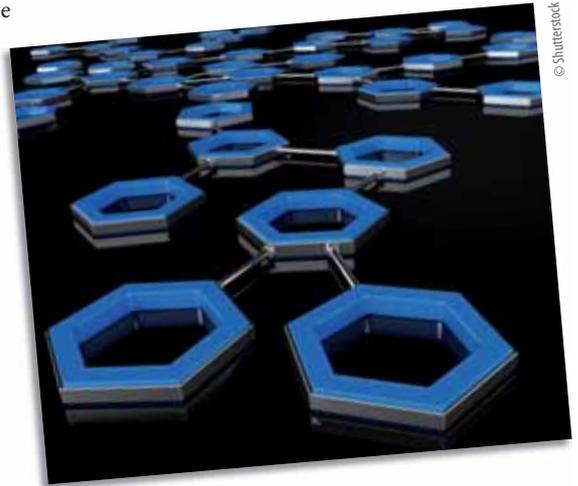
The added value of this virtual research lies not just in the huge computational power, but also being able to connect the best minds across the world, or bringing together different disciplines to contribute to a research project. This collaboration is key to creating new knowledge and innovation.

Of course, this revolution in research did not just come out of the blue. Researchers are facing unprecedented levels of complexity in tackling scientific challenges with global societal impact, such as climate change. With increasingly complex problems data deluges — so computer power and collaboration was a necessity. The challenges faced by the 21st century scientists cannot be addressed by a single researcher, institution or country, they need to join forces.

Researching climate change, for example, requires complex computer simulations that access data stored in online repositories all over the globe. Creating individualised models of humans for targeted healthcare requires increasingly sophisticated modelling and simulation. And emulating catastrophes, such as nuclear disasters, pandemics and tsunamis, to design civil protection schemes requires researchers to increasingly experiment in virtual worlds rather than in real environments! This is the future...

• How have you seen e-Infrastructures change in the past few years (from origins in GÉANT to now)?

Looking back, originally e-Infrastructures were developed for, and by, high energy physicists, and indeed they have brought huge advances to research in that field. E-Infrastructures have evolved from being a technical solution for a conceptual scientific problem, to also being immensely relevant to society today — a real benefit to people on the ground. Apart from the sectoral spillovers, we have also seen the increasingly global reach of e-Infrastructures.



• In what ways do you think the field will evolve in the long term?

Well, this depends on our own needs and imagination. The technology is there, but the fields of application can be limitless. Over the last four years Belief has run brainstorming sessions to map visions for new applications, and how they can be realised. We have seen that huge advances in biomedical informatics will bring massive benefits to society — and it may even have large commercial implications in the long term. We will see emerging economies and developing countries being enabled by these e-Infrastructures, but adapted appropriately for the needs and level of training of local researchers and users. In these countries we may even see the equivalent of ultra-cheap laptops and infrastructure for the bottom billion, allowing 'micro-research' that will empower local communities, and connect rural areas in Africa to cutting-edge diagnosis and treatment in the EU, for instance.

E-Infrastructures can bring 'crowdsourcing' to whole new levels in order to tackle research problems. You just need to imagine, or define the need and if the finance is there, and the right governance system to make it sustainable, then it can be delivered.

• **Are rapid developments in cloud computing a threat or potential boon to traditional grid infrastructure? How do you see it all panning out and where will Europe fit into the picture?**

Wow, big question. The short answer is no, they are not a threat to each other. In a sense they are two sides of the same coin. They both provide access to remote computing resources and offer services on top of this access. But grid infrastructures generally offer dedicated free access to researchers, whilst clouds lease their resources on a commercial basis. But there is a reason for this. The specific IT requirements of the academic community to tackle highly, complex, *sui generis* problems justifies a tailor made approach. Also, the academic environments require open access.

These two points mean that the more commercial cloud environment will not become the only paradigm for e-Infrastructures. Of course, the two models may be synergetic. In the future, it is likely that e-Infrastructures will benefit from virtualisation technologies and usability that the commercial clouds are developing.

Overall however, the two will continue to be distinguished really between free and open access on one end and the commercial business model for clouds. They will both boom together. A new EU communication highlighted the strategic role of e-Infrastructures as a crucial asset underpinning European research and innovation policies so it will continue to rise alongside the trend of commercial clouds. They will both be permeable though, sharing ideas, people and technological advances.

• **It's been reported that Europe's ties with other continents are important to the future of this field...**

Well, in a sense, collaborating with these continents are the future of this field. If Europe just collaborated within its own borders, sure we would have an efficient European research area. But it would not be half as competitive as an EU which opened up to collaboration with researchers and ideas in other countries. This also aligns with the new Lisbon Treaty where a global Europe is emphasised and empowered.

India is at the cutting edge of certain research areas like software and software-based services over the cloud. Africa is in early days but it is performing amazing e-Infrastructures enabled research. We can expect that the emerging economies will be on par with the EU soon enough. After all, they are applying the lessons that the EU took 10 years to learn!

Whatever happens, I am certain that the EU's lead will be maintained. The technology

delivering e-Infrastructures and the thinking for the future are all coming from the EU. It is catalysing the global collaboration of scientists, technologists and policy-makers worldwide to deliver this new research paradigm.

ICT achievements in countries such as Brazil and India are well known in the media, but South Africa and sub-Saharan Africa deserve some more comment. In fact, South Africa is a country which has revealed not only valuable grid and e-Infrastructures adoption but it is facing great challenges in terms of astronomy and I am referring now to preparations for the square kilometre array (SKA).

South Africa is making good headway in the preparation phase toward hosting one of the most exciting scientific endeavours in recent years. The first phase, a one-dish prototype, has already been constructed at the Hartebeesthoek Radio Astronomy Observatory in Gauteng and a seven-dish engineering test-bed, to be built near Carnarvon in the Northern Cape Province, is planned. South Africa's commitment to the success of SKA is further highlighted by the initiation of the MeerKAT frontier project, which aims to implement an array of more than eighty 12-metre-diameter dishes to enable test-bed technology. These dishes are situated in the Karoo region of the Northern Cape Province and are due to be fully operational by 2012.

