ISSN 1977-4028

European Commission

research eu

RESULTS MAGAZINE

N°33
JUNE 2014

SPECIAL FEATURE

THE HEARTBEAT OF EU SCIENCE

SOCIAL SCIENCES AND HUMANITIES

CAN MACHINES CRACK THE MYSTERY OF MUSIC CREATION?

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research*eu
RESULTS MAGAZINE

Published by
The Community Research and Development Information Service (CORDIS) managed by the Publications Office of the European Union
2, rue Mercier
2985 Luxembourg
LUXEMBOURG
cordis-helpdesk@publications.europa.eu

Editorial coordination
Gyn Nilsson

The *research*eu results magazine* is published by the Community Research and Development Information Service (CORDIS) and managed by the Publications Office of the European Union. Content is prepared using several sources, including CORDIS, the Research Information Centre, ERC, as well as original material collected specifically for this publication.

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ISSN 1831-9947 (printed version)
ISSN 1977-4028 (PDF, EPUB)

EDITORIAL

by the editorial team

COMBATTING HEART DISEASE ON ALL FRONTS

Most of us have at least one acquaintance who has suffered a heart attack at some point between their early 20s and late 90s. Fortunately, an increasing number of patients recover and can move on with their life — although their lifestyle is not quite the same after a cardiac event. Practicing physical exercise, maintaining a healthy diet, resting, avoiding stress and quitting cigarettes and alcohol are some of the main prerequisites to avoiding a relapse; but medicines, therapies and surgeries have also evolved to a point where fatalism can increasingly be ruled out.

But does it mean the worst is behind us? To this day, cardiovascular disease still causes 4 million deaths every year, around half of all fatalities across Europe. And health professionals and researchers still have much on their plate if they want to further curb this trend. The EU is well aware of that, and heart disease is very high on its political and research agenda. Under FP7, more than 100 projects related to heart disease have been funded.

'To this day, cardiovascular disease still causes 4 million deaths every year'

To mark the World Congress of Cardiology (WCC), which took place on 4-7 May in Melbourne, Australia on the initiative of the World Heart Federation, the *research*eu results magazine* highlights some 11 projects either recently completed or close to completion. The common element in these projects is their contribution to better treatments for heart disease, however they cover very specific topics ranging from risk factors to new drugs, beneficial plant-based medicine, implants and stem cell therapy.

Among these articles are three interviews. One is with Juan Pablo Lázaro-Ramos from TSB in Spain, who told us how the HEARTWAYS project is on track to make patient rehabilitation more efficient, less expensive and more enjoyable for the patient. Then, we discuss the CARE-MI project with its coordinator Dr Antonio Bernad of Spain's CNIC. The project is bringing forward a new approach in stem cell therapy for 'Ischaemic heart disease' (IHD), which he hopes could benefit patients in five years from now.

Finally, our interview with Prof. Michael Atkinson from Helmholtz Zentrum München, Germany ventures into the unknown with a thorough analysis of low radiation impact on the human heart.

The magazine also includes our usual seven sections, and closes with a list of upcoming events.

We look forward to receiving your feedback. You can send questions or suggestions to: cordis-helpdesk@publications.europa.eu

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Nothing gets lost: the power of biomass

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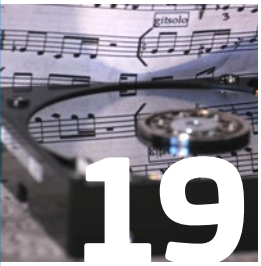

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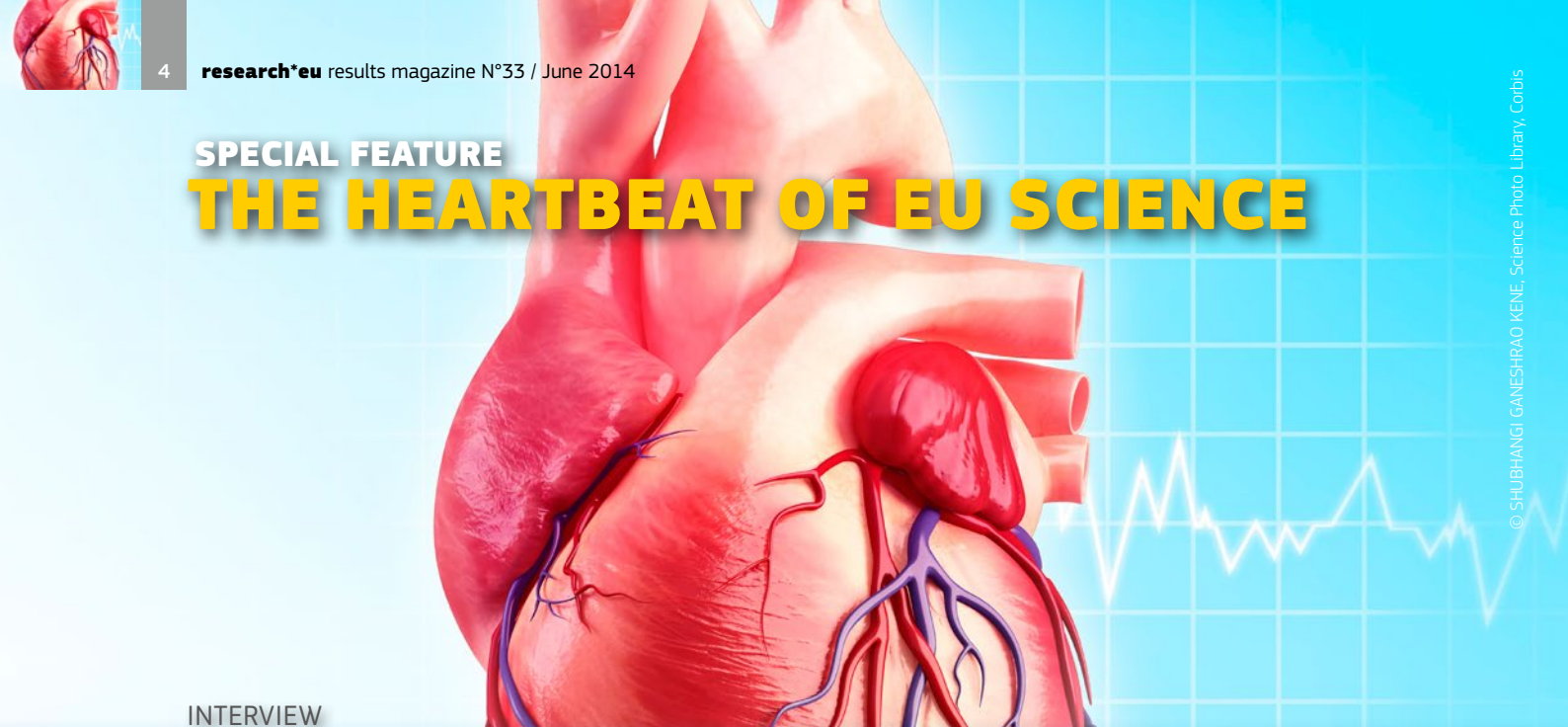
THE HEARTBEAT OF EU SCIENCE



INTERVIEW

HOME-BASED REHABILITATION FOR CVD PATIENTS

Patients who are found to suffer from cardiovascular diseases often have long years of treatment ahead of them and are urged to drastically change their lifestyle. But what is probably the most difficult part of the process is the return home where old habits die hard. A new technology relying on remote sensors could soon make post-CVD-event life a whole lot easier.

Cardiovascular disease (CVD) is a real plague for society. Not only is patient rehabilitation difficult, but the financial burden is enormous. According to WHO estimates, CVD costs the EU some EUR 196 billion each year. And despite public investment, it still causes as much as 46 times the number of deaths and 11 times the disease burden caused by AIDS, tuberculosis and malaria combined. Four million patients die of CVD each year in Europe.

In order to live longer and eventually reduce the health and financial burden CVD represents for society, patients are required to quit smoking, eat more fruit and vegetables and increase physical activity, all this while being subjected to combination drug therapy and having their blood pressure monitored on a regular basis. Whilst this is all manageable in the hospital, it is much more difficult at home where exercise-based cardiac rehabilitation continues to be underutilised.

The HEARTWAYS (Advanced solutions for supporting cardiac patients in rehabilitation) project was born from the idea that implementing quality performance measures, automated referral systems, and the option of exercise-based cardiac rehabilitation at home for some patients may all help to reduce the risk of suffering an acute cardiac event again. The project, which is due to end in September, is developing advanced wearable sensors and intelligent algorithms for supporting cardiac patients in rehabilitation outside medical centres.

Juan Pablo Lázaro-Ramos, R&D director at TSB in Spain and coordinator of the project, explains how the new technology will help to monitor the vital signs needed for diagnosis, assess exercise performance and progress, and enable remote personalised support as part of monitoring more patients without reducing the quality of care.

What are the main objectives of the project?

Juan Pablo Lázaro-Ramos: HEARTWAYS aims to develop an advanced, remote, modular IT solution for patients suffering from cardiovascular disease as they begin a rehabilitation process outside medical centres — at home for example.

The technology is comprised of: t-shirts embedded with wearable sensors to monitor breathing rates and heart rates; ECG and pulsioximetry measurements; accelerometers placed in patients' arms and legs to measure exercise performance; and intelligent algorithms. We gather data on exercise, lifestyle, the patient profile and clinical history, and translate this into a risk assessment of future health events.

The technology is of course targeting professionals — helping them with

patient follow-up, intervention strategies and clinical care plans, but it doesn't stop there. Patients will also have access to their personal data by means of a mobile app, so that they can adapt their lifestyle and control the effectiveness of physical exercise, wherever they are.

★ What is new or innovative about the technology you are developing?

The HEARTWAYS technology is the first cardiovascular monitor predicting risk based on personalised data. The innovation resides both in individual technologies and in the overall system. Bringing all stakeholders and solutions together around a single system for use by both patients and professionals is an innovation per se.

The special gloves integrating pulsiometry and other sensors, and the creation of intelligent multiparametric analysis middleware integrating information coming from various sources into a single communication framework, are also major innovations. The system leaves the door open to additional information systems and sensors, making future integration with existing customer IT systems an easy task.

Generally speaking, HEARTWAYS will allow doctors following up CVD patients to prescribe technology for the mid and long-term rehabilitation process, which they couldn't do until today.

★ How will it improve patients' lives?

Our technology is efficient, safe and cost-effective. It brings CVD patients closer to their families, allows them to blend back into society, and reduces stress associated with management of the disease as well as the need for psychological support.

The related reduction in hospitalisations and acute events also enables significant cost savings to be made.

★ What were the main difficulties you faced and how did you resolve them?

We faced four main challenges, each related to one of the technologies we developed.

The first challenge was the development of algorithms capable of performing personalised risk assessments in terms of the risk of new acute heart events in the short-term. Then, we had to find a way to produce usable and affordable sensors, knowing this has, until now, been one of the main drawbacks of such technology.

© Juan Pablo Lázaro-Ramos

JUAN PABLO LÁZARO-RAMOS

Making our mobile app accessible by all patients, intuitive and integrated into everyday patient processes, was also a challenge.

Last but not least, we had to position our technology in a market traditionally reluctant to take up technology prescriptions because of the lack of evidence. HEARTWAYS will gather its own evidence by means of a clinical study that will measure both economic savings and improvements in the clinical condition of patients using it.

★ What are the next steps for the project itself and after it ends?

We will soon start clinical trials with 30 users in two hospitals in Valencia (Spain) in order to validate the clinical protocols behind the assistance process.

We need to validate the overall composite in different countries (Croatia, Italy and Portugal) regarding usability, acceptability and expectations from an end user point of view and from the market point of view. Then, we need to provide a product exploitation plan in both public (public health systems) and private markets (rehabilitation clinics and centres, private insurance-based healthcare providers).

★ When do you expect the technology to be made available for patients?

The clinical trials start in July 2014 and last until April 2015. If indicators on economic savings and improvements in terms of risk and cases of relapses are positive, trials will continue in hospitals already using the technology and should be available to customers and patients by the end of 2015 or early 2016, especially in the public sector.

Market prospection started this year, and it is possible that early bird private customers may start using the system in the last quarter of the year, once the medical device certification process is complete.

★ If successful, what could HEARTWAYS mean in terms in economic benefits for society?

Exercise-based cardiac rehabilitation has proven to be beneficial for patients. It can lead to a 25% reduction in mortality from cardiovascular disease over three years, improve psychological factors and quality of life, create incentives for a healthy lifestyle and reduce the probability of future cardiac events and hospital readmissions.

HEARTWAYS

★ Coordinated by TSB in Spain.
★ Funded under FP7-SME.
★ http://cordis.europa.eu/projects/rcn/105228_en.html

CELL THERAPY FOR HEART DISEASES

Regenerative medicine is emerging as a promising approach to restoring damaged tissue architecture and function, particularly for ischaemic heart disease. An ischaemic episode implies restricted or no blood flow to the heart, causing irreversible necrosis of the affected heart muscle (also called myocardium).

Clinical pictures of patients who have suffered such heart attacks suggest little if any reparative capacity of the heart after injury. A number of clinical trials have tested the ability of bone marrow cells to regenerate heart muscle with unfortunately minimal functional improvement. This highlights the need for alternative treatment strategies that rely on the regeneration or replacement of the injured *myocardium*.

"Partners were able to estimate that heart muscle cells regenerated annually with a frequency of 2 % in younger people and below 1 % in the elderly population."

As a result, scientists from the EU-funded CARDIOCELL (Development of cardiomyocyte replacement strategy for the clinic) project set out to study pluripotent and adult heart stem cells. Their aim was to identify key signalling pathways that drive the differentiation of these cells down the cardiac muscle lineage.

Mammalian heart muscle development was studied using a mouse model. Through this, researchers identified transcription factors (Islet1, Fgf10) and signalling pathways (Fgf, BMP) that are important for cardiac development. Work on the heart-derived progenitor and stem cells led to the identification of markers (CD36, N-cadherin, ATP1b1) and procedures for their purification.

Radiocarbon (C-14) dating was used to assess the ability of human cardiomyocytes to regenerate as it can date organic molecules like DNA down to one year. The average age of heart muscle cells was six years younger than the individual, indicating that these cells had regenerated during adulthood. Using mathematical modelling, partners were able to estimate that heart muscle cells regenerated annually with a frequency of 2 % in younger people and below 1 % in the elderly population.

The consortium also explored new strategies for heart muscle cell-replacement therapies for ischaemic heart disease. From the mouse heart, they were able to isolate a cell population with stem cell-like properties and propagate them for a long time in culture. The option of *myocardium* prosthesis was also considered with the design of synthetic matrices to support the growth and function of heart muscle cells.

CARDIOCELL generated invaluable information that opens up new avenues for therapeutic interventions after cardiac infarction. The proposed cell sources are considered safe for transplantation and are expected to improve the outcome of patients suffering from ischaemic disease.