• **What is the significance of e-Infrastructures to European economies?**

Developing the right strategy for creating a competitive and innovation-driven organisation is a delicate and uncertain balance for any business leader. The same goes for countries or regions trying to make their constituency thrive in the global knowledge economy. For the EU however, what is certain is that the infrastructures for research are of crucial importance — without these, your best brains do not have the capacity to generate new knowledge.

The EU is targeting e-Infrastructures as the best process for delivering innovation both in terms of fundamental research and applied or commercialised research. The adoption of e-Infrastructures will hugely benefit EU societies by avoiding duplication of work and research already carried out and by fostering collaboration for new knowledge and innovation. Successful implementation of the investments already done by European institutions will position Europe as a hub of scientific excellence and contribute to the consolidation and further development of a cohesive European research area benefiting largely the EU economy. But I stress, this is only possible if we collaborate globally.

• **What do you see yourself doing in a decade or so? Will there be a new name for your profession?**

I think the new name will be an old name. That is to say we will stop calling it e-Infrastructures or e-Research, and just call it research. A time will come when students are taught how to collaborate virtually as a natural prerequisite for scientific disciplines. Just as peer review and observing facts for proving theories became internalised into research from the Renaissance onwards, so will virtual collaboration become internalised and normal. It will be the way to carry out research.

As for where I see myself? Maybe surfing some waves off the coast of Brazil or South Africa...

Thanks to Stephen Benians of Belief-II for contributing this article.

Belief was funded by the FP6 'Research infrastructures' activity and Belief-II by the 'Research infrastructures' strand of the FP7 Capacities programme.
<http://www.beliefproject.org>



Supercomputing for the masses

Having helped scientists study the building blocks of the Universe, peer inside the human body in minuscule detail and monitor climate change, grid computing could soon be put to more mundane uses by your home or office computer.

A team of European researchers has developed middleware designed to allow any computer running any operating system to simply, efficiently and cost-effectively access the distributed computers that make up the grid. Their work promises to trigger a kind of popular revolution in which everyone will be granted access to the powerful resource-sharing technology that, until now, has largely been the preserve of academia.

‘Grid computing, which allows users to access the computing resources of many different machines distributed around the world, has been invaluable to science. However, much of the business world and the general public have had few ways to use it due to the complexity of installing and configuring grid software, accessing grid networks, obtaining permissions to use resources, etc.’ explains Farid Ould-Saada, a physicist at the University of Oslo, Norway.

Working in the EU-funded project ‘Grid-enabled know-how sharing technology based on ARC services and open standards’ (KnowARC), Mr Ould-Saada is leading a team of researchers in an effort to expand accessibility to grid resources. Their ultimate goal is to make computing power on the grid as easily accessible to everyone as information is on the internet.

‘Getting access to the grid should be as simple as installing a new browser to get on the internet... only then will the survival and expansion of the grid be assured,’ the KnowARC director says.

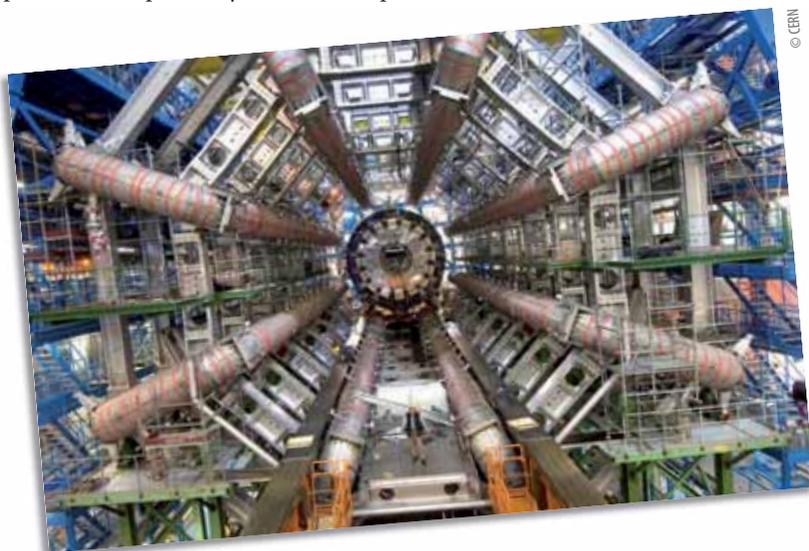
In an effort to achieve that goal, the KnowARC researchers set about improving existing advanced resource connector (ARC) middleware — software designed to provide interoperability between comput-

ing systems, architectures and platforms. Originally developed by several Nordic research institutes in the Nordugrid collaboration, which is currently chaired by Mr Ould-Saada, the next-generation ARC middleware is now being used across Europe to set up grid networks.

The software was recently selected by the European Grid Initiative Design Study (EGI_DS) as one of three key middleware solutions for a stable and sustainable European super-grid infrastructure. And, thanks to work carried out in the KnowARC project, it will soon be provided as a standard installation with the popular Debian and Fedora distributions of open source operating system Linux, giving anyone easy access to grid resources.

‘Providing ARC through Linux distributions was one of the goals of the project... and we also wanted to ensure deployment on proprietary operating systems such as MS Windows and Mac OS. This has always been something of a challenge because in data-driven scientific computing Linux is the platform of choice, but we’ve reached the point of full platform independence,’ Mr Ould-Saada says.

Because of the distributed and diverse nature of the resources that make up the grid, interoperability is essential. A single user, for example, will often need to use resources from multiple computers with different processing speeds, running different operating systems and connected in different ways to the network and even to separate grids. The ARC system constitutes that necessary bridge, thanks in part to the KnowARC team’s use of and contributions to standards to build their middleware, including several proposed by the international Open Grid Forum (OGF).