CARDIOCELL

★ Coordinated by Lund University in Sweden.
★ Funded under FP7-HEALTH.
★ http://cordis.europa.eu/result/brief/rcn/8448_en.html

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POTENT MULTIDRUG PILL FOR CARDIOVASCULAR DISEASE

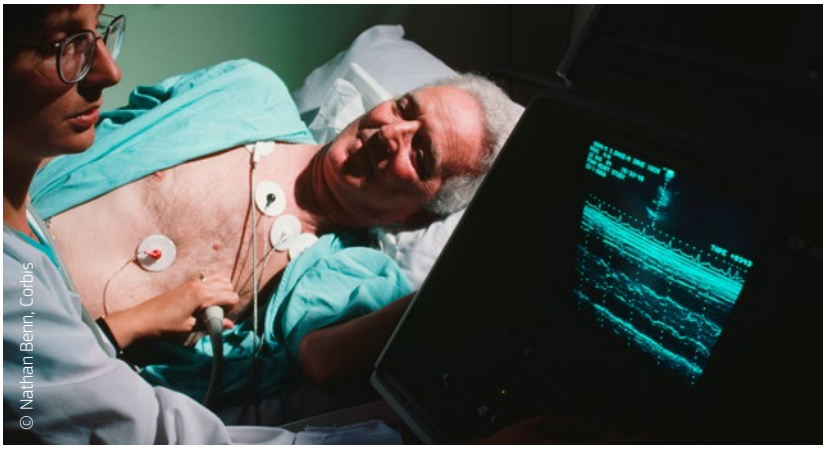
Globally, 'cardiovascular disease' (CVD) is a leading cause of mortality, costing European economies about EUR 192 billion annually. Most CVD patients show poor long-term adherence to their treatment regimen due to factors such as complexity, physician inertia and cost.

To successfully lower 'Systolic blood pressure' (SBP) and 'Low-density lipoprotein' (LDL) levels in CVD patients, the barriers to adherence and treatment gaps need to be overcome. To achieve this, the EU-funded randomised, blinded clinical trial UMPIRE (Use of a Multidrug Pill In Reducing cardiovascular Events) was initiated in Europe and India.

The trial enrolled 1 004 patients in Europe and 1 000 patients in India. Some CVD patients were dosed with a single pill having a 'Fixed-dose combination' (FDC) of several drugs. The 'polypills' contained aspirin 75 mg, simvastatin 40 mg, lisinopril 10 mg, and either atenolol 50 mg or hydrochlorothiazide 12.5 mg. The FDC-taking patient compliance as well as SBP and LDL levels were compared to those patients taking their usual cocktail of medications.

Despite an underestimation of patient adherence, trial outcomes revealed that using FDCs significantly improved patient compliance and effectively lowered SBP and LDL levels. Barriers to adherence such as complexity were successfully overcome through packaged delivery, low cost, simplified prescription dosage and consumption. Increased patient adherence demonstrably offset the risk of suboptimal risk-factor control with a significant reduction seen in cholesterol and BP levels.

This randomised trial was the first of its kind to assess the long-term use of FDCs on CVD patients. An FDC treatment strategy would also lower costs of medication and overall healthcare, thus increasing patient acceptance. Implementation of an FDC strategy in health policies for CVD could improve patient access to care, and reduce treatment inequalities and associated healthcare costs even in resource-poor countries. Ultimately, CVD patient outcomes and quality of life will considerably improve with FDC implementation.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UMPIRE

- Coordinated by the Imperial College of Science, Technology and Medicine in the United Kingdom.
- Funded under FP7-HEALTH.
- http://cordis.europa.eu/result/brief/rcn/9915_en.html

INTERVIEW

ASCERTAINING LOW-DOSE RADIATION IMPACT ON THE HEART

We are all exposed to radiations. Such exposure can be harmless at very low doses but damage our health above certain thresholds. But what happens in between is more difficult to predict. The PROCARDIO project is casting light on part of this mystery, with a focus on radiation-induced heart disease.

We might not always realise it, but our body is constantly subjected to radiations. Part of this consists of what is commonly called 'background exposure'. Over their lifetime, Europeans are exposed to an average 2 400 µSv (microsievert) every year. About 80 % of these radiations are natural, and have a very limited impact on our health. Others, like those emitted by cell phones, have been debated for years as intensive use is suspected to increase cancer risk.

Other non-natural sources of radiations include work in nuclear power plants, medical imaging and radiation therapy technologies. Although essential to diagnosis and treatment, the likes of X-rays and CT scans have to be used parsimoniously. Every time a patient's body is scanned for a fracture or tumour or — in the case of cancer treatment — is subjected to radiations, there can be varying levels of impact on our health.

But what exactly do we know about such impacts? Experts agree that the actual radiation risk to different parts of the body varies. Radiations at high doses are known to cause cancer, however research around 'Radiation-induced heart disease' (RIHD) has recently been gaining momentum.

The EU-funded PROCARDIO (Cardiovascular risk from exposure to low-dose and low-dose-rate ionising radiation) project, which involved partners from Europe, the United States and Japan, will be capital in this quest for understanding radiation impact on the human heart. It is also very unique since, unlike previous research, it involves researchers who decided to look into the impact of low-dose exposure while challenging preconceptions and casting new light on contradictory findings.

Prof. Mike Atkinson, Director at the Institute of Radiation Biology in Germany and coordinator of PROCARDIO, told us about his team's findings so far.

What are the main objectives of the project?

Prof. Mike Atkinson: PROCARDIO was designed to address a very specific problem in radiation protection. We know that high doses of radiation, typically those received in cancer treatment or from atomic bomb detonations, damage the human heart. Our concern is that much lower doses, those typically received in the nuclear workplace or from diagnostic medical imaging such as CT scanning, may also be damaging to the heart. If this were true, we would need to amend clinical practice and workplace dose limits to afford adequate protection.

Unfortunately, the epidemiological evidence of an effect on the heart at these low doses offers contradictory findings. A major reason for the lack of consensus lies in the way in which effects at low doses are predicted. This is based on the extrapolation of evidence collected at high doses where the effects are easy to identify. Whilst it may be true that the effects decrease in a linear fashion with decreasing doses, it may equally be true that there is a threshold below which no damage may be expected, or even that lower doses may be more damaging than predicted by a linear dose response. Only by understanding the biological mechanisms of radiation action on the heart can

we construct the correct dose response relationship needed to extrapolate effects down to low doses.

★ What is new or innovative about the project's approach?

Our understanding of cardiovascular effects of radiation is very much coloured by the experience of observations made at very high, almost lethal doses. Here, tissue damage and cell death predominate, leading to heart failure due to destruction of vital functions or massive inflammatory responses to the damage.

In PROCARDIO we have thrown away these preconceptions and started from a blank sheet of paper, making no assumptions about the mechanisms operating at low doses. We have formulated a number of new hypotheses to explain the radiation effects at low doses, low-dose rates (acute versus chronic exposures), the effects of different radiation qualities (e.g. photons vs. heavy ions) and the cell types directly and indirectly involved in the response to radiation insults. At the same time, we joined forces with a large EU-funded epidemiological study on the survivors of childhood cancer. This allowed us to gather new epidemiological data on the long-term effects of cancer radiotherapy and to use these data to test our hypotheses.

"Our project plan included a sister project (CEREBRAD) to study the risks stemming from radiation exposure to the brain."

★ What were the main difficulties you faced and how did you resolve them?

The diversity of activities meant that we had to assemble a highly interdisciplinary research team, many of whom had no prior experience of cardiovascular research. This was resolved by recruiting an international scientific advisory board led by one of the chief cardiologists in the United States. A second major difficulty was the lack of experimental facilities for the study of chronic effects of radiation. Here, we formed a strategic alliance with the Institute of Environmental Sciences, Rokkasho, Japan in one of the first joint Europe-Japan collaborations in radiation research. Our project plan included a sister project (CEREBRAD) to study the risks stemming from radiation exposure to the brain. Combining two large projects was a daunting task, but we have worked very hard to maintain and grow the links between the two projects, including running joint scientific sessions, organising common training and education activities, and sharing technology and results. We are all very proud that the two projects have grown closer together, with a lot of unexpected cross-fertilisation arising.

★ Are you satisfied with the project outcomes so far?

Although it is rather early to consider the overall project outcomes, we have already made a number of exciting scientific breakthroughs thanks to PROCARDIO. These have changed the way that the cardiovascular effects of radiation are viewed. For example, we show that two distinct types of cell are affected by low doses of radiation, the vascular endothelial cell (a blood vessel lining cell) and the cardiomyocyte (contractile heart muscle cell). Another immediate impact of the work is that we identified the role of the mitochondria (energy-producing sub cellular structure) as the major site of damage. Our biomathematical activities have produced a whole series of mathematical models that will be used to test the shape of the dose response curve when our epidemiological efforts are finished.


© Prof. Mike Atkinson

PROF. MIKE ATKINSON

★ What are the next steps for the project itself and after it ends?

National funding is already being awarded to consortium members to continue the work started under PROCARDIO. We have already begun to reformulate new hypotheses to replace those that were disproved by the research work, thus driving our understanding of radiation effects forwards.

★ When and how do you expect patients to start benefiting from your research?

Already we can see the impact of our work, as stakeholders and medical practitioners have been specifically targeted to make them aware of the potential long-term health risks of even low doses of radiation exposure to the heart. This new awareness of the risks to the heart is being seen in therapy planning and in imaging activities, where the heart is now spared from exposure as much as possible. We are seeing a shift in perception in the radiological protection community as well, where the heart is no longer considered a radiation-resistant organ, adequately protected by legislation designed to protect against cancer.

PROCARDIO

★ Coordinated by the Helmholtz Zentrum München in Germany.
★ Funded under FP7-EURATOM-FISSION.
★ http://cordis.europa.eu/result/brief/rcn/12654_en.html
★ Project website: http://www.procardio.eu/

MODELLING DISEASES IN MEDITERRANEAN COUNTRIES

The MEDCHAMPS initiative focused on awareness-raising to prevent 'cardiovascular diseases' (CVDs) and diabetes in Mediterranean countries. Project activities included the development of country-specific epidemiological models and policies for prevention and treatment.

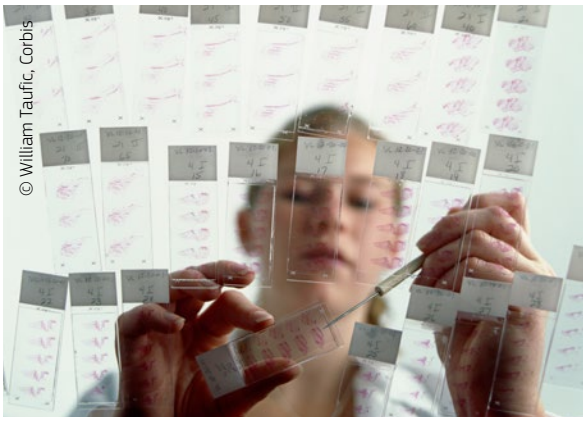
Diabetes and CVDs are increasing in prevalence in low- and middle-income countries around the Mediterranean Sea. This has alerted health authorities to take appropriate action and devise country-specific recommendations in order to reduce the burden of these diseases.

Based on this, the EU-funded MEDCHAMPS (Mediterranean studies of cardiovascular disease and hyperglycaemia: analytical modelling of population socio-economic transitions) project wished to conduct an epidemiological analysis of the risk factors implicated in diabetes and CVDs in occupied Palestinian territories, Syria, Tunisia and Turkey. The information would then be used to formulate policy recommendations inside and outside the health sector.

For 'Coronary heart disease' (CHD), risk factor data including cholesterol levels, blood pressure, diabetes and 'Body mass index' (BMI) were collected and computed into epidemiological models. Findings revealed an increase in BMI and a persisting prevalence of smoking among men, mainly in Syria. There is a high probability that mortality rates due to CHD rose in Syria and Tunisia as a result of the associated risk factors.

A survey on diabetes and CVD policies in these countries revealed a lack of comprehensive and well defined measures. Major contributors to this situation were the centralised management system, the scarcity of information on the aforementioned diseases and a lack of specialist health personnel. The data from all four countries were computed into CHD and diabetes models and compared with observed data and global estimates of disease burden.

Overall, the MEDCHAMPS risk factors were successful in explaining the mortality rates due to CHD and predicting diabetes prevalence. The information was utilised by project partners who proposed appropriate policies for each country, with healthcare cost estimations and appropriate action plans. One such measure is the reduction of dietary salt intake through a health promotion campaign, food packaging labelling and reducing salt content in processed food. Successful outcomes will reduce the incidence or severity of CVDs and diabetes through timely interventions and lifestyle changes.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MEDCHAMPS

- Coordinated by the University of Newcastle Upon Tyne in the United Kingdom.
- Funded under FP7-HEALTH.
- http://cordis.europa.eu/result/brief/rcn/6766_en.html

NEW TREATMENT FOR MYOCARDIAL INFARCTION

Although the long-term prognosis of patients after 'Acute myocardial infarction' (AMI) has improved, the one-year mortality rate is still as high as 13%. New data suggest that autologous 'Bone marrow-derived mononuclear cells' (BM-MNCs) can restore cardiac function following AMI.

A major reason for the high morbidity and mortality rates after sustained AMI is that the heart has an inadequate regenerative response to the myocardial necrosis. Despite the use of available conventional treatment, mortality rates of patients with post-infarction heart failure are still high and rehospitalisation occurs at a yearly rate of 6 to 8%. The EU-funded BAMI (The effect of intracoronary reinfusion of bone marrow-derived mononuclear cells (BM-MNC) on all-cause mortality in acute myocardial infarction) project is a phase III multinational, multi-centre study that aims to demonstrate that a single intracoronary infusion of autologous BM-MNCs reduces mortality following AMI.

During its first two years, BAMI reviewed existing data regarding bone marrow aspiration technique and cell harvest. The consortium then selected the best method of cell delivery. Intracoronary infusion is the most common route of delivery and employs balloon angioplasty with cells being infused through an over-the-wire balloon.

The trial Protocol and Statistical Analysis Plan have been created. The Protocol, Investigators' Brochure and related trial documents were submitted for clinical trial approval and a positive decision has been received. Some countries have already received approval for the trial. Partners taking part have developed a randomisation system and a database for future BAMI patients.

Information about the project and its progress has been disseminated at meetings, through press releases, newspapers, TV reports and radio features that have included interviews with patients following recruitment, treatment and reinfusion of stem cells.

Successful trial outcomes will demonstrate that transcoronary infusion of bone marrow-derived progenitor cells is safe and might reduce the mortality rate by 25% and the rehospitalisation rate by 15%.

BAMI

- Coordinated by Queen Mary and Westfield College in the United Kingdom.
- Funded under FP7-HEALTH.
- http://cordis.europa.eu/result/brief/rcn/12872_en.html
- Project website: http://www.bami-fp7.eu/

CONSUMING LUPINS FOR A HEALTHY HEART

Seeds of the Lupinus species, also called lupins, have been consumed by Mediterranean populations for thousands of years. These protein-rich food sources could prove to be a sustainable and healthier alternative to milk, meat, egg and soybeans.

The EU-funded LUPICARP (Innovative functional foods from sweet lupin protein for cardiovascular prevention) project will investigate the health benefits of sweet lupins as food and feed. A multi-centre randomised study will compare the effect of diets based on lupins with animal proteins in terms of cholesterol metabolism.

"Lupins are composed of 35-40% proteins, high fibre and antioxidants."

Their ability to reduce or prevent dyslipidaemia will be assessed using low-density lipoprotein-cholesterol values as well as inflammatory and metabolic markers. Other important aspects such as taste, nutritional factors, safety, growing conditions, yield and other applications will also be looked into.

Literature reviews and previous scientific studies including several EU-funded projects have revealed that lupins are composed of 35-40% proteins, high fibre and antioxidants. Sweet lupins are low in alkaloids (that cause bitter taste), and anti-nutritional substances such as phytoestrogens are at negligible levels. Primary allergies from consuming lupins are extremely rare. Another bonus is their ability to stabilise emulsions and foams.