© CERN

The complex processes that provide interoperability and share grid resources are largely automatic and hidden from the user, bringing the time it takes to install, configure and use the ARC system down to a couple of hours instead of days or even weeks.

‘Typically, in an academic environment, accessing the grid has been extremely complex. It involves training people to use it, obtaining permissions to use resources and installing and configuring the necessary software. With the ARC middleware much of this complexity is eliminated,’ the project director says.

Significantly, simplicity is not a handicap to performance. Of the three middleware solutions selected by the European Grid Initiative (Unicore and gLite are the other two), Mr Ould-Saada is confident that ARC has the most potential for wide deployment in new domains due to its ease of installation and use. He points to Nordugrid’s valuable contribution to the processing of the enormous amounts of data produced by the Large Hadron Collider at CERN in Switzerland.

‘We were supposed to contribute 5% of the total computational resources, but in reality we have been contributing 10% and in some instances as much as 30%,’ he notes.

As a result of the KnowARC team’s work and their promotional activities, the ARC middleware is also being used as the basis for grid computing solutions in a variety of fields, including medicine, bioinformatics and geographical data.

‘At Geneva University Hospital, ARC helps researchers intelligently access their medical image database, which grows by more than 100,000 images per day. Also in Switzerland we work with the Swiss Multi Science Computing Grid where ARC is helping researchers build models of Alpine terrain in order to monitor changes and predict the risk of avalanches,’ Mr Ould-Saada says.

Looking ahead, the KnowARC director expects the grid and the ARC middleware to continue to evolve. He points, for example, to the emerging integration of grid computing with cloud computing in which storage as well as computational resources are distributed.

‘In a matter of years, I hope to see resources and storage being as easy to access remotely as information is on the internet today,’ he says.

KnowARC received funding from the EU’s Sixth Framework Programme for research.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=91143>



Grid browser finds the meaning of life

A web browser that can understand technical terms in life sciences and automatically find additional resources and services has been developed by European researchers. It could lead to a new generation of intelligent search engines.

The life sciences community has built numerous databases — such as for gene sequencing and information about diseases — that are available to researchers as ‘grid’ services.

‘Grid computing is essentially about building virtual organisations that are independent of the physical location where they reside,’ says Michael Schroeder of Technische Universität Dresden.

The problem is how to link those services to other scientific information found on the web. Mr Schroeder is coordinator of the EU-funded project ‘A semantic grid browser for the life sciences applied to the study of infectious diseases’ (Sealife), which has created a browser to make grid services for the life sciences much more accessible.

‘We have the web on the one hand and then we have grid computing, with its many services, on the other,’ he says. A semantic grid browser seamlessly integrates them.

‘It tries to understand what it finds on web pages, interprets this content and then links it, on the fly, to services that might be useful to the user.’

The key to the Sealife browser is a ‘semantic hyperlink’ that shows up on the page to direct users to relevant services. The link is not put there by the website but by the browser itself.

How does it do that?

First, the browser needs to understand the content of the page and identify terms which could be linked to grid services. An example tested in the Sealife project is the naming of genes. Each human gene has an average of 5.5 names, the project coordinator points out, but if it can be identified correctly, a link can be made to a wealth of information about that gene.

The browser must also be able to handle ambiguity. ‘If I see “Jaguar” on a web page, what is it? Is it an animal? Is it a car? Is it the Mac operating system?’ Sealife uses specialised algorithms to work out the context from other words on the page and correctly interpret the meaning.

It is still not an exact science, though. The Sealife team entered their algorithm in an

international competition with 50 others to identify names of genes. They won, with an 81% success rate, though Mr Schroeder says they have now got that up to 87%.

The second challenge is the background knowledge that allows the browser to make sense of the identified terms. Such knowledge is formally known as an ‘ontology’, a systematic hierarchy of concepts and their relation to one another. Biology, with its extensive taxonomies, is an ideal field for semantic grid browsing.

‘All these efforts of building hierarchical classification systems have been at the core of biology for centuries,’ says Mr Schroeder. ‘Biologists are used to it and there are many efforts to make information exchangeable.’

But outside the life sciences such systematic classification is not so well developed, and the Sealife project has created editors to build ontologies from published literature in any specific field of interest.

‘We developed algorithms that grind through this data, identify the key concepts and then the ontology editor offers these concepts to you,’ Mr Schroeder explains. ‘If you agree, it then searches the web to find things that look like definitions. This whole process of building this background knowledge cannot be fully automated but you can ease the pain of doing this quite significantly.’

Different varieties of the Sealife browser build on work by partners in Edinburgh, Manchester, London and Sophia-Antipolis, as well as in Dresden. They have been tested in three scenarios: evidence-based medicine, mining of scientific and patent literature, and in molecular biology. In each case, the focus has been on infectious diseases.

So successful has the project been that TU Dresden has created the spin-off company Transinsight to exploit work done in Sealife. The company has sold semantic browsers to such major customers as BASF and Unilever and runs the GoPubMed search engine, which is linked to the respected PubMed archive of biomedical literature.



But there is no reason why a semantic browser should be confined to specialised academic areas. Could we have a browser that understands everything? Mr Schroeder thinks that is not as far-fetched as it may seem. ‘The vision is to include every domain,’ he says. ‘For example, if we were able to extract and formalise the knowledge in Wikipedia we would have this general background knowledge that covers all areas.’

Many researchers look forward to a next-generation search engine that can understand what the user is looking for and return much more relevant results than today’s engines can. ‘This will involve integrating information,’ says Mr Schroeder, ‘because very often answers to questions are not provided in one document as a single statement that I can pick up by keywords.’

‘In the future, we will need background knowledge and this is at the core of Sealife. If we build semantic into search, and make it scaleable, then you will have the next-generation search engine.’

The Sealife project received funding from the ICT strand of the EU’s Sixth Framework Programme for research.

Promoted through the ICT Results service.
<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=90591>

Watch this space!

Keep an eye out for the next issue of *research*eu focus* showcasing what the European Union is doing to strengthen the research and innovation capacity of its outermost regions.