To ensure product optimisation and commercial readiness, the LUPICARP consortium is composed of five lupin food manufacturers, one lupin ingredient producer and five research and technological development performers from academia and hospitals. The consortium agreement was finalised at the start of the project to ensure smooth technology transfer by discussing intellectual property and patent rights distribution.

In keeping with European Food Safety Authority (EFSA) documents and European regulations, LUPICARP has ensured that foods used in the clinical study will be safe. Alkaloid levels and nutritional compositions were taken into account and challenging logistical aspects such as food storage and delivery resolved. Approval for the clinical study was successfully obtained. Nine business cases were prepared for the participating small- and medium-sized enterprises (SMEs).

Globally, increasing population numbers are responsible for raising demands for protein-based foods and feeds. Unless more plant-derived sources are used, this trend will cease to be eco-sustainable as plant proteins are less water- and soil-intensive and consume carbon dioxide — a major player in global warming. Approval of the health claims of lupin-based food products will boost SMEs in the EU food sector with an expected turnover of several million euros.

LUPICARP

- Coordinated by the University of Milan in Italy.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/12887_en.html
- Project website: http://www.lupicarp.eu/

NEW CONCEPT FOR MYOCARDIAL IMPLANTS

Cell therapy and tissue engineering are emerging as novel therapeutic paradigms for heart muscle repair. This new approach is based on an increased number of heart muscle cells, cardiomyocytes, within the diseased area.

One strategy currently available involves the combination of cells with polymeric scaffolds ex vivo to generate an implant construct. This is then grafted onto the heart muscle. However, these procedures are hampered by the limited direct functional integration of grafted cells and high degree of donor cell death following cell grafting in host myocardial tissue.


© Shelley D. Spray, Corbis

The EU funded four-year NANOCARD (Nanopatterned scaffolds for active myocardial implants) project is supporting work in this field through a consortium of 11 corporate and academic partners. NANOCARD aims to create a new concept for implant design. Overall, the development is based on 'High-throughput screens' (HTS) for identifying specific 'extracellular matrix' (ECM) materials. This is followed by *in vitro* tests for the recruitment of cells and cardiac tissue formation, and *in vivo* (animal) testing of implants.

NANOCARD successfully developed and implemented HTS and identified ECM components that resulted in the most efficient recruitment of endothelial and myocardial cells. Researchers found that the optimal condition for the formation of vessels is low fibrin concentration (7.5 mg/ml) and high cell density.

"Scaffolds were implanted into a rat heart after the induction of myocardial infarction."

Scaffolds were implanted into a rat heart after the induction of myocardial infarction. There was no indication of cardiac or systemic toxicity of the implanted scaffolds. However, no positive effect was seen on cardiac function.

An important impact of NANOCARD lies in the evaluation of new technologies and the generation of data for future efforts in the development of functional myocardial implants.

NANOCARD

- Coordinated by the Max Planck Society in Germany.
- Funded under FP7-NMP.
- http://cordis.europa.eu/result/brief/rcn/9998_en.html
- Project website: http://www.mf.mpg.de/NanoCARD/

RESOLUTION OF CONGENITAL HEART DEFECTS

'Congenital heart defects' (CHDs) are present in the heart at birth and affect almost 1 % of the population. Besides poor life expectancy and quality of life for patients, considerable healthcare expenses are also incurred.

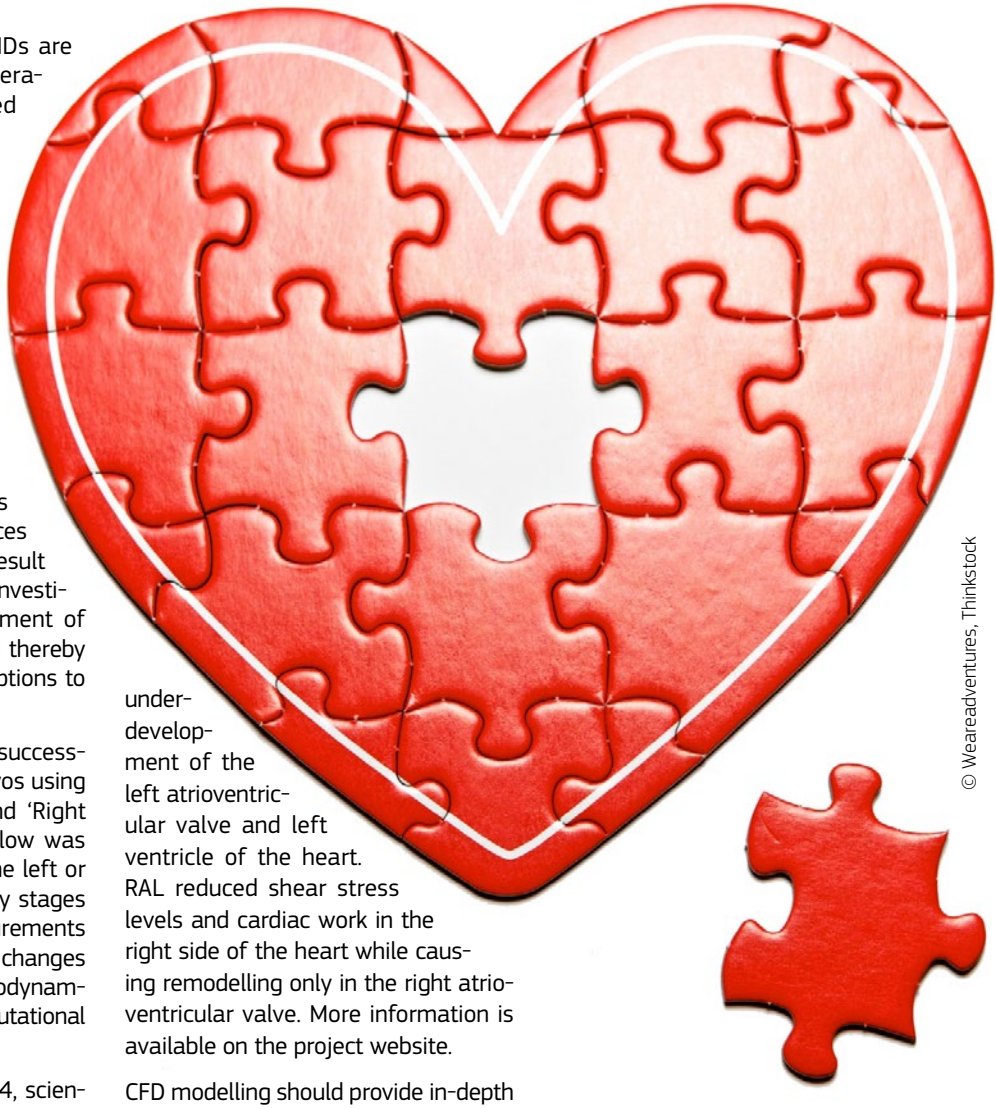
Conventionally, severe CHDs are treated via high-risk operations on the developed heart in early childhood to restore normal blood circulation, but outcomes are uncertain. No link has been found between genetic mutations and CHDs, suggesting that forces causing abnormal blood flow in the foetus are responsible for CHDs.

The EU-funded project HEMODYNAMICS IN CHD (Mechanical regulation of congenital heart defects) is investigating the in utero forces that remodel the heart and result in CHDs. Researchers plan to investigate the embryonic development of CHDs in chicken embryos and thereby find alternative therapeutic options to prevent CHDs.

Relevant heart defects were successfully created in chicken embryos using 'Left atrial ligation' (LAL) and 'Right atrial ligation' (RAL). Blood flow was thereby disturbed on either the left or right side of the heart at early stages of heart development. Measurements were made of morphological changes such as valve size, and haemodynamics were modelled using 'Computational fluid dynamic' (CFD) methods.

Using LAL on embryonic day 4, scientists successfully created an animal model of 'Hypoplastic left heart syndrome' (HLHS). A CHD created using RAL was the first model of its kind to ever be generated to describe CHDs affecting the right side of the heart. 3D geometries from 'micro-computed tomography' (micro-CT) were used to make morphological measurements. Haemodynamics were assessed using ultrasound images. Parameters such as peak velocity and average velocity through the heart valves helped determine shear stress levels and changes in cardiac performance.

Analysis of the ultrasound and micro-CT images revealed some interesting facts. LAL reduces shear stress in certain areas inside the heart, causing underdevelopment of the left atrioventricular valve and left ventricle of the heart. RAL reduced shear stress levels and cardiac work in the right side of the heart while causing remodelling only in the right atrioventricular valve. More information is available on the project website.



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CFD modelling should provide in-depth information on changes in haemodynamic environments, such as shear stress levels and their effects on heart development. Correlating the structural changes to haemodynamic alterations should provide novel insight into CHD occurrence, its progression and possible treatment options.

"Parameters such as peak velocity and average velocity through the heart valves helped determine shear stress levels and changes in cardiac performance."

HEMODYNAMICS IN CHD

★ Coordinated by Doğuş University in Turkey.
★ Funded under FP7-PEOPLE.
★ http://cordis.europa.eu/result/brief/rcn/12940_en.html

INTERVIEW

NEW STEM CELL THERAPY FOR ISCHAEMIC HEART DISEASE

An EU-funded project is looking into 'Cardiac stem cells' (CSCs) to tackle the problem of chronic heart failure in Europe. Whilst previous research has concentrated on cells from the patients themselves, the CARE-MI team focuses on cells from various donors. Clinical trials are expected as soon as summer 2014 in Spain and Belgium.


© Antonio Bernad

ANTONIO BERNAD

Ischaemic heart disease (IHD) was responsible for 12% of all deaths in the OECD in 2011. The disease, which causes blood supplies to the heart to diminish, progressively damages heart tissue.

Whilst the introduction of angioplasty and stents has successfully helped reduce early mortality rates, the lack of solutions to repair the damaged tissue often leads to initial patient recovery being followed by cardiac remodelling and 'Chronic heart failure' (CHF). The only cure for CHF is heart transplantation, but few patients are lucky enough to find a compatible donor in time.

An alternative to heart transplantation may reside in endogenous CSCs, recently discovered pluripotent cells contained in adult myocardium (heart muscle). CSCs can potentially heal tissue through the production of new cardiac muscle cells (cardiomyocytes) or trigger molecular pathways of cardiac repair through growth factors.

This potential has only been tested recently by using autologous cell therapy for repairing damaged tissue. Put simply, the method consisted in using the patient's own cells to repair the myocardium. But although promising, the autologous approach has so far proved very time-consuming, expensive and, most importantly, relatively ineffective.

Researchers from the CARE-MI (Cardio repair European multidisciplinary initiative) project have set out to tackle this issue with the help of FP7 funding, by shifting the view from autologous to allogeneic. Instead of taking cells from patients themselves, they developed a new methodology relying on cells from different donors.

Dr Antonio Bernad, coordinator of the project, believes this technique could be the basis of ready-to-use, affordable and user friendly therapies based on the in situ activation, multiplication and differentiation of endogenous CSCs.

★ What are the main objectives of the project?

Antonio Bernad: Our main goal is to develop widely available and clinically applicable treatments for IHD. CARE-MI exploits the biology of 'endogenous resident cardiac stem cells' (eCSCs) and the molecular mechanisms responsible for their activation and differentiation in situ. The proposed therapies may directly impact the resident eCSCs population, resulting in their activation, expansion and differentiation into cardiomyocytes — endothelial and smooth muscle vascular cells — to regenerate the contractile tissue and the microvasculature lost as a result of the ischaemic event.

These therapies have been validated in initial preclinical results in animals presenting a cardiac anatomy, physiology and pathology comparable to that of humans. Now, if we want to enable an effective and clinically-applicable myocardial regenerative therapy, we have to compare the relative merits of the two arms proposed, and see if combining them can result in any additional benefits.

★ What is new or innovative about the project?

CARE-MI relies on the use of allogeneic 'Cardiac stem cells' (CSCs) and/or a limited number of regenerative factors, known to be secreted by the eCSCs, for the activation/promotion in situ of the endogenous repair programme. These allogeneic CSCs, which survive only transiently in the recipient, set off a potent endogenous regenerative process by activating the endogenous eCSCs. The latter is capable of limiting progressive degeneration and partially restoring the anatomy and function of damaged myocardium.

The two proposed treatments and/or their combination will, for the first time, provide generic off-the-shelf regenerative therapies which will be ready to be applied at any time wherever the technical means and professional expertise needed to treat AMIs and perform PTCAs are available — that is, in most large medical centres.

Because of their generic nature, these therapies will be available to all candidate patients. An additional attractive feature of the proposed approach is the fact that despite their generic and off-the-shelf nature, these treatments will produce autologous regenerated myocardium. We believe that the transition from autologous cell therapy — as already clinically tested widely — to the use of allogeneic cells for their paracrine effect before moving to a cell-free therapy based on the subset of the paracrine factors is not only a logical conceptual progression, but also the safest route for making progress in this field.

★ What were the main difficulties you faced and how did you resolve them?

CARE-MI put an enormous effort into developing a solid background that demonstrates the feasibility of the use of allogeneic CSCs for the treatment of ischaemic cardiac disease. The logistics of the clinical trial have been a major challenge for the consortium. For example, aspects related to large-scale cell production became especially painstaking as we were producing a medicinal product. The strict controls and the importance of robust results on the cell identity have consumed most of our efforts — under the leadership of CORETHERAPIX Ltd, partner and promoter of the clinical trial.

Moreover, the conditions associated with an allogeneic scheme (mainly CSC immunoregulation properties and putative CSC immunoresponse) have also involved many discussions, especially in defining the more solid and reliable methods for evaluating those

properties. However, thanks to the collaboration of sound experts in the consortium, as well as external scientific advisors, CARE-MI has overcome most of these difficulties.

★ Are you satisfied with the project outcomes so far?

The project has produced very relevant results in this fourth year; CARE-MI has completed the GMP production of the cell therapy medicinal product to be used in the clinical trials, while the complete 'Clinical trial application' (CTA) has been submitted to Spanish and Belgian Regulatory Agencies (AEMPS and FAGG respectively).

The Spanish Regulatory Agency approved the CTA on 16 April 2014 — allowing CARE-MI to achieve one of the major milestones of the project — and we are awaiting the final decision from Belgium's Regulatory Agency (FAMHP). A clinical trial is expected to start shortly; currently we are in the recruiting phase and we expect to start treating our first patients this summer. This is a very exciting opportunity for us and we hope that we can produce more relevant results during the year.

★ What are the next steps for the project itself and after it ends?

Our next steps are devoted to speeding up the other relevant arm of our project, testing the growth factor therapy as a feasible alternative for the treatment of IHD. Our final goal is to produce enough data to generate the preclinical dossier taking into consideration our previous experience with regulatory agencies. Of course, we will also be involved in the development of the clinical trial and will try to produce relevant results regarding patient immune responses to the treatment, along with data regarding the safety and effectiveness of the proposed therapy.

Additionally, we have submitted a proposal (H2020) for the clinical evaluation of CSC (CARE-MI) in the chronic scenario. If we get funding, we would be ready to go into a clinical trial in two years.

★ When do you expect patients to start benefiting from your research?

When talking about innovative treatments we need to be very cautious to avoid giving false hope. We are in phase I/II of a clinical trial, which means that additional trials will be requested prior to the final release of the product.