Getting a FEEL for friendly computing environments

New algorithms that help software agents communicate more efficiently with one another represent an important step forward in reducing the intrusiveness of computing equipment.

Gadgets such as the mobile telephone and personal computer have become part of everyday life in much of the world. An effort is underway to find alternative ways of interacting with these ubiquitous electronic devices, perhaps heralding the end of the PC as we know it.

Ground-breaking European research in this area of software agents has been carried out by various teams involved in the EU-funded project 'Non-intrusive services to support focussed, efficient and enjoyable local

activities' (FEEL). Three years of research culminated in the delivery of several new prototypes.



Biohybrid information processing potential reviewed

A European project has merged natural neural networks, honed by millions of years of evolution, with microelectronic chips. A survey has been conducted by the consortium members to gauge the potential of its research in the field of biohybrid computation.

As the volume of data generated worldwide is expanding to unforeseen proportions, the demand for novel means of information processing is accelerating. Biohybrid artefacts involve the fusion of information and communication technologies with biological entities. This synergistic arrangement promises to open the door to new forms of sensing, communication and computation required for the data overload.

Using biological neurons as natural, efficient parallel processors, the European project 'Information processing by natural neural networks' (Inpro) aimed to develop a new method of information processing by combining nerve cells with chip technology. A post-research market analysis was performed by Inpro to gauge the potential of this sort of neural network for information processing.

During the analysis, many academic and industrial institutions were interviewed. The consensus of opinion was that obstacles which previously tended to slow down progress in the field of pure and applied neuroscience had been addressed successfully by the project research.

However, before applications such as brain/machine interfaces can come to fruition, the sound basis established by the Inpro project must be developed further. Future research planned includes the use of microelectric arrays (MEAs) to monitor large assemblies of neurons on a long-term basis. Expansion of the technology in this way promises to reveal the nature of neural properties like plasticity and its link with memory.

Computer scientists with the University of Southampton in the United Kingdom discovered ways of accelerating the transfer of information between agents through argumentation. Several new algorithms were developed based on their findings and incorporated into the FEEL software following extensive testing.

It should be emphasised that the algorithms are suitable not only for concepts such as focused on by FEEL, but also more generally for distributed computing paradigms. In particular, their speed may be valuable for applications requiring real-time exchange of data, including e-business.

Funded under the FP5 programme Information Society Technologies.
Collaboration sought: further research or development support.
<http://cordis.europa.eu/marketplace> > search > offers > 5313

See also page 25 'Argumentative agents for online deal-making'

Application of the variables contributing to synaptic plasticity and the changing strength of signal between two neurons may also help elucidate the poorly understood phenomenon of learning. As it is, Inpro's results can contribute to the development of new algorithms that may revolutionise information processing.

Expansion of [biohybrid computing] technology ... promises to reveal the nature of neural properties like plasticity and its link with memory.

Funded under the FP5 programme Information Society Technologies.
(FET-Open)
Collaboration sought: information exchange/training.
<http://cordis.europa.eu/marketplace> > search > offers > 5314

Scratchbot could save lives

European researchers have designed a robot, called Scratchbot, which is capable of reproducing the behaviour of rats by using whiskers to explore its environment.

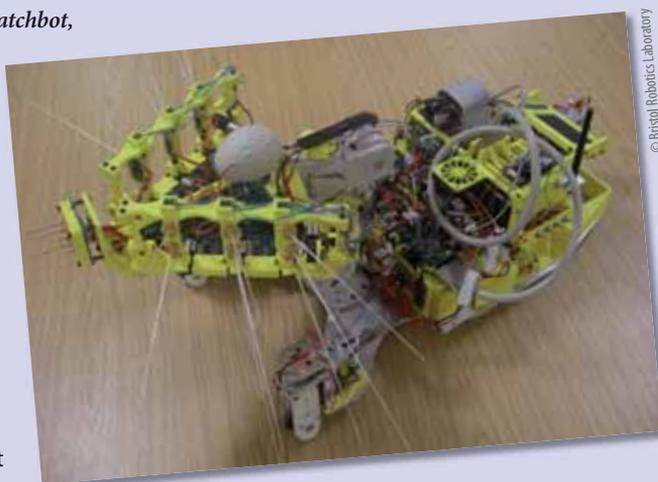
Scratchbot, which stands for 'Spatial cognition and representation through active touch', has drawn the attention of *Popular Science* magazine in its list of 'Best of What's New'. Using 18 plastic whiskers in a sweeping (five times per second) motion to navigate its surroundings, the Scratchbot is a robot rat developed by Bristol Robotics Laboratory (BRL) and the University of Sheffield in the UK, which is a partnership between the University of the West of England, Bristol, the University of Bristol, and the Active Touch Laboratory at the University of Sheffield.

'For a long time, vision has been the main biological sense most studied by scientists,' explains Dr Tony Pipe of BRL. 'But active touch sensing is a key focus for those of us looking at biological systems which have implications for robotics research. Sensory systems such as rats' whiskers have particular advantages,' he adds.

'In humans, where sensors are at the fingertips, they are more vulnerable to damage and injury than whiskers. Rats have the ability to operate with damaged whiskers, and broken whiskers on robots could be easily replaced, without affecting the whole robot and its expensive engineering. This award is a welcome recognition that our research is a leap forward for technology in this area.'

The capacity in which animals use touch is what inspired the researchers to develop this new technology. Rats, for example, can determine the exact position, shape and texture of objects thanks to their whiskers. They can also make fast and accurate decisions about objects, and then use the information to develop environmental maps.