However, we are confident of our results in the preclinical phase and expect positive outcomes with patients. It is difficult to predict the exact date on which this treatment will be available for the wider public, but we have set a five-year timeframe for our estimations. This is strictly dependent on the optimal development plan of our industrial partner, CORETHERAPIX, supporting Phase III.

CARE-MI

★ Coordinated by CNIC in Spain.
★ Funded under FP7-HEALTH.
★ http://cordis.europa.eu/projects/rcn/94265_en.html
★ Project website: http://www.caremiproject.eu/
★ http://bit.ly/1h88b3y

STEM CELLS TO TREAT A DAMAGED HEART

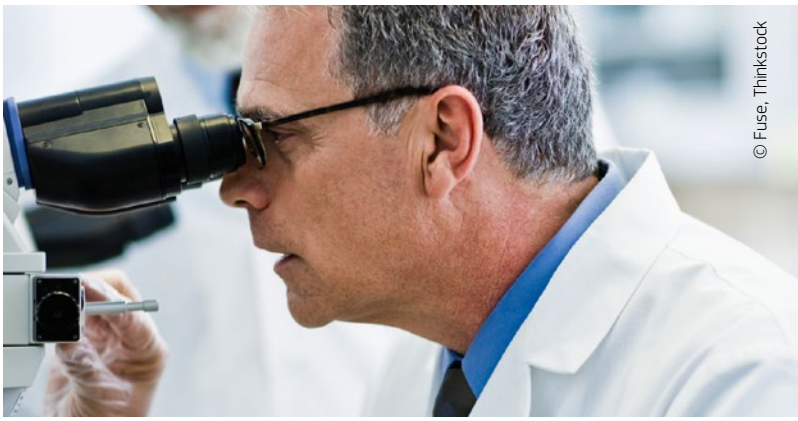
Seeking to develop novel therapeutic approaches to the treatment of cardiac infarction, scientists from the MESENDOT study proposed the use of 'Mesenchymal stem cells' (MSCs).

Cardiac infarction is considered one of the leading causes of mortality worldwide. Given the low regenerative potential of cardiac muscle, patients who have suffered cardiac infarction often progress to congestive heart failure.

MSCs are a powerful source of stem cells since they are able to differentiate to a plethora of cell types. As a result, they are increasingly being used in regenerative medicine and for the development of biological prosthetic implants. Recent reports suggest that MSCs concentrate around blood vessels, but the precise MSC natural microenvironment is not completely understood.

The key objective of the EU-funded MESENDOT (Regulation of mesenchymal stem cells by vasculature and enhancement of their regenerative potential for the treatment of acute myocardial infarction) project was to investigate the reciprocal interplay between MSCs and their microenvironment. By elucidating the cues that MSCs receive from the *endothelium* as well as the effect of the stem cells on angiogenesis and endothelial differentiation and function, scientists hoped to come up with novel treatments for myocardial infarction.

With a particular focus on the vascular niche, MESENDOT members aimed at delineating the molecular mechanisms responsible for its homeostasis. Using a co-culture system of human adipose tissue-derived MSCs with 'Human umbilical vascular endothelial cells' (HUVECs), scientists were able to conduct a high-throughput analysis of the secreted proteins. Various proteins were found to be up-regulated, including CXCL-6, a chemokine highly expressed in the heart and also implicated in MSC proliferation and migration.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The outcome of CXCL-6 administration on the inflammatory response post-infarction was addressed in a rat model of acute and chronic myocardial infarction. Injection of MSCs was also investigated as a strategy for reducing the infarct size.

Taken together, the findings of the MESENDOT study provide a new role for MSCs as a treatment pathway for cardiac infarction. Although clinical validation is pending, the results of this investigation open up new dimensions for the regenerative potential of MSCs.

MESENDOT

★ Coordinated by SERMAS in Spain.
★ Funded under FP7-PEOPLE.
★ http://cordis.europa.eu/result/brief/rcn/12589_en.html

BIOLOGY AND MEDICINE

NEW SURGICAL BREAKTHROUGH IN REPAIRING DAMAGED SPINAL DISCS

Lower-back pain due to damaged spinal discs is a major cause of long-term disability for millions of people. Seeking a cure, EU-funded researchers have developed a new surgical approach and the materials to repair damaged spinal discs, potentially helping many sufferers enjoy better, more productive lives.

Some 30% of European workers suffer from back pain, the top work-related disorder reported by the European Agency for Safety and Health at Work. The human cost of this suffering in terms of lost wages, and the economic consequences in healthcare spending, are both exorbitantly high.

In response, researchers in the DISC REGENERATION (Novel biofunctional high porous polymer scaffolds and techniques controlling angiogenesis for the regeneration and repair of the degenerated intervertebral disc) project have developed a solution for those with damaged spinal discs, the predominant cause of severe and lasting back pain. They have developed a new surgical approach and the necessary materials that enable surgeons to repair damaged intervertebral discs.

The team used modelling to determine the complexity of the stresses placed on the human vertebral disc and then calculated the bio-active repair capability needed for any replacement. Following this work, they developed suitable materials for both the hard outer element of the disc (the annulus) and the soft, gel-like inner core (the nucleus). They then worked out how to inject both types of material with minimum invasive surgery, and how to seal the disk afterwards.

Specialised treatment

Back pain from spinal-disc problems has to be treated in different ways. Younger people with sports-derived injuries may be able to recover to some extent via the body's own natural healing process. But when the problem is due to disc degeneration, as is common in older people, the repair process has to be helped.

In view of the above, the team developed two different types of injectable gels for the soft inner core, the nucleus, of the spinal disc. While both are bio-hybrid structures that closely resemble the human tissue in its essential attributes, there are differences.

The first gel type, designed for use with patients up to the ages of 40 to 50, is loaded with live human cells, and is suited to those vertebral discs that still have the ability to self-repair to some extent.

The second gel type has no live cells, and instead is made of gellan gum and esters of hyaluronic acid components. This second type is designed for patients over 50, whose spinal cells are less able to repair and regenerate themselves. The gel also includes a growth component to help regenerate the disc nucleus.

Cooperation and expertise

Project coordinator Professor Luigi Ambrosio of Italy's National Research Council (CNR) is proud of the team's success in reaching project targets.

'There is no one single achievement I would emphasise,' he says, 'but it is the integration of all the different expertise and techniques that went so well … the image analysis, the materials technology, the cellular structures, the bio-active compounds, the surgery, the injection method and a custom approach for partial and total disc replacements. What we have achieved is a real step forward in treating spinal-disc problems.'

The concepts, materials and surgical practices developed by the DISC REGENERATION project are still relatively new developments in medicine. 'Spine-motion preservation' is an emerging technology, and the next step will be to undertake a full-scale clinical trial.

If the techniques developed within the project prove successful with living patients, they could not only relieve back pain for many, but also become one of the strongest market opportunities in the European medical-technology industry.

DISC REGENERATION

★ Coordinated by the National Research Council in Italy.
★ Funded under FP7-NMP.
★ http://ec.europa.eu/research/infocentre/article_en.cfm?artid=31978

MANAGING MALARIA FROM ABOVE

According to the World Health Organisation, out of the hundreds of millions of malaria cases, over 80 % are located in Africa. A European–African consortium has worked on the development of 'Earth observation' (EO) systems for controlling malaria-transmitting mosquitoes.

There is a global front towards reducing the burden of malaria by 2015. For effective implementation of malaria vector control measures, stakeholders are considering EO, 'Geographical information' and 'Global positioning systems' (GIS and GPS, respectively).

The EU-funded project MALAREO (EO in malaria vector control and management) aimed to develop such technology and introduce it into malaria control programmes. The area of interest was the cross-border region of Mozambique, South Africa and Swaziland. These three countries have different malaria epidemiological profiles. Swaziland is currently in the malaria elimination stage while South Africa is in the malaria pre-elimination stage and Mozambique the malaria control stage.

The project partners developed EO applications to support the daily work of the National Malaria Control Programmes (NMCP). The solutions generated by MALAREO mainly included a variety of thematic maps, e.g. land use/land cover map, water body map and household map. High-resolution maps covering the whole project area were generated to assist malaria programme managers in the planning of optimal malaria vector control measures. EO data from different sensors (MODIS, ASTER, RAPIDEYE & METEOSAT) are being used in combination with malaria survey data from South Africa, Swaziland and Mozambique.

RAPIDEYE data were used to generate malaria-relevant land cover/use classes which are of special interest to NMCPs for identifying malaria risk areas and looking at the influence of land cover/use on vector presence and malaria risk. Very high-resolution imagery was used to identify houses and small huts. Information on the house type, amount and distribution is very valuable for more efficient 'Indoor residual spraying' (IRS).

As mosquitoes are drawn to water for breeding, water bodies are potential breeding sites for the most prominent malaria vector in the region. Water body maps serve as input for modelling malaria risk and developing breeding site probability maps. Low-resolution EO data (rainfall estimates, land surface temperature, vegetation indices) were used to assess factors related to malaria transmission. By taking into account the population distribution in the project area, partners were able to model the spatial distribution and spread of malaria.

"The project partners developed EO applications to support the daily work of the National Malaria Control Programmes."

All these EO products were combined into a MALAREO MapBook for assisting in the implementation of malaria vector control measures. With appropriate stakeholder training, EO solutions could be applied in the fight against malaria.

MALAREO

- Coordinated by Eurosense Belfotop in Belgium.
- Funded under FP7-SPACE.
- http://cordis.europa.eu/result/brief/rcn/10418_en.html
- Project website: http://www.malareo.eu

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TARGETING CANCER: NANOCONTAINERS DELIVER LOCALISED CHEMOTHERAPY

Cancer is the second most common cause of death in the EU — and this figure is expected to rise due to an ageing population in Europe. In his ERC-funded NANOTHERAPY project, Professor George Kordas has developed 'nanocontainers' — tiny hollow spheres with a width measured in molecules — which are attracted to cancer cells and, once there, deliver their payload of chemotherapy drugs. It is a kind of 'guided missile', aimed at the heart of a cancer cell.


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'Our project NANOTHERAPY (A Novel Nanocontainer drug carrier for targeted treatment of prostate cancer) aims to use nanoparticles or 'nanocontainers' as carriers for drug delivery to target diseases such as cancer,' explains Prof. Kordas. 'We have demonstrated their success and are now in the process of moving towards clinical trials.'

'What we are talking about is extremely local chemotherapy,' he continues. The containers could be loaded with drugs and injected into the patient. The team has designed coatings for the nanocontainers that are sensitive to a cancer environment and external alternating magnetic fields (such as radio-frequency radiation). These 'targeting molecules', which are added on the carriers' surface, are attracted to cancer cell molecules: making it possible to target specific cancers. This has been demonstrated in two types of cancer — breast and prostate cancer.

Guided missiles

'Our main achievement is the proof of targeting,' the professor says. 'There's nothing like this combination in the literature. Our containers have specificities to the cancers and the way they accumulate in cancer cells is unique.'

The project team has developed a chemical process for fabricating hollow containers from polymers. 'We make a core, add a coating crafted with the targeting molecules, then remove the core,' explains Prof. Kordas. 'The surface is therefore coated with molecules that have positive and negative sites that are both attracted to, and trapped by, the molecules on the outside of cancer cells.'

The nanocontainers are also sensitive to the cancer cells' internal environment and are destroyed on entry — delivering the payload of drugs inside. They can be used to deliver traditional chemotherapy drugs, but may also enable a new generation of more effective drugs that are even more toxic to cancers. Because they will be delivered safely to the cells where they are needed, any side effects for the patient should be significantly reduced.

'Through targeting they become much more concentrated around cancer cells. So the non-toxic nanocontainers can deliver toxic drugs directly to the cancer,' he continues. 'Our results so far indicate a 20-30% reduction in cancer cells in just two weeks. The nanocontainers become internalised in the cells and are destroyed — becoming non-toxic — while releasing their loaded drug, destroying the cancer cells' DNA.'

'Chemotherapy doses are limited by patients' tolerance to the drugs' toxicity — usually related to their weight and height — but localised delivery means higher concentrations are possible,' he explains. 'Combination therapy can reduce total toxicity by 70%, but our nanocontainers can reduce toxicity to the patient to close to zero.'

Business plan and patents

'Most of our work during this five-year project has been on the chemistry used to produce these targeting molecules,' he explains. 'At first, we used computer simulation to design new molecules and then went on to explore their properties: what sites are active? What can be bonded together? What difference does attaching them to the surface of the nanocontainer make to the molecules?'

'My background is in a different field — physics and materials science — where I had been designing nanocontainers for 10 years,' he recalls. 'But that was for industrial applications — such as self-healing of cars and building materials — so I'm thankful to the ERC panels, evaluators and reviewers for being open-minded enough to fund this medical research based on the quality of my previous work.'

'Thanks to the ERC grant, we were able to recruit 15 very high-standard researchers to the team — mostly working in polymer chemistry and pharmacology. The ERC 'Proof of Concept' grant is now funding a business plan and the filing of patents on the technology.'

'During the summer of 2014, we plan to find companies to test the technology,' the professor says. 'The nanocontainers can deliver any drug — for different diseases and types of cancers — so we want to work with several companies. We may be around three years away from clinical trials, however.'

'I have lost friends to cancer and I hope this technology will help people,' he says. 'I will be very happy if it can contribute to reducing suffering.'

NANOTHERAPY

- ★ Coordinated by Demokritos in Greece.
- ★ Funded under FP7-IDEAS-ERC.
- ★ http://erc.europa.eu/erc-stories/targeting-cancer-nanocontainers-deliver-localised-chemotherapy
- ★ Project website: http://www.ims.demokritos.gr/nanotherapy/index.php?option=com_content

PATIENTS WITH KIDNEY FAILURE TO GET A NEW LEASE ON LIFE

End stage kidney disease is a global public health problem with an estimated 2.4 million patients on dialysis. The number of new cases is rising (7-8 % annually) due to population ageing and increased diabetes prevalence. The NEPHRON+ project is improving the lives of patients by developing a wearable artificial kidney device, enabled with information and communication technologies for remote monitoring.

Chronic kidney disease will affect 1 in 10 of us at some point in our lives. For those of us unlucky enough to suffer renal failure as a result, the health consequences can be disastrous.

Without treatment, kidney failure is deadly. However, even the best treatments are not ideal. Patients have to be treated with a dialysis machine at home or in hospital, sometimes as often as once every four hours. Patients spend a large part of their lives connected to dialysis equipment.

What's more, the life expectancy of a person in their 20s who has suffered kidney failure is just 20 years, unless they're lucky enough to receive a donated organ.

All this could change, however. An EU-funded research consortium has been developing a wearable artificial kidney that would make it possible for dialysis patients to lead a more full and active life while adding another 10 to 16 years to their life expectancy.


© Nanodialysis

The future of wearable dialysis

The NEPHRON+ (ICT-enabled Wearable Artificial Kidney and Personal Renal Care System) 'Wearable artificial kidney device' (WAKD) is currently undergoing animal trials and will have to pass several rounds of stringent tests in humans before it is ready to be used by all patients with kidney disease. However, the project has reached a stage where commercial partners are ready to take the technology to the next stage. With kidney failure rates on the rise and pressure on hospitals to find more cost effective and clinically effective treatments, the market for wearable dialysis devices could be worth as much as EUR 15 billion per year, according to Dr Leonidas Lymberopoulos, project coordinator.