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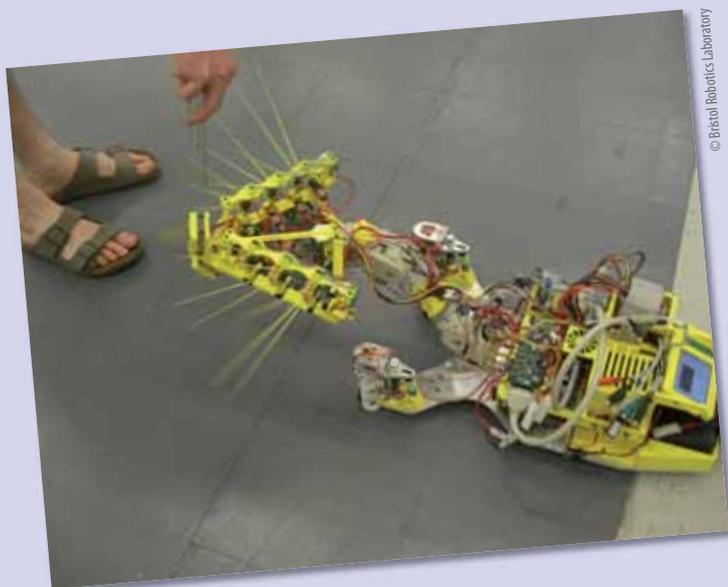
When one of Scratchbot's whiskers is bent as a result of contact with an object, a sensor on its shaft signals software to turn the robot toward the object. Whiskers in close proximity to an object move less, while whiskers that are further away make wider sweeping motions to determine the edges of the object.

'We held a workshop earlier this year at the University of Sheffield in which we were able to demonstrate the unique properties of the Scratchbot and the direction of our research in the development of actively-controlled, whisker-like sensors for intelligent machines,' says Professor Tony Prescott of the University of Sheffield. 'Although touch sensors are already employed in robots, the use of touch as a principal modality has been overlooked until now. By developing these biomimetic robots, we are not just designing novel touch-sensing devices, but also making a real contribution to understanding the biology of tactile sensing.'

The new technology can be of benefit to people in precarious situations like workers in collapsed mines. 'Whisker technology could be used to sense objects and manoeuvre in a difficult environment,' Dr Pipe offers as a potential application. 'In a smoke-filled room for example, a robot like this could help with a rescue operation by locating survivors of a fire.'

Scratchbot is part of the EU-funded project 'Integrating cognition, emotion and autonomy' (ICEA), which received over EUR 6 million under the Sixth Framework Programme's 'Information society technologies' thematic area. ICEA, which ended December 2009, targeted the development of biologically inspired artificial intelligence systems.

Promoted through the Research Information Centre.
<http://ec.europa.eu/research/infocentre> > search > 13973



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Using oxide-based ceramics in gas turbines

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

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

These advantages included being able to raise the turbine inlet temperature to more than 1,400°C. A fully operational stationary gas turbine would then experience around a 20% gain in thermal efficiency and a 40% increase in output power. This is compared to an all metal engine with air cooled components. The use of ceramics was also expected to reduce nitrogen oxides (NOx) emissions to less than 10 ppm.

The main obstacles to greater use of structural ceramics in gas turbine engines have included the demonstration of the

components in real engines. A further obstacle has been the development of materials tailored to specific loading conditions. The overall aim of the CERCO project was to use ceramics to improve the performance of small stationary gas turbines.

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

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

Funded under the programme BRITE/EURAM III.

Collaboration sought: further research or development support.
<http://cordis.europa.eu/marketplace> > search > offers > 4564



Catalytic membrane reactors for gas separation

Materials scientists in the United Kingdom made an important contribution to the development of a catalytic membrane that forms the heart of a new reactor.

A European project 'Novel eco-efficient oxidation processes based on H₂O₂ synthesis on catalytic membranes' (NEOPS) sought to further the use of hydrogen peroxide as an oxidant. One of the important project milestones involved the construction of a catalytic membrane reactor to generate H₂O₂.

Experts in the production of advanced carbon materials from Mast Carbon

Ltd were called in to assemble a special membrane. They created a procedure to deposit a very thin layer of microporous carbon, in the order of just a few microns, on a ceramic substrate.

The key to a high quality product turned out to be proper curing of the resin precursor via thermal ageing. In addition, activation of the carbon layer helped improve the performance of the palladium catalyst added at a later stage.

Catalytic membrane reactors incorporating such technology are well suited to applications targeting gas separation. A prime example is hydrogen recovery for fuel cells. Mast Carbon Ltd and its partners are looking to collaborate with potential end-users to customise the NEOPS reactor to their specific needs.

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

Collaboration sought: further research or development support; joint venture agreement; financial support.
<http://cordis.europa.eu/marketplace> > search > offers > 5307

Optimising chemical vapour deposition

The scientists involved in the Nanomag project discovered that metal alloys must be properly prepared to ensure the longevity of thin films deposited on their surface.

Magnesium (Mg) alloys are highly susceptible to corrosion and abrasion. Surface treatments do exist, but concerns regarding the associated environmental hazards have limited the use of Mg components in the automotive and aviation industries. The European Union has funded research into new, environmentally friendlier coating technologies.

One such project, entitled Nanomag, brought together experts from seven coun-

tries, including materials scientists from the University of Bari in Italy. Their task was to optimise the deposition of a very thin layer of silicon oxide (SiOx) on the Mg surface that was capable of protecting against corrosion, tarnishing and other threats.

They turned to plasma-enhanced chemical vapour deposition (PECVD), specifically a radio-frequency (RF) plasma with hexamethyldisiloxane, oxygen and argon as

feed gases. Several experiments were performed during the three-year project. The best results were obtained when the substrate was first introduced to an RF plasma fed with hydrogen operated at high pressure but at a lower power density.

The research team with the University of Bari has therefore recommended the inclusion of this pre-treatment step in order to facilitate adhesion of the SiOx.

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

Collaboration sought: information exchange/training.
<http://cordis.europa.eu/marketplace> > search > offers > 5232

Optical gas diagnostics with tunable diode lasers

As semiconductor production becomes increasingly costly, achieving a good return from such a high capital investment requires shorter processing times as well as increased manufacturing yield. To improve control over the fabrication process, scientists explored the potential of optical sensors as monitoring tools.