The advantages of wearable dialysis

The NEPHRON+ system works like a conventional dialysis machine, taking the patient's blood and passing it through a number of filters, removing waste products that would be excreted

"The market for wearable dialysis devices could be worth as much as EUR 15 billion per year."

in a healthy patient's urine and making sure that the patient's blood pressure stays at a safe level. The patient can see the monitored data via their smartphone. What's more, the data can be sent to the patient's specialist doctor, so that their condition can be monitored at all times. In addition, the wearable device will reduce the chance that a patient has to go to hospital for emergency treatment, as

constant dialysis is much more effective than intermittent treatment.

Frank Simonis, technical manager of NEPHRON+ explains: 'Continuous, 24/7 dialysis with a wearable device offers a smooth and uniform extraction of toxins over the day similar to the natural kidney. This improves the health condition tremendously and eliminates the 'after dialysis sickness syndrome' that many patients suffer from.'

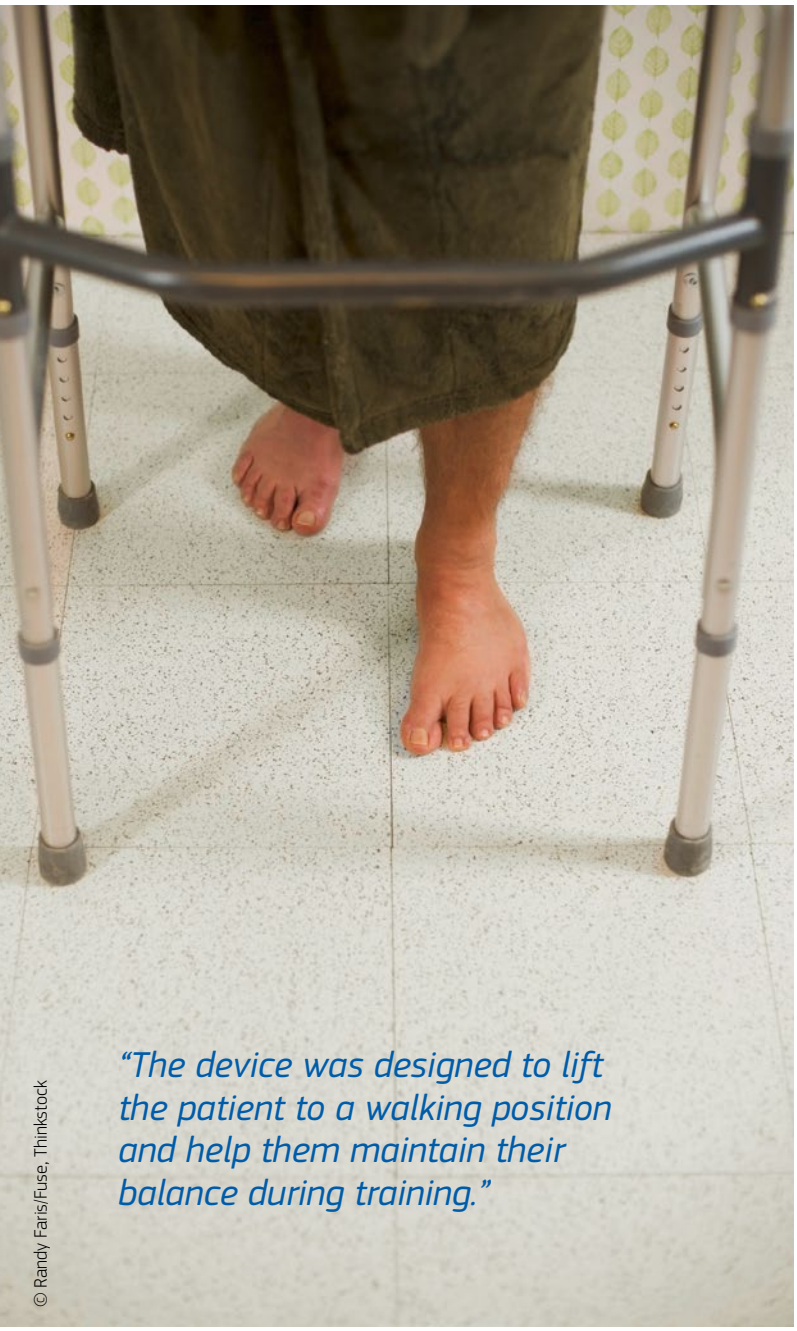
Dr Lymberopoulos suggests that the cost of caring for a patient with kidney disease will fall due to the reduction in the need for prescription medicine, nursing staff and installation costs. Cost savings in medical care are expected to be EUR 15 000-20 000/patient/year. With 340 000 patients in Europe this implies an annual saving of EUR 5-7 billion. Most importantly, explains Ms Anastasia Garbi, former project leader, 'the patient can now lead a more normal life, working and exercising without the regular long visits to the haemodialysis centres.'

NEPHRON+

★ Coordinated by Exodus in Greece.
★ Funded under FP7-ICT.
★ http://cordis.europa.eu/result/story/rcn/13003_en.html
★ Project website: http://www.nephronplus.eu

A STROKE REHABILITATION DEVICE

Currently, 1 in 500 people in Europe will suffer a stroke, and this number is expected to double in the next 50 years. Finding rehabilitation solutions for stroke patients could improve their physical recovery and overall quality of life.



"The device was designed to lift the patient to a walking position and help them maintain their balance during training."

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Stroke constitutes one of the common causes of disability in Europe, with patients failing to live independently in their own homes. Given that stroke patient rehabilitation and hospitalisation costs amount to billions of euros per year, Europe is determined to find rehabilitation solutions that will restore their mobility.

To regain their independence, patients that have suffered a stroke episode must learn to walk again as soon as possible without assistance. To aid in such physical recovery, the EU-funded WALKX (Development of a raising, walking and exercise device with upper body support for rehabilitation of stroke victims) project developed a gait training device. The term gait training is used to describe the rehabilitation process of walking again through physical exercise and coordinated walking steps.

The WALKX rehabilitation device consisted of a weight-bearing vest that supports the upper body and is linked to a sensor system. The device was designed to lift the patient to a walking position and help them maintain their balance during training. The upright position is vital for gaining strength and for improving blood circulation and organ function after a stroke. At the same time, this support function will relieve physiotherapists of a significant amount of weight, since they often injure themselves during gait training.

Finally, to allow patients to train more intensely while remaining stationary, a motorised feet propulsion unit was added to the device. Their training would also be more controlled and variable with task-specific walking activities.

Apart from offering quality rehabilitation to stroke patients, the WALKX device provides the opportunity for overall physical training, thereby preventing future stroke attacks. The ergonomic nature of the WALKX device could be exploited for recovery from other medical conditions, including spinal cord injuries and Parkinson's disease.

WALKX

★ Coordinated by the Made for Movement Group in Norway.
★ Funded under FP7-SME.
★ http://cordis.europa.eu/result/brief/rcn/12998_en.html
★ Project website: https://sites.google.com/site/walkx262569/

SOCIAL SCIENCES AND HUMANITIES

CAN MACHINES CRACK THE MYSTERY OF MUSIC CREATION?

Who has not wanted to compose as catchy a song as Bob Dylan, Paul McCartney or Charlie Parker? French researcher Dr François Pachet has always been fascinated by the mystery of how these great musicians managed to create these amazingly iconic, and strangely addictive, melodies.

Thanks to his ERC Advanced Grant, Pachet and his team are working on a software package, FLOWMACHINES (Flow Machines: Interacting with Style), which will help musicians or writers to explore the magic of creativity and compose music or write books in an easier way. By deciphering the intriguing relations between technology and musical creativity, he aims to offer clues to creators who wish to turn style and its various dimensions into malleable and interactive objects.

The idea behind Pachet's project is that when you want to create something really different, you need to invent your own style. 'New things usually come from taking existing styles and adding a new element; a chord sequence, a new rhyme or a different rhythm for instance. If you take Picasso, the way he invented his style was by playing with, and distorting, the styles of his predecessors. Picasso was actually a very good painter in the style of Velazquez and others before him. By playing with their styles, Picasso developed his own,' explains Pachet.

He is working on the development of a computer-based compositional tool that makes developing your own individual style easier. This so-called 'Flow machine' works with sequential data such as musical notes, chords or words in texts. A string of this data makes a corpus, which can be for instance all music composed by Charlie Parker or all texts written by Marcel Proust. 'What we are trying to do is to add into the corpus new ideas, which we call constraints. It means that a person using the 'Flow machine' can decide to compose blues in the style of Charlie Parker but to have all the notes different,' says Pachet.

Thanks to the 'Flow machine', the constraints are added digitally and the user can quickly see the result and decide whether the musical phrase is what they had in mind. If it is not, they can alter the constraints. 'A trick of this project, in a positive way, is to turn the creativity question into a mathematical problem,' emphasises the researcher.

What's old is new again

To conduct their research, Pachet's team develops new technologies based on models invented by Russian mathematician Andrey Markov. Markov models have many applications: from economic evaluations to Google's ranking algorithms. Markov chains are

well-known tools used to model the statistical properties of temporal sequences. Sequential data are the equivalent of Markov chains in the 'FLOWMACHINES' project. 'What makes our experiments innovative is that no one was able until now to control the degree of plagiarism when replicating these chains. Recently, we have come up with new results where our 'Flow machine' was actually able to do this. This is a real breakthrough,' notes Pachet.

According to him, the 'Flow machine' will not produce pastiches, but new music and texts. 'We create new sequences in a way that people can still recognise the original style of a musical piece without having to use any of the successive items that were present in the original corpus. What we can do is to take all jazz from the 1920s, 30s, 40s and 50s and compose a new piece where only 10% of it originates from the 20s for example.'

Asked about what inspired him to call his project FLOWMACHINES, Dr Pachet responded that the idea came from a concept developed by Hungarian-American psychologist Mihaly Csikszentmihalyi who describes 'flow' as the state of mind of people who have found the ideal equilibrium between boredom and total absorption in what they are doing. The 'Flow machine' can act as a tool to help people to achieve this state of flow.

Comic strip, Morricone and his future plans

Pachet, who is also a jazz musician and has released several CDs, has plans to publish a comic strip about his project. He also wants to write a book about the series of interviews he conducted with famous composers to advance his research. 'A few weeks ago we interviewed Ennio Morricone and asked him about the melodies he had composed for Once Upon a Time in the West and so on. We did the same with Ivan Lins, one of the best composers in Brazil,' Pachet adds. His idea is to try to understand why people intuitively like the melodies they composed.

Pachet has worked at Sony Computer Science's lab, a 'blue sky' research centre based in Paris, for the last 16 years. This environment has enabled him to focus on his research uninterrupted. 'I think there is a lot of convergence between the mission of the ERC and the mission of this lab. The ERC grant has given me the freedom to hire people, to travel to meet musicians, and to buy equipment. But the grant also brings you recognition and the confidence of the people you meet in your work.'

The result of Pachet's project could be soon put to the test in a very public way. Last year, the researcher obtained a licence to play in the Paris metro where he plans to go with his 'Flow machine' to gauge people's reactions. 'The Paris metro is the biggest stage in the world with millions of people taking the metro every day. To be honest, I have not gone there yet but I will take my chance as soon as I feel the courage to conduct my experiments in the spotlight offered by this renowned location,' concludes Pachet.

FLOWMACHINES

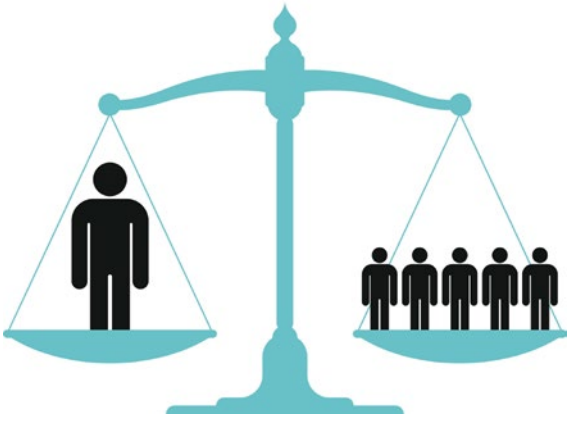
- Coordinated by Pierre-and-Marie-Curie University in France.
- Funded under FP7-IDEAS-ERC.
- http://cordis.europa.eu/projects/rcn/104383_en.html
- http://erc.europa.eu/erc-stories/can-machines-crack-mystery-music-creation
- Project website: http://www.flow-machines.com
- http://bit.ly/1j1t1S4

THE EMERGING DEBATE ON INEQUALITIES

An EU-funded project has offered new insight into inequalities in income/wealth and education, and their associated social/political/cultural impacts. With important policy implications, the initiative's research activities spotlight inequality for 25 EU countries as well as for Australia, Canada, Japan and the United States.

As inequalities become increasingly pronounced, and especially so in wealthier countries, there is a need to study associated changes in the social, political and cultural domains. The GINI (Growing inequalities' impacts) project was set up to separate and underline the issues at hand. Project objectives focused on three broad areas relevant to the emerging international debate: different dimensions and the precise nature of various inequalities, impacts and policies.

Since the 1980s, income inequality has increased in most of the developed world. Country studies revealed significant variations in the ways and extent to which individual nations have attempted to alleviate associated pressures or to handle their consequences. Researchers also examined country-specific differences concerning educational inequalities, and social as well as political and cultural impacts of increasing inequalities in income, wealth and education. Another research focus was on redistributive and educational policies.



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Project results were mainly disseminated through the concluding conference, circulation of a summary of results (also available on the project website) and a special workshop organised by the Directorate-General for Employment, Social Affairs and Inclusion. Five policy papers, presented at the workshop, were written for the Directorate-General.

GINI partners generated extensive knowledge on the topic of inequalities with regard to income, earnings and education, and presented a diverse set of policy conclusions. These cover, among others, policies related to the welfare state, unemployment and active labour market policies, exclusion, resourcing policies and education.

GINI

- Coordinated by the University of Amsterdam in the Netherlands.
- Funded under FP7-SSH.
- http://cordis.europa.eu/result/brief/rcn/9828_en.html
- Project website: http://www.gini-research.org

ENHANCING SUICIDE PREVENTION MEASURES

European researchers have employed a comprehensive approach towards suicide research and the development of interventions. Their assessments and recommendations for implementation are contributing to sustainable suicide prevention policymaking.

Supported by EU funding, the OSPI-EUROPE (Optimizing suicide prevention programs and their implementation in Europe) project aimed to provide stakeholders, health politicians and the European Commission with an efficient and evidence-based suicide prevention concept.

Consortium members, representing 14 institutions from 10 European countries, implemented a state-of-the-art intervention programme on suicide prevention in four European model regions. Building on concepts and materials developed within the European Alliance Against Depression (EAAD), they covered five areas of focus: Level 1 involved the education and training of primary care physicians; Level 2 covered public awareness; Level 3 targeted training opportunities for community facilitators (e.g. priests, social workers, teachers and the media); Level 4 involved offers for high-risk groups and support for self-help activities and relatives; and Level 5 entailed the restriction of lethal means.

"Project partners developed a newly optimised and improved intervention concept."

Consultations with key players and a thorough review and evaluation of published reports on prevention programmes informed the development of this state-of-the-art intervention concept. Cross-national differences in suicide rates were considered, and a comparative analysis carried out of possible explanations for these differences and their related aspects. This analysis facilitated the appropriate adaptation of intervention programmes to specific situations in different European regions.