In recent years, significant advances have taken place in near infrared semiconductor lasers. They have been applied as light sources in telecommunications and high-speed, integrated computer networks, as well as for optical data storage. The small size and modular flexibility of tunable diode lasers, meanwhile, has paved the way towards a new generation of compact and reliable gas sensors.

Molecular absorption spectroscopy in the near infrared is one of the most rapidly growing applications of tunable diode lasers. At first, the development of optical sensors based on tunable diode laser spectroscopy was driven by scientific inquiry. Researchers at the Fraunhofer

IWS Dresden, in Germany, were tempted to transfer laser-optical sensors from monitoring air pollution to industrial processes.

With the increased complexity of the semiconductor fabrication process, online analysis of high purity gases has become a key issue in automating the process control. The optical spectrometer developed during the project 'Advanced techniques for high temperature system-on-chip' (Assyst) offers an attractive alternative to conventional control methodologies which are based on monitoring the chamber pressure, gas flow as well as forward and reflected power.

While indirect control methodologies may fail to sense important aspects of the semiconductor fabrication process, this near infrared spectrometer is extremely sensitive to the presence of oxygen and vapour. Besides oxygen produced from the breakdown of water or the 'outgassing' from the walls of vacuum processing chambers, it is designed for measuring traces of contaminating gases such as hydrogen sulphide (H₂S).

Moreover, the modular configuration of the spectrometer assembly allows a choice of multiple spectroscopic components and improvement of the system's performance to meet the needs of specific applications.

Funded under the FP5 programme Growth

(Competitive and sustainable growth).

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 5062

Making polymers more plastic than ever

Polymers play an important role at every level in society; in industry, business and everyday life. The European PMILS project has utilised a model that will accelerate the development of new designer polymer materials.

An amazing range of products can be manufactured using polymers — from compact discs to waste bins. By varying the identity of the monomers and the processing conditions, the potential for new products is enormous. However, developing a new material can be costly in terms of time and finance while it is synthesised and tested for the desired properties.

The EU-funded project 'Polymer molecular modeling at integrated length/time scales' (PMILS) aimed to streamline this procedure by developing models to predict, in advance, a material's properties from its molecular details and manufacturing conditions. One option was to apply stochastic differential equations (SDEs) to the problem. Stochastic differential equations can be used to model a wide range

of systems, from materials, such as rheological behaviour of polymers, to money markets.

Project partners at the Imperial College of Science, Technology and Medicine applied SDEs to the model of polymer melt dynam-

ics. This had previously been developed by Öttinger, an authority on mathematical aspects of stochastic methods, and colleagues. Based on the comparison of experimental viscosities with those predicted by the model, optical parameters of polymers can be deduced. The input included important polymer properties relating to their rheological properties such as reptation time, a reflection of molecular stiffness.

Plastic is a clean sterile material that is low density while potentially possessing strength and heat resistance. As such, novel polymers are in increasing demand for many applications including healthcare and car manufacturing. Improved modeling is creating opportunities for faster development thus increasing the competitiveness of the European market.

Funded under the FP5 programme Growth

(Competitive and sustainable growth).

Collaboration sought: further research or development support.

<http://cordis.europa.eu/marketplace> > search > offers > 5260



Huge long-term potential for new breed of gas sensors

A little bit of gas can provide a lot of important information which can be used for things as diverse as saving lives during fires and making vehicles run more efficiently. Now a new generation of optical sensors, developed by European researchers, is revolutionising trace gas detection.

It was not so long ago that gas detection was biological, and canaries were the state-of-the-art gas detectors. Until well into the 20th century the little birds were used to detect build-ups of deadly carbon mon-

oxide in mines and thus saved the lives of thousands of miners.

The canaries were retired when electro-chemical sensors were developed to

monitor chemical processes and measure variables, such as resistance, to detect the build up of gases. Despite the refining of the technology over a period of many years, this way of sensing gas emissions is unsatisfactory in several ways — not least the time it takes.

What was needed was a new type of sensor, based on new technologies, which could very quickly detect and identify any special or unusual gas build up in the ordinary ambient air and either sound the alarm or institute corrective measures.



A cross-disciplinary EU-funded project, 'New mid-infrared sources for photonic sensors' (NEMIS), was set up to study the problem and develop a working model of a new type of optical sensor based on recent advances in laser technology and photonics.

Specifically, the researchers worked to develop a system based on a new type of laser with a range of characteristics suited to detecting gases, other than those naturally occurring in air, at room temperature.

The vertical-cavity, surface-emitting semiconductor laser diodes (VCSELs) which were used to drive the NEMIS photonic sensing system for trace gas analysis allow for the construction of robust, long-lasting and low-cost sensors.

Explains project manager Alexander Bachmann: 'The advantages of using VCSELs rather than conventional lasers, apart from cost-efficiency, are that you can tune the wavelength more broadly. Usually a laser can only be tuned over less than a nanometre by changing the electrical current, but a VCSEL has the ability to tune over more than five nanometres.'

Because the sensor is looking for anomalies in wavelengths to detect gas — in the case of the pilot study with the gas being carbon monoxide (CO) — laser 'tunability' allows for both greater flexibility and the ability to create a self-contained, sealed sensor.

Each gas has a unique 'absorption line' which allows the laser to detect its presence, so if the laser can be tuned up and down it means

a series of lines representing different gases can be detected by a single sensor.

It also means that self-calibrating sensors, which continuously check against a sample of gas at a pre-set or known wavelength, before going to a different absorption line to take measurements for CO and other gases, become practical.

As the sensors are self-calibrating there is no need for human interaction and they can be sealed in tough containers which not only have a life of many years but can also be put into hostile environments in industrial installations without suffering corrosion.

'Perhaps the biggest challenge for us here was the wavelength,' says Mr Bachmann. 'No laser able to do what we wanted done at the wavelength range we had to work at — 2 to 3.5 μm — had been developed. So one of the main achievements of the project has been to develop lasers that are suitable for optical gas sensing.'