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OSPI-EUROPE implemented its comparable multilevel community-based prevention intervention across countries with diverse EU health systems and socio-cultural characteristics. For each country — Germany, Hungary, Ireland and Portugal — two specific population regions were selected, one for intervention and the other for control. The project team evaluated suicide prevention efficacy and intermediate outcomes, as well as implementation processes and health economic aspects.

Although there are difficulties in proving the effectiveness of every possible measure, the multilevel intervention approach and evaluations offer insight into the mechanisms and measures involved: which are redundant or have potential for optimisation. On the basis of evaluation results, project partners developed a newly optimised and improved intervention concept.

Intensive dissemination and public relations activities were an important part of the project's work, and helped to reach the wider public, the scientific community, policymakers and stakeholders at both national and EU levels. Overall, OSPI-EUROPE contributed to comprehensive and evidence-based recommendations for implementing sustainable suicide preventive measures.

OSPI-EUROPE

- Coordinated by Leipzig University in Germany.
- Funded under FP7-HEALTH.
- http://cordis.europa.eu/result/brief/rcn/5907_en.html
- Project website: http://www.ospi-europe.com
- http://bit.ly/1nd05dJ

BETTER USE OF STATISTICS FOR ECONOMIC GROWTH

Europe 2020 is the EU's 10-year growth strategy that seeks to facilitate smarter, more sustainable and more inclusive economic growth. Scientists have developed important ways to enhance the exploitation of business statistics to meet goals.

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More efficient policymaking and socioeconomic research to achieve economic growth require high-quality statistical business information. The EU-funded project BLUE-ETS (BLUE-Enterprise and Trade Statistics) focused on development of cost-effective improvements in the collection and use of business data that simultaneously reduce the complexity of related regulations for businesses.

"Developed options can reduce the statistical burden through application of soft computing and text mining."

The project was tailored to the European Commission's programme Modernisation of European Enterprise and Trade Statistics (MEETS). Work focused on pilot testing advanced statistical methodologies and cutting-edge best practices, as well as ensuring greater contributions of National Statistical Institutes (NSIs) in creating such tools and procedures.

Scientists have developed options for data producers that reduce the statistical burden through application of soft computing and text mining. They include tools for fast extraction of relevant data, a fuzzy logic tool for classification and a neural network-based tool drawing on genetic programming. Researchers have also provided a number of methodologies for data users. These include techniques to improve statistical data availability, integrate data and databases, and enhance access and release.

Enterprises are both data users and data providers and thus have a disproportionate burden regarding their contribution to high-quality statistical business information. BLUE-ETS has proposed ways to reduce that burden as well as highlighted the importance of motivation on the part of enterprises to both use and contribute to NSI statistics. The project also pointed to the important role of NSIs in improving both their own statistical literacy and that of business users.

Finally, scientists developed a new set of indicators to help official statistics capture structural jumps and changes to be more relevant to policymakers. Some of these cover measurement of intangible assets, a multidimensional competitive index for public institutions, indicators for business collaboration and collaborative working environments, while others cover rural areas.

BLUE-ETS has successfully demonstrated that reducing the statistical burden on businesses can be accomplished with methodologies and activities that actually increase the accuracy and robustness of statistical business information and its relevance for policy use. Implementation will help the EU through the severe economic crisis it is now facing and point the way to continued economic growth in the future.

BLUE-ETS

- Coordinated by the National Institute of Statistics in Italy.
- Funded under FP7-SSH.
- http://cordis.europa.eu/result/brief/rcn/12990_en.html
- Project website: http://www.blue-ets.istat.it

OPENING UP A UNIVERSE OF EMPLOYMENT POSSIBILITIES

Nearly a quarter of Europe's adults under 25 are not in education, employment or training. These so-called NEETs are struggling to get on the first step of the employment ladder in this harsh economic climate. Young adults say that they need more confidence to get through job interviews but, with opportunities so scarce, they often go into interviews feeling nervous and underprepared. Now an EU-funded research project that uses virtual reality is helping to change that.

Youth unemployment leads to a range of problems, from poverty to social exclusion. The longer that young people stay unemployed, the harder it is for them to ever enter the workplace.

But getting that first job is a daunting prospect. As well as having less work experience than the generation above them, first-time job seekers are at a disadvantage in interviews. The TARDIS (Training young Adults' Regulation of emotions and Development of social Interaction Skills) project is redressing that balance by offering young people 'virtual interviews' to practise their social skills and help them prepare for the real thing.

TARDIS — A vehicle for success

The designers of the system — a consortium of academics from the Netherlands, Germany, France and the UK — have created a system that uses 'virtual agents'.

'The platform provides a realistic interviewing environment, as close as possible to real life,' says Dr Aurélie Jonquoy, the TARDIS Project Manager. 'TARDIS is a 'serious game', in which many potentially limiting features of the real world are removed. As young people are familiar with — and like — using computer games, the game aspect of TARDIS is very important in keeping them motivated to train again and again and as many times as they need.'

The system is made up of several parts: the user interacts with a virtual interviewer via a webcam and an audio headset. The virtual interviewer asks questions and gives realistic verbal and non-verbal feedback, such as giving encouraging comments, or making gestures of boredom or annoyance.

Helping young adults to manage interview stress

The system also has a sophisticated emotional model that allows it to understand how the user is feeling, based on their body language and tone of voice. This model allows the virtual interviewer to give appropriate responses to the user. As an added feature, the user can see at a glance where they looked confident and relaxed, and where they appeared to be nervous.

The system is being promoted and offered to youth organisations throughout Europe. One of the early adopters is the YMCA London South West. Their Get On Track programme targets young people in economically disadvantaged parts of London. Anna Harris, the Get On Track Project Coordinator, explains why they have volunteered to pilot the system:

'The reason for engaging in the TARDIS programme was to give the young people some valuable interview practice and experience,' she said. 'I think having regular access to such a project would be fantastic as it allows the young people to see themselves in an interview situation and have relevant key feedback which can help progress and refine their interview skills. This will then reduce the pressure felt when attending interviews and also help in setting them up to win.'

'With TARDIS, young people can explore their strengths and weaknesses and reduce their anxiety of applying and being interviewed for jobs,' said Dr Jonquoy, adding that the virtual agent will allow over-stretched youth organisations to help many more disadvantaged young people.

TARDIS

- Coordinated by Pierre-and-Marie-Curie University in France.
- Funded under FP7-ICT.
- http://cordis.europa.eu/result/story/rcn/13067_en.html
- Project website: http://www.tardis-project.eu
- http://bit.ly/1j1vWKs

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"The team modified a CTS, developed and patented by a partner for cars, to be suitable for helicopter use."

ENERGY AND TRANSPORT

SMART SENSORS FOR GREENER HELICOPTERS

EU-funded scientists have developed technology to monitor torque and rotation speed of helicopter turboshaft engines. These smart sensors could play an important role in the development of greener and quieter helicopters in the near future.

The 'Sustainable and green engine' (SAGE) 5 concept is an 'Integrated technology demonstrator' (ITD) for developing eco-friendly and silent turboshaft engines for helicopters. This is in line with the Clean Sky initiative. Reducing emissions of toxic gases is largely related to increasing fuel conversion efficiency and thus lowering fuel consumption. Power transmission optimisation can thus increase efficiency and reduce noise. In order to optimise fuel consumption and engine function, it is necessary to modulate shaft speed and the temperature and pressure of air, fuel and oil.

EU-funded scientists investigated the potential of smart monitoring technology to facilitate reductions in emissions and noise as part of the project ACTIPPTSENS (Active pressure, position and temperature sensors for turboshaft engines). The original focus was on two types of emerging sensor technologies: 'Contactless torque sensors' (CTSs) to measure torque and rotation speed and piezoelectric 'microelectromechanical system' (MEMS) sensors. For the latter, the plan was to incorporate a 'piezoelectric transducer' (PZT) pressure sensor based on electrospun PZT nanofibres with a thermocouple to measure operating temperature.

The team modified a CTS, developed and patented by a partner for cars, to be suitable for helicopter use. It was manufactured and tested, demonstrating better sensing performance and durability against ageing. In addition, it is capable of measuring static behaviour and can be plugged into the shaft rather than being inserted in a cut.

Although the piezoelectric nanofibre mesh with the desired microstructure was successfully fabricated, technical difficulties with further process steps prohibited subsequent development of the PZT-MEMS sensor. Scientists thus used a commercial PZT solution instead.

Further development and optimisation of the smart monitoring technology will have important implications for the production of greener and quieter helicopters in the near future.

ACTIPPTSENS

- Coordinated by Tecnalia in Spain.
- Funded under FP7-JTI.
- http://cordis.europa.eu/result/brief/rcn/12991_en.html
- Project website: http://www.actipptsens.eu/

SOLAR-POWERED AIR CONDITIONING

Air conditioning in the summer months is putting more and more pressure on the electrical grid. To address this problem, a new research project has developed a low-cost, solar air conditioning unit.

Absorption cooling is a system that uses a heat source to drive cooling and requires very little power. Although a very promising technology, current systems are expensive and incompatible with common air conditioning designs.

In response, the EU-funded CESAR (Cost-Effective Solar AiR conditioning) project sought to design and build a small, cheap absorption cooling unit that uses a renewable energy source. To achieve this, they needed to develop new cooling fluids, heat exchangers and a control system.

As such, CESAR tested various cooling fluids before settling on the most promising one and studying it extensively for compatibility with the prototype device. The rest of the heat exchange system (absorber, generator, condenser and evaporator) has been redesigned to reduce cost and improve efficiency. Design software and algorithms were also advanced to aid in the development and testing of the prototype in the laboratory and in the field.

"CESAR tested various cooling fluids before settling on the most promising one."

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Further development and validation of control system software and design tools is required. This new solar air conditioning unit promises to revolutionise the industry through significant power savings and increased use of renewable energy sources.

CESAR

- Coordinated by Tecnalia in Spain.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/13058_en.html
- Project website: http://www.cesarproject.net

NEW LENS TECHNOLOGY FOR SOLAR COLLECTORS

Researchers have developed a prototype production method for the manufacture of optical lenses that would improve the efficiency of solar collectors. The lenses themselves have a micro-structured surface that provides extreme precision, allowing for highly accurate control of incoming light.

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The 'concentrated photovoltaic' (CPV) market currently relies on optics made of silicon-on-glass. The light transmission through this type of lens deteriorates over time, and the lifetime of the material can be as short as 15 years.

A better option in terms of durability is a polymer-on-glass lens, which would also increase the power generation of CPV modules by 5%. Within the EU-funded POLYGLASS (Development of a new method to produce high efficiency solar concentrators based on polymer casted directly on glass) project, consortia successfully developed a prototype manufacturing process and prototype CPV module that uses these lenses.

The project set out to deliver this new competitive product with a view to prolonging material lifetimes, reducing installation and maintenance costs, and reducing manufacturing costs. Ultimately, the intention was to increase the generation of solar power.

Crucial to the success of the project was the development of a suitable polymer, a production tool and a manufacturing process. Once achieved, researchers constructed the prototype CPV module, which was subjected to industry standard tests to prove suitability.

"Crucial to the success of the project was the development of a suitable polymer, a production tool and a manufacturing process."

The prototype was also exposed to daylight, showing good performance in generating electrical current under normal conditions. Furthermore, researchers reported excellent results for adhesion between the polymer and glass, which could have other potential applications beyond the project.

POLYGLASS technology comes at a time when demand for solar collector systems and cost-effective components is high. As such, it is set to increase European competitiveness in this area, especially because the novel manufacturing process is flexible.

POLYGLASS

- Coordinated by DKI Plast in Denmark.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/12997_en.html
- Project website: http://www.polyglass-fp7.eu

HIGH-TECH SAFETY BOOST FOR TRAIN AXLES

A set of new instruments promises to help assess cracks and corrosion in train axles, streamlining maintenance and upgrading safety. This promises to enhance train operation and bring benefits to rail users.

Europe's rail infrastructure for passengers and cargo is growing considerably, demanding increased reliability and safety in rail vehicles and equipment. Train axles in particular are prone to damage from constant cracking and corrosion that increases with distance travelled. The EU-funded project WOLAXIM (Whole life rail axle assessment and improvement) worked on upgrading the efficiency of axles by extending their shelf life and improving inspection technologies.

The project developed three promising methods for detecting cracks and evaluating corrosion. The first involves a portable microscope and software tools to pinpoint corrosion more efficiently and improve decision making on scrapping axles. The second method involves shortening overnight inspections of hollow axles for high-speed trains from 20 minutes to 5 minutes, while the third verifies axle strength as wagons pass through the station.

The project designed and tested an instrument that detects cracks 2-3 mm deep on the axles of trains passing through inspection stations at 5-10 km/h. It also built an instrument to assess corrosion damage, including risk of fatigue crack growth within an area of 10 cm^2 over a 10-second measurement period. The third instrument that was produced inspected hollow axles using a non-rotating probe and could detect cracks up to 3 mm deep within 5 minutes. Lastly, the project team developed software to help calculate inspection intervals for crack growth caused by corrosion fatigue, providing yet another analysis tool for axle life estimation.

With the European Commission considering rail as the greenest transport mode and working towards its propagation, the project results could help enhance safety and efficiency significantly. This is especially important since there are currently around 250 000 passenger carriages and over 1.2 million freight wagons in circulation with a total of 3.5 million axles.

The project will particularly help small and medium-sized enterprises in the sector to build on these results and cater to this enormous market. This will bring benefits not only to the transport sector but to the economy as well, while underlining rail as a safer, greener and leaner transport mode.

WOLAXIM

- Coordinated by TWI Limited in the United Kingdom.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/13036_en.html
- Project website: http://www.wolaxim.eu
- http://bit.ly/1gGlttA

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HELPING TRANSPORT KEEP ITS COOL

Any future technology used in surface transport will need to be cooled in the quietest and most efficient way possible. Therefore, an EU-funded initiative has investigated the thermal efficiency and acoustic performance of cooling systems in road vehicles and trains.

Strict EU environmental regulations have increased the demand for cooling units in vehicles that do not produce excessive noise. The ECOQUEST (Efficient Cooling Systems for Quieter Surface Transport) project developed a quieter cooling unit with lower carbon dioxide (CO_2) emissions for both automobiles and trains.

Project partners developed new compact layouts, innovative heat management strategies, innovative fan designs and new passive noise control measures. These were integrated into the new cooling systems. Mass produced units for cars and larger units produced in smaller numbers for trains were considered at the same time.

Researchers investigated all aspects of engine cooling. For the automotive application, a typical car platform was chosen and heat dissipation studied by modelling various module configurations. These were then analysed using system tools such as multiphysics simulation software.

"Two full-scale modules, one for cars or lorries and another for trains, were implemented in vehicles and examined under realistic test conditions."

The cooling system for trains involved a detailed study of the coolant efficiency ratio, noise emission and energy consumption. In addition, researchers investigated the best use of space, the optimal weight of the unit and integration into a powertrain. By coupling the vehicle model with the cooling system, the entire system could be successfully studied.

New design strategies were validated by full-scale tests. Two full-scale modules, one for cars or lorries and another for trains, were implemented in vehicles and examined under realistic test conditions. The technologies were developed with regard to improving thermal efficiency while minimising energy consumption, CO_2 emissions, noise and costs.


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A high-performance numerical acoustics simulation method was adapted and validated through a separate series of small-scale model tests at an acoustic laboratory for noise assessment. The results will provide an important tool for future component development and certification of the vehicle.

Commercialisation of ECOQUEST cooling systems will reduce noise at source while increasing energy efficiency and reducing CO_2 emissions. This will enable Europe's automobile and locomotive manufacturers to develop more eco-friendly surface transport for people and goods, and enhance the EU's global competitiveness.

ECOQUEST

- Coordinated by the University of Siegen in Germany.
- Funded under FP7-TRANSPORT.
- http://cordis.europa.eu/result/brief/rcn/11344_en.html
- Project website: http://www.uni-siegen.de/ecoquest/

EFFECTIVE NEW SELF-HEATING TECHNOLOGY

Efficient heating of tools and materials during manufacturing significantly decreases production time and costs as well as energy consumption. EU-funded scientists have developed novel technology to do this in many applications.

Composites are increasingly used in numerous applications and current demand exceeds the production capabilities of manufacturers. Textile preforming combined with liquid moulding technologies offer exciting potential for automation and enhanced productivity, but innovation is required to overcome certain technical challenges.

EU funding gave scientists the opportunity to develop solutions through the project EMBROIDERY (Development of energy efficient / lightweight composite parts and tooling based on Tailored Fibre Placement technology / self heating technology). The focus was on exploitation of 'Tailored fibre placement' (TFP) technology that was developed in the 1990s for embroidery machinery. Researchers adapted it for advanced composites manufacturing, by embedding carbon fibres or metallic wires in elastomeric materials or rigid composite laminates to produce a resistive self-heated layer.

Three applications were identified by small and medium-sized enterprises (SMEs): self-heated flexible membranes for preforming or repair tasks, self-heated rigid laminates for tooling (moulding) and self-heated rigid laminates for multifunctional composites. The team chose silicone membranes for testing along with pre-preg materials, a liquid laminating resin and a surface gel coat for the laminates. Heat transfer simulations explored the best configuration of self-heated laminates for homogeneous thermal

distribution in 'Resin transfer moulding' (RTM) moulds.

"EMBROIDERY promises a significant cost reduction and sales growth compared to currently manufactured components."

TFP enables fibre steering such that the fibre orientation can be aligned with the stress field for optimal reinforcement and material usage and ultra-light components. Scientists conducted embedding trials to validate flexible membranes and prepreg materials for rigid laminates. The electrical and thermal properties of specimens demonstrated that this technology can fulfil all requirements, and novel high-performance prototypes were produced. Scientists developed the computer algorithms to enable automated fibre steering via spindle control of an endless feeding device for maximum benefits.

EMBROIDERY concepts for self-heating based on TFP-embedded layers promises a significant cost reduction and sales growth compared to currently manufactured components. This technology decreases production time and energy consumption while increasing the quality of components and will have a major impact on the competitiveness of related SMEs.

EMBROIDERY

- Coordinated by Tecnalia in Spain.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/13038_en.html
- Project website: http://www.embroidery-project.eu

AN ECO-FRIENDLY HELICOPTER ENGINE

EU-funded scientists have developed a novel diesel engine for light helicopters as an alternative to conventional turboshaft engines. The technology demonstrated substantial reductions in fuel consumption and emissions.

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Helicopters conventionally employ a turboshaft engine that has a much better power-to-weight ratio compared to diesel engines. However, engine efficiency decreases dramatically with increasing altitude and it requires a large and heavy reduction gear to reduce the main rotor speed to the desired revolutions-per-minute. The EU-funded project DELILAH (Diesel engine matching the ideal light platform of the helicopter) developed a lightweight, high-power diesel engine that can also operate on biofuel.

The team conducted a multi-criteria analysis to develop the desired clean-energy solutions. Scientists focused on optimising the design of a turbocharged diesel engine with self-ignition and an electronic control system. Their goal was to achieve substantial reductions in the emission of toxic substances, carbon dioxide (CO_2) and noise.

To realise such an engine, the team employed extensive modelling to solve problems related to engine configuration design and integration with the rotorcraft. Scientists analysed the high-dimensional, dynamic, multi-body mechanical system and the adaptive control system to address issues related to vibration, noise, oscillations, engine control and response.

Comparison of flight scenarios demonstrated that the DELILAH optimal turbocharged diesel engine for light helicopters could potentially reduce fuel consumption by 50%. As a result, CO_2 emissions were halved with 20 times less carbon monoxide production and over 200 times less soot than conventional turboshaft engines. The results are fully in line with the environmental impact reductions laid out by the Advisory Council for Aviation Research and Innovation in Europe (ACARE) for the year 2020. The engine is compatible with the use of alternative fuels such as 100% biofuel (B100), reducing dependence on fossil fuels and thus reducing greenhouse gas emissions.

DELILAH technology promises to have a significant impact on the environmental and operating costs associated with helicopter flight. Increasing the competitiveness of the helicopter industry while drastically reducing emissions will make the new diesel engine for light helicopters a marketing dream.

DELILAH

- Coordinated by Lublin University of Technology in Poland.
- Funded under FP7-JTI.
- http://cordis.europa.eu/result/brief/rcn/12977_en.html

ENVIRONMENT AND SOCIETY

INTERNATIONAL EXCHANGE FOSTERS BETTER LOCAL ACTION ON DEFORESTATION

Many efforts are being made at a governmental and global level to reduce deforestation and other major contributors to climate change. The REDD-ALERT project focused on how such international and national policy initiatives — for example, the discussions taking place under the 'United Nations framework convention on climate change' (UNFCCC) — could be translated into ideas for action on the ground.

Through the research activities of its 12 partners in four different regions in the world, the project helped establish links between international policymakers and the local stakeholders whose activities have an impact on deforestation. The project team examined the socio-economic drivers and environmental impact of their practices, and the policy options that could be pursued to reduce associated 'greenhouse gas' (GHG) emissions.

The REDD-ALERT (Reducing emissions from deforestation and degradation through alternative landuses in rainforests of the Tropics) project involved several European and international agricultural research institutes. Focusing on four representative countries (Cameroon, Indonesia, Peru and Vietnam), the project team 'looked at ways in which funds arriving at the national level could be used to reduce deforestation,' explains Dr Robin Matthews, project coordinator.

International funding is available to a country in return for reducing its deforestation rate. 'So take, for example, Cameroon,' says Dr Matthews. 'If it can demonstrate that it has reduced its rate of deforestation below an agreed baseline, it would then be eligible to receive carbon credits to compensate for that,' he adds.

The modelling work carried out by the project team has shown that the success of the implementation of 'Reduced emissions from deforestation and degradation' (REDD+) mechanisms is dependent on local contexts and that it is difficult to generalise. 'The devil is in the detail, and solutions need to be tailored to each individual situation,' he says.

One activity of the project focused on the changes in GHG emissions of forest areas in Indonesia as they make way for palm oil and acacia plantations. 'From our work, we now have a much better grasp of the implications of these changes. The results will contribute to the new 'Intergovernmental panel on climate change' (IPCC) guidelines for calculating greenhouse gas emissions from these land-use changes,' explains Dr Matthews.

"The results will contribute to the new 'Intergovernmental panel on climate change' (IPCC) guidelines."

One of the international partners, the World Agroforestry Centre (ICRAF), which is headquartered in Nairobi, Kenya, had a key role to play in the project. The partner analysed the changes in land-use in relation to above ground carbon stocks. 'Our work, together with the other project partners, helped quantify the emissions for the specific pattern of tree cover change on the three continents, taking into account their contrasting drivers of change,' says Meine van Noordwijk, Chief Science Advisor at ICRAF.

'We also advised on how national systems for monitoring, reporting and verification can be set up, making use of pre-existing data from various sources. Overall, the work showed that conflict resolution rather than payments must be the first step towards making a difference in tropical forest margins, when seen from a bottom-up perspective,' says van Noordwijk.

Another key outcome of the project was the publication of a book, Climate Change, Forests and REDD, which was produced by the University of Amsterdam with contributions from all the project partners. The book assessed drivers and policy instruments for promoting REDD+ and making it effective in different countries.

At the UNFCCC CoP18 meeting in Doha, in 2012, the project team held a side event in the European Union (EU) pavilion to address the relevance of REDD and, indeed, raise the question of its future, which the book also tackled. According to Dr Matthews, 'The support from the EU to the REDD-ALERT project meant that we were able to draw together a team of world-class researchers on tropical deforestation to address the REDD+ initiative on the global imperative of reducing emissions from land-use change in the tropics.'

REDD-ALERT

- Coordinated by the Macauley Land Use Research Institute in the United Kingdom.
- Funded under FP7-ENVIRONMENT.
- http://cordis.europa.eu/result/brief/rcn/11548_en.html
- http://ec.europa.eu/research/infocentre/article_en.cfm?artid=31916
- Project website: http://redd-alert.hutton.ac.uk

LIFE CYCLE ASSESSMENT FOR GREEN BUILDINGS

A 'Life cycle assessment' (LCA) determines the environmental impact of a product, starting with the extraction and processing of raw material and ending with its disposal or recycling. An EU-funded initiative has developed operational guidelines for conducting LCAs on energy-efficient buildings.

LCAs can be used for the certification of sustainable buildings and the development of 'Environmental product declarations' (EPDs) for products used in building construction. There is also a growing trend to use them during building projects as a decision-making support tool.

The EEBGUIDE (Operational guidance for performing life cycle assessment studies of the energy efficient buildings initiative) project developed a common methodology and set of rules for conducting LCA studies on energy-efficient buildings. The methodology is based on existing guidelines such as the International Organisation for Standardisation (ISO) and the 'International reference life cycle data system' (ILCD) handbook.

EEBGUIDE will enable LCA practitioners from the private and public sectors to quantify environmental impacts in a consistent and meaningful way. For this purpose, a guidance document was developed and LCA case studies provided and disseminated to LCA practitioners and industry. A website was also set up to act as an information hub.

The EEBGUIDE guidance document will help assess the life cycle of both existing buildings and those under construction. It can also be applied to building products and technical solutions within the 'Energy efficient building European initiative' (E2B EI), an industry-driven research programme.


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At the European policy level, EEBGUIDE directly links the construction industry to the European Platform on LCA and the ILCD data network.

Project activities also impacted European policies such as the 'Integrated product policy' (IPP), the new 'Construction products regulation' (CPR) and the Lead Market Initiative for Europe on sustainable construction. Environmental indicators and LCA will also influence the thematic strategies on the 'Prevention and recycling of waste' and the 'Sustainable use of natural resources'. Some important and recent instruments in this regard are the 'Sustainable consumption and production' (SCP) and the 'Sustainable industrial policy' (SIP) action plan.

"The EEBGUIDE guidance document will help assess the life cycle of both existing buildings and those under construction."

Other impacts of EEBGUIDE will include the creation of new high-skilled jobs, improved European competitiveness, and healthy and secure eco-friendly working conditions. In addition, the use of participatory approaches in the development of the guidance document will help contribute to a more democratic and knowledge-based society.

EEBGUIDE

- Coordinated by Fraunhofer in Germany.
- Funded under FP7-ENVIRONMENT.
- http://cordis.europa.eu/result/brief/rcn/12955_en.html
- Project website: http://www.eebguide.eu
- http://bit.ly/1hX7UAF

POSSIBLE ECO-IMPACTS OF CO_2 LEAKAGE

Although scientists don't expect significant leakage of carbon dioxide (CO_2) from large-scale carbon capture and storage projects, they have assessed the risks just in case. Using field experiments, observations of natural CO_2 emissions and modelling, they have provided data to inform assessments of the possible impact of CO_2 leakage on onshore and offshore ecosystems.

The objective of the EU-funded RISCS (Research into impacts and safety in CO_2 storage) project was to conduct fundamental research that could shape frameworks for the safe management of CO_2 storage sites. The project specifically looked at marine and terrestrial ecosystems.

In Italy, the Netherlands, the United Kingdom and Norway, marine scientists examined the effect of CO_2 exposure on individual species (e.g. shrimp and crabs) and communities, including microorganisms. They also examined the recovery potential of marine sediments after CO_2 exposure and studied the effects of natural CO_2 off Italy.

Norway and the United Kingdom were host to onshore experiments that assessed the impact of CO_2 on oats, wheat, barley and oilseed rape. Grass/clover cover, pasture plots and groundwater were also investigated, the latter at natural CO_2 sites in Italy, Greece and France.

Other work involved numerical onshore modelling of the movement of CO_2 through the soil and its effect on plants. Marine modelling focused on the dispersion of CO_2 in the water column by tides and the sensitivity of different species to CO_2.

The key results obtained during the study have been compiled in the RISCS publication 'A guide to impacts of potential leaks from CO_2 storage' in order to provide a sound basis for the selection of appropriate CO_2 storage sites and safety measures. These guidelines will also allow site operators and regulators to adequately assess the potential impacts of leaks on near-surface ecosystems.

"Norway and the United Kingdom were host to onshore experiments that assessed the impact of CO_2 on oats, wheat, barley and oilseed rape."

RISCS

- Coordinated by the Natural Environment Research Council in the United Kingdom.
- Funded under FP7-ENERGY.
- http://cordis.europa.eu/result/brief/rcn/12987_en.html
- Project website: http://www.riscs-co2.eu

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GENETIC TESTING FOR BROOD-SPAWNING FISH

Selective breeding schemes in aquaculture are expensive and difficult to implement for mass-spawning fish species. However, recent research has developed a cost-effective way to improve the efficiency of selective breeding for these fish.

Selective breeding for mass-spawning and communally reared fish, such as the European seabass and the gilthead seabream, is difficult because it is hard to control the contribution of specific parents in a brood. The industry also requires a way to limit inbreeding, and to regulate when and how the breeding animals spawn.

"REPROSEL produced optimised breeding schemes that resulted in less than 1 % inbreeding and improved breeding efficiency."

The EU-funded REPROSEL (REPROduction protocols and molecular tools for mass spawning and communal rearing based SELective breeding schemes applied to multiple-spawning marine fish) project aimed to improve the selective breeding methodology in these two commercial species by designing and testing a high-throughput genetic heritage test. In addition, the consortium wanted to design selective breeding schemes and produce guidelines for farmers regarding mass spawning and communally reared marine fish species.

Researchers analysed several commercial breeding facilities to identify ways to improve spawning efficiency. They found that hormone treatments were successful in synchronising spawning in both species.

To design the genetic tests, data was collected from various public databases to develop 'Single nucleotide polymorphism' (SNP) and 'Short tandem repeats' (STR) markers, which could be used to differentiate individual fish. Software was then developed to allocate parentage based on genetic similarity. Testing showed that the software was able to identify both parents with up to 99-100 % accuracy.

Using this newly developed tool along with a breeding simulation programme, REPROSEL produced optimised breeding schemes that resulted in less than 1 % inbreeding and improved breeding efficiency. The project also published a set of guidelines for farmers on selective breeding schemes for mass spawning and communally reared marine fish species.

For mass-spawning fish breeders, REPROSEL outcomes offer great benefits in terms of genetic improvements to their fish and thus potential economic savings. More sustainable breeding programmes and an improvement in the competitiveness of the breeders' market are expected.

REPROSEL

- ★ Coordinated by Nofima in Norway.
- ★ Funded under FP7-SME.
- ★ http://cordis.europa.eu/result/brief/rcn/13048_en.html

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HOVERCRAFT TO CLEAN OCEAN OIL SPILLS

Oil spills can have devastating consequences for coastal and open sea waters, and timely responses are often limited by the vehicles used to reach the scene. Now, thanks to EU funding, a specialised hovercraft that will enable immediate emergency action has been unveiled.