Once the researchers had done their bit, the project's industrial partners developed a demonstrator which initially was able to detect ammonia (CO NH_3). Sensors for other gases including carbon dioxide (CO_2) and hydrogen sulphide (H_2S) are under development.

While it will take many years for the new technology to become part of our everyday lives, Bachmann believes there is a much shorter timeframe for NEMIS sensors to



be commercially deployed for industrial and security applications.

'Within a couple of years, we will see sensors costing probably several thousand euros each being deployed in industrial settings to detect gases for security reasons. But bear in mind they will not need any manual calibration and will continue to work efficiently for many years.

'But as the market grows and the systems become more affordable then there is huge scope for deployment. In the auto industry, sensors could be used to monitor engine emissions and ensure optimum efficiency, or they could be used for climate control in all sorts of settings from homes to aeroplanes. When the unit price drops to less than EUR 50, they will probably be in every home,' he says.

Promoted through the ICT Results service.

<http://cordis.europa.eu/ictresults/index.cfm?section=news&tpl=article&ID=91038>

Improved suspension seats ease discomfort

The performance of suspension seats used in transport vehicles has been evaluated to determine the level of discomfort caused by low-frequency horizontal and rotational motion.



The performance of suspension seats can significantly affect workers in various occupations who are exposed to vibration, for example operators of on-road and off-road vehicles, small marine craft and trains. The project 'Evaluation and improvement of suspension seat vibration isolation performance' (Vibseat) sought better working conditions for such operators by evaluating suspension seat performance in the horizontal and rotational axes.

In order to supply industry with the technology for creating marketable seats which can isolate vibration in these axes, field trials were necessary for acquiring representative measurements of vehicle vibra-

tions. Laboratory studies were also needed to evaluate human factors such as the body's resistance to vibration and physical discomfort levels registered by operators.

Additional tests revealed the primary locations of discomfort stemming from exposure to roll, pitch and oscillation when operators are seated on a flat rigid seat and on a rigid seat with a backrest.

Results indicated that the use of a backrest lessened discomfort and that subjects were more sensitive to rotational oscillation than to translational oscillation. The dissemination of these findings can be useful in providing a standard for the testing of seats designed to lessen exposure to horizontal whole-body vibration.

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

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

<http://cordis.europa.eu/marketplace>search>offers>5247>

Europeans tackle wind turbine development

European researchers have discovered a way to develop a more reliable wind turbine design. By taking detailed measurements of the load distribution on a 10-metre-long wind turbine blade under natural wind conditions, the team can offer precise information concerning the wind flow over the wind turbine blade surface.

A team of researchers set out to provide a basis for designing a better wind turbine blade. This meant finding a balance between design strength and sensitivity, as well as to guarantee that the maximum amount of energy is produced in a consistent manner.

The research is part of two EU-funded projects: 'Integrated wind turbine design' (Upwind) and 'Next generation design tool for optimisation of wind farm topology and operation' (Topfarm). Both were led by wind energy experts at Denmark's national laboratory for sustainable energy at the Technical University of Denmark (Risø DTU), and included researchers from the Danish groups Vestas, LM Glasfiber and DONG Energy, as well as Germany's Siemens.

LM Glasfiber developed the wind turbine blade, which has 350 measuring points in the form of pressure sensors and microphones, among others. These features are linked to a measuring laboratory at the root of the wind turbine blade. The Norwegian group Det Norske Veritas (DNV) checked the safety calculations for the wind turbine. According to DNV, the maximum wind speed at which the turbine should run is 15 metres per second (m/sec). It should be noted that the experiment could only be conducted under perfectly dry weather conditions.

The team effectively fitted in 12 measuring periods, from late spring to late summer, and obtained extensive data.

'Our measurements are by far the most comprehensive to date, and because they were conducted out in the open and on an industrial full-scale wind turbine, they take account of the impact of turbulence and blade rotation as well as elasticity,' explains Dr Helge Aagaard Madsen of DTU's Wind Energy Division who co-led the research with Christian Bak.

Our measurements are by far the most comprehensive to date [...] There is no doubt that they will be valuable for international wind energy research as a whole.

'There is no doubt that [the measurements] will be valuable for international wind energy research as a whole. Moreover, we have — so to speak — been listening to the air flow across the blade using 60 microphones and recording 50,000 measurements a second, thereby obtaining an extremely detailed picture of how the wind is translated into load on the blades, i.e. looking at what lies at the very heart of utilising wind power.'

The team plans to continue with their measurements in the hope of establishing the difference between the properties of a blade profile on a full-scale wind turbine in the open air, and the properties of a similar profile under controlled wind conditions in a wind tunnel.

Risø DTU also tested a laser-based wind scanner in the Upwind project, funded under the 'Sustainable development, global change and ecosystems' thematic area of the EU's Sixth Framework Programme (FP6) to the tune of EUR 14.6 million. The researchers said the scanner allowed them to conduct three-dimensional measurements of wind speeds, wind direction and turbulence around a wind turbine. Upwind targets the development of large wind turbines, both onshore and offshore.

The team also used another laser to measure the velocity distribution in the wake of the rotor. The results obtained were part of the Topfarm project, which received EUR 1.7 million under the same thematic area.

Promoted through the Research Information Centre.
<http://ec.europa.eu/research/infocentre> > search > 13833



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>

Symposium on B cells

The European Science Foundation (ESF) and the European Molecular Biology Organisation (EMBO) will hold a symposium on 'B cells and protection: back to basics' from 18 to 23 April 2010 in Sant Feliu de Guixols, Spain.

Microbes populated the earth long before any eukaryotic cell. Therefore, in order to survive, mono- and multi-cellular organisms had to develop mechanisms of adaptation, cohabitation and defence against bacteria, fungi and viruses. One of these mechanisms is mediated by immunoglobulins in the serum and at mucosal surfaces.