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It was developed as part of the HOVERSPILL (Multienvironment air cushion oil spill fast response and post emergency remediation system) project. The aim was to solve the problem that traditional vehicles have in reaching areas like shoals, beaches and muddy points.

The team set out to create a vessel that would be cheap and easy to maintain, and easy to transport and store. The craft also needed to be capable of a high operative speed, and of storing oil collected from spills.

Researchers successfully met these goals by producing an amphibious air cushion vehicle and an oil-water separator. This came after in-depth studies into critical features, like an intuitive piloting system, the ability to navigate rocks and a versatile platform to transport different kinds of equipment.

"The hovercraft is highly modular, which will allow it to be used in different contexts and scenarios."

All the necessary components were individually tested and, once fully assembled, prototypes were tested in the field. Feedback from members of the consortium as well as operators was very positive.

The hovercraft is highly modular, which will allow it to be used in different contexts and scenarios. This innovative solution represents a milestone in the response and remediation of oil spills.

HOVERSPILL

- Coordinated by Innova in Italy.
- Funded under FP7-TRANSPORT.
- http://cordis.europa.eu/result/brief/rcn/12985_en.html
- http://bit.ly/1gfYxki

SCANNER TO MEASURE FISH WEIGHT IN SITU

Accurately estimating fish biomass is a vital aspect of commercial aquaculture. A recent project has developed a system to improve these estimations through the continuous remote monitoring of fish in sea cages.

There is currently a 5% error in the estimates of fish weight, leading to an annual loss of EUR 91 million. Recouping these losses will help the EU aquaculture industry become more globally competitive.

"There is currently a 5% error in the estimates of fish weight, leading to an annual loss of EUR 91 million."

The EU-funded FISHSCAN (Development of novel system for continuous remote monitoring of weight, growth, and size distribution of fish in aquaculture enclosures) project aimed to achieve 99% accuracy in fish weight measurements. Their goal was to develop a product that would continuously measure the weight, size and growth of fish in sea cages.

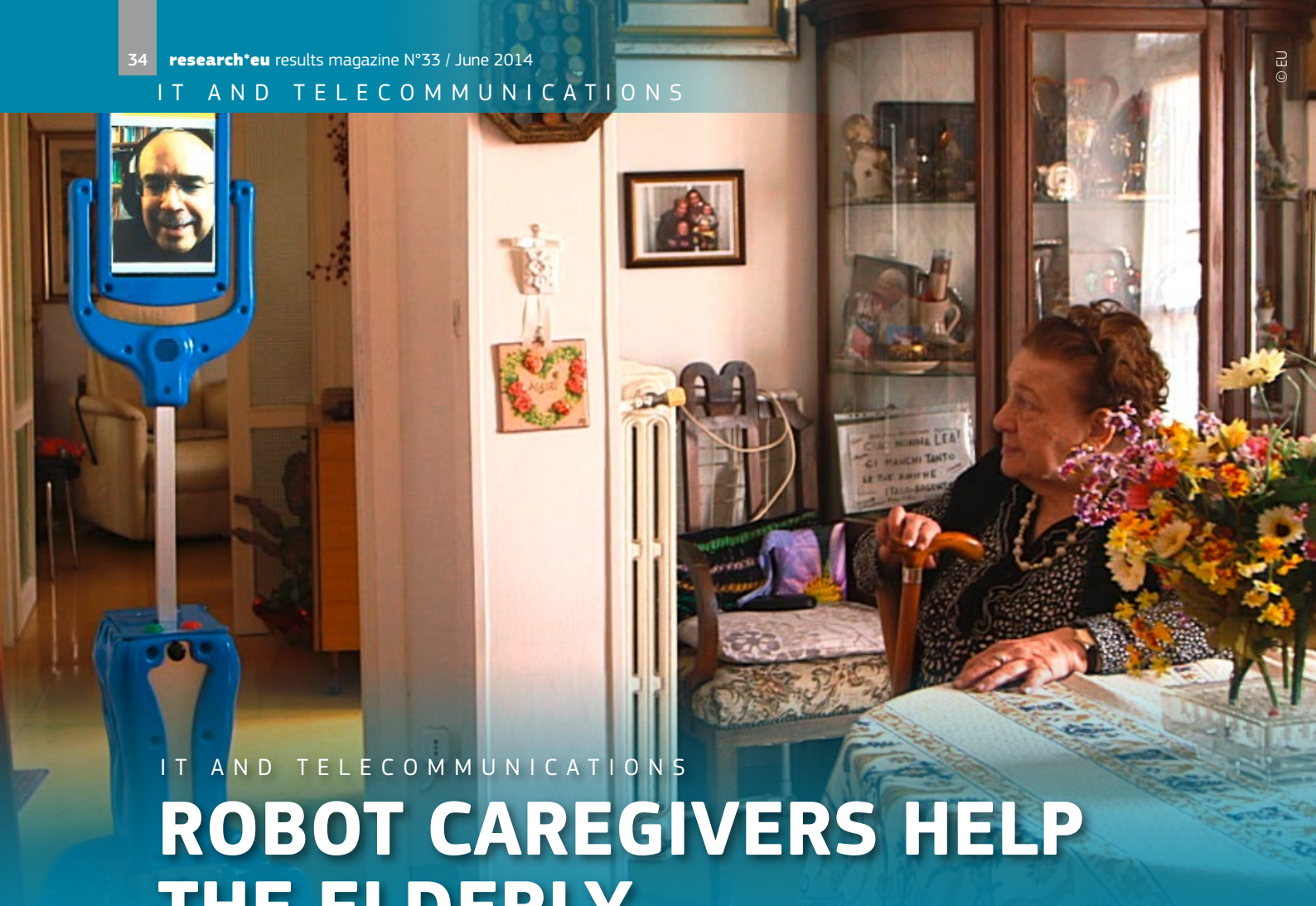
Researchers started with a survey of future users in order to better understand their needs before designing the system. FISHSCAN also studied fish responses to the proposed system to better inform the product design.

Appropriate materials were evaluated and chosen to house the system's camera and lighting module. Following this, design specifications were developed and several prototype systems built. These included an underwater housing unit with lights and a camera, as well as a surface module for recording and transmitting data.

The small businesses involved in the project will continue to test and refine these prototypes on site in order to produce the final FISHSCAN system. It is estimated that the system could save farmers up to EUR 41 million annually.

FISHSCAN

- Coordinated by Storvik Aqua in Norway.
- Funder under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/13025_en.html
- Project website: http://www.fishscanproject.com



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IT AND TELECOMMUNICATIONS

ROBOT CAREGIVERS HELP THE ELDERLY

Our life expectancy is growing by the day and members of the 'silver generation' are making up an ever-larger proportion of the population. Can technologies help us in caring for ourselves, our older relatives and friends? Could we learn to live together with robots while being watched over by sensors? The people behind one EU research project certainly think so.

Our aging population is changing our society's dynamics and economy. By 2050, there will only be two (instead of four) Europeans of working age for each person over 65, and within a decade Europe will need to care for an estimated 84 million people with age-related health problems.

There is an upside to this challenge, though. Collectively, Europe's over-65s have a disposable income of over EUR 3 trillion and a substantial part of this will be ploughed back into the caring economy. According to Stephen Von Rump, CEO of Giraff Technologies AB, the EU market for robots and other devices that help take care of our elderly will reach EUR 13 billion by 2016, and at least EUR 14.5 billion in the US.

The demand for care services has many countries stretched to the limit. That's where technology can help. According to Mr Von Rump: 'Today there are an estimated 5 million homes in the EU where elderly residents are receiving formal care services, and 12 million homes globally. Those numbers would more than double if we include the elderly who don't receive formal care, but who (or whose families) would gladly pay for a telecare service if it extended their time living at home.'

GIRAFF+: A robot carer in your home

GIRAFF+ (Combing social interaction and long term monitoring for promoting independent living) is an EU research project on testing how a network of sensors in cooperation with a robot can help older people live safer, more independent lives and enjoy social life from their home. The star of the system is Giraff, a telepresence robot. It moves around the person's home and enables them to interact with family, friends and healthcare professionals via videoconference. The GIRAFF+ system comes with sensors throughout the home and in wearable devices. These sensors are designed to detect activities like cooking, sleeping or watching television, but they also provide medical information, like blood pressure and body temperature. They allow the person's carers to remotely monitor their wellbeing and to check for falls. One of the users in the GIRAFF+ pilot, 94-year-old Lea Mina Ralli, wrote on her blog: 'People ask why I don't just

live with my daughter; the reason is she has grandchildren of her own and many new responsibilities. But with this valuable assistant that I call 'Mr Robin' I'm more relaxed about the years ahead, and so are my children and grandchildren.'

An emerging market in caring technology

'The system will be installed in 15 homes by the end of 2014,' says Amy Loutfi, the project coordinator. 'So far we have had six homes in Europe — two homes each in Spain, Sweden and Italy — where people have lived with the GIRAFF+ system. We are currently in the middle of the evaluations, but we are already seeing that various aspects of the system are appreciated differently by the different users. This goes to show that there is no 'one-size-fits-all' approach to technology at home, and that the latter should be both adaptable and tailored to the user's needs.'

Current plans are to put the system into commercial production next year, based on an upfront fee and monthly subscriptions which would make it competitive when compared to increasingly expensive full-time care.

"With this valuable assistant that I call 'Mr Robin' I'm more relaxed about the years ahead, and so are my children and grandchildren."

GIRAFF+

- Coordinated by Orebro University in Sweden.
- Funded under FP7-ICT.
- http://cordis.europa.eu/result/story/rcn/13066_en.html
- Project website: http://www.giraffplus.eu
- http://bit.ly/1lEoWWQ

LOCATION-BASED APPS COME OF AGE

Smartphones look set to welcome a new generation of highly accurate location-based apps based on advanced European ground and satellite technology.

As technology marches on encouraged by consumer demand, smartphone-based positioning applications are becoming increasingly ubiquitous. However, the inaccuracy of 'Global positioning system' (GPS) technology represents a key barrier to advancing such applications. The 'European geostationary navigation overlay service' (EGNOS, a pan-European satellite navigation system) and the EU's Galileo 'Global navigation satellite system' (GNSS) hold much potential in helping to overcome these limitations.

The EU-funded project POSTO (Methodology and SW libraries for the design and development of GALILEO/EGNOS-based POSiTiOning applications for smartphones) is working to contribute to efforts. It is setting out the methodology and supplying the software to help small and medium-sized enterprises (SMEs) create Galileo/EGNOS chipsets for smartphone applications.

To achieve its aims, the project consortium is analysing existing smartphone platforms and related software development kits. It is adapting EGNOS algorithms to smartphone platforms and defining relevant guidelines to support technology manufacturers and developers, particularly the SMEs involved in the project.

Already, the project team has analysed the state-of-the-art in smartphone positioning applications development using EGNOS technology along with surveys and questionnaires. It has also defined the technical requirements for outlining the methodology.

POSTO's work will be pivotal in providing applications related to hiking and forestry, as well as in tracking vulnerable people such as children and the elderly. Other applications that could be developed include a construction management application, a site health monitoring application in restricted or dangerous areas, and the AgriGeo application.

Preliminary smartphone applications in these fields have already been designed and developed, while the project's results so far have been disseminated to stakeholders. This is poised to help SMEs significantly in developing new, more precise location-based applications that consumers are demanding or could benefit from. Thanks to POSTO, smartphones are set to become even smarter within a relatively short period of time.

POSTO

- Coordinated by Helileo in France.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/13043_en.html
- Project website: http://www.posto-project.eu
- http://bit.ly/1gZsxvK

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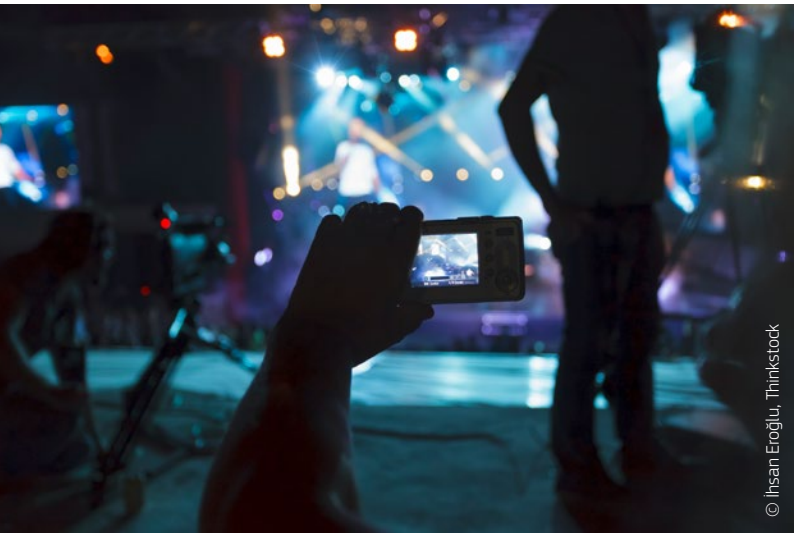
SCENENET: 3D RECREATION OF LIVE EVENTS FROM MOBILE VIDEOS

Ever been to a rock concert and wished you could experience it again, just as it was... or better? This may be possible soon thanks to an EU-funded research project, SCENENET, which is developing the technology to combine mobile feeds from different spectators around the arena to reconstruct the event in 3D.


© Ihsan Eroğlu, Thinkstock

Chen and Nizan Sagiv had the idea when they were at a Depeche Mode concert in Tel Aviv five years ago. 'While I was busy watching the show, Nizan was watching the crowds,' explained Chen, SCENENET (Mobile Crowd Sourcing Video Scene Reconstruction) project coordinator. 'He could not help noticing the huge number of faint lights from mobile phone screens. People were taking videos of the show. Nizan thought that combining all the videos taken by individuals into a synergetic, enhanced and possibly 3D video could be an interesting idea. We discussed the concept for many months, but it looked too futuristic, risky and complicated.'

"We have, at the end of the first year, and sooner than expected, already built the entire SCENENET pipeline based on current state-of-the-art components."

Israel-Europe collaboration

They sought advice from ISERD, the Israel-Europe R&D Directorate, and contacted Prof. Peter Maass from the University of Bremen in Germany, and Prof. Pierre Vandergheynst from the Ecole Polytechnique Fédérale (EPFL) in Lausanne, Switzerland, with whom Chen had worked on an earlier 7th Framework Programme project, UNLOCX.

The result is the SCENENET project, awarded EUR 1.33 million by the European Commission, and coordinated by Chen and Nizan's Ra'anana-based company, SagivTech, specialists in computer vision and parallel computing.

SCENENET, which is funded by the 'Future and emerging technologies' (FET) scheme just as UNLOCX was, runs until January 2016 and consists of four European partners: the University of Bremen, Steinbeis Innovation, and European Research Services, all in Germany, and Switzerland's EPFL.

The first year of the project has seen the team develop the mobile infrastructure for the video feeds, a mechanism for tagging them, and their transmission to a cloud server. They've also developed basic tools for a human-computer interface that will allow users to view the 3D video from any vantage point 'in the arena' and edit the film themselves. This, they believe, will help create online communities for sharing the content and reliving the concert experience together. With this in mind, the partners are to study privacy and intellectual property rights issues