B cells (a specific kind of lymphocytes) and their antibodies, both natural and adaptive, play a fundamental role in the immediate and late defence against microbes. They also protect the organism from viruses, neutralising them before infection. Therefore, although over the last years B cells have been considered the mere executors of the orders derived from the complex interaction between antigen presenting cells and T cells, new attention is concentrating on the humoral immune response.

The event, composed of lectures by invited high-level speakers, short talks, poster sessions and round table and panel discussions, will be dedicated to these cells and new findings in the field.

For further information, please visit:
<http://www.esf.org/activities/esf-conferences>

Fifth international conference of digital arts

The Fifth international conference of digital arts (Artech) 2010 'Envisioning digital spaces' will take place on 22 and 23 April 2010 in Guimarães, Portugal.

The aims of the event include promoting interest in digital culture and its relation to art and technology as a research field, establishing a common space for discussion and exchange of experiences, and to act as a forum for emerging digital artists and new forms of digital expression.

Other topics on the agenda concern the relationship between digital culture, architecture and design. In traditional design processes, architects consider aesthetics and function, bearing in mind technical, social and economic elements to achieve a final structural design proposal. Can innovative digital tools offer new approaches for architectural design to emerge and still respect the essence of traditional design? This is the challenge.

For further information, please visit:
<http://www.artech-international.com/artech2010/>

Cold regions hydrology workshop

A three-day workshop on cold regions and hydrology will be held in Innsbruck, Austria from 28 to 30 April 2010.

This scientific symposium will review and assess the latest developments in observation and modelling of the water cycle and run-off in areas exposed to snow and glaciers. The event will also aim to provide guidance in future data assimilation techniques, modelling and observation systems.

Organised by the Network of Climate and Cryosphere Research at the University of Innsbruck (ENVEO IT) and the European Space Agency (ESA), the event programme will include a number of presentation papers and a round table discussion. There is the possibility that selected papers will also be published in a topical journal following the workshop.

For further information, please visit:
<http://www.congrex.nl/10c06>

'Space propulsion 2010' forum

The four-day space propulsion 2010 event will be held in San Sebastian, Spain from 3 to 6 May 2010.

The event programme aims to bring together the spacecraft and space transportation propulsion communities. Areas which will be examined include:

- consequences of propulsion techniques following the application of systems approaches;
- European and international ambitions vis-à-vis challenging space exploration programmes;
- utilisation duality of propulsion techniques in civilian and military applications;
- information exchanges at the international level in the areas of propulsion for spacecraft and space transportation.

Technical and programme planning issues will be discussed in order to support the preparation of future activities and road-maps in all fields of space propulsion.

The forum is also making a special bid to attract students who may wish to pursue a career in the field of space propulsion.

For further information, please visit:
<http://www.propulsion2010.com>

Micronano system workshop

The two-day workshop MSW 2010 for those in the fields of micro- and nano systems will be held in Stockholm, Sweden on 4 and 5 May 2010.

This event will attract anyone from Scandinavia working or researching in the micro- and nano systems field. Participants will be exposed to a number of ongoing research developments and industrial activities that focus on a diverse range of applications, including medical, cleantech (clean technology), telecommunications, transport, security, and automation.

One-to-one meetings between interested parties will be arranged for the purpose of possible collaboration on joint projects. Presentations and posters are also organised. The event will end with a banquet dinner.

For further information, please visit:
<http://www.msw2010.org/index.html>

Fourth international conference on e-democracy

The Fourth international conference on e-democracy (EDem10) will be held on 6 and 7 May 2010 in Krems, Austria.

E-democracy seeks to engage active citizen participation through a combined use of information and communication technologies.

The event will address a number of issues that affect the development of e-democracy, such as transparency and communication, participation and collaboration. Several leading experts in the field have been confirmed as keynote speakers.

For further information, please visit:
<http://www.donau-uni.ac.at/en/department/gpa/telematik/index.php>

Biennial conference of the European Association for Research on Adolescence

The 12th biennial conference of the European Association for Research on Adolescence will be held in Vilnius, Lithuania from 12 to 15 May 2010.

The event will focus on various branches of psychology for adolescents. These include clinical psychology, biological psychology, developmental psychology, social psychology and other disciplines studying adolescence.

Participants will have the opportunity to discuss not only the latest developments in terms of theory and methodology, but also the impact of the social and economic environment on adolescence.

This conference is set to bring together researchers and practitioners from different disciplines across Europe and all over the world. The understanding of adolescence in different countries is extremely important given the role that culture plays in the transition to adulthood.

For further information, please visit:
<http://www.eara2010.eu>

NASA-ESA workshop on product data exchange

The 12th National Aeronautics and Space Administration (NASA) - European Space Agency (ESA) workshop on product data exchange will be held in Oslo, Norway from 18 to 20 May 2010.

Following on from previous annual workshops, the event venue alternates between the United States and Europe, and the theme for this year's event is 'Open data exchange — the simpler the better'.

The workshop scope has grown from focusing mainly on quality standards to a broader range of technologies and standards for the exchange and sharing of data. Nonetheless, the event goal remains the same: to facilitate and improve collaboration between organisations and disciplines to achieve highly efficient and effective product life cycles for the development and operation of complex systems. High quality, reliable and robust electronic data exchange is an essential enabler.

The programme will be similar to previous workshops: an opening evening reception followed by three days of presentations, plenary keynotes and discussions,

networking opportunities, and meetings. There is also the possibility for companies to exhibit related products.

For further information, please visit:
<http://conferences.esa.int/pde2010>

International conference on language resources and evaluations

The seventh edition of the international conference on language resources and evaluations (LREC) will take place in Valletta, Malta from 19 to 21 May 2010.

This event provides a unique forum for researchers, funding agencies and industrial leaders from diverse backgrounds to explore the challenges and opportunities in the language sciences.

Delegates will discuss ways to find new synergies and promote initiatives for international cooperation in language sciences, and how to progress in language technologies and the development of corresponding products, services and applications, and standards. The event will be accompanied by workshops taking place before and after the main programme.

For further information, please visit:
<http://www.lrec-conf.org/lrec2010/>

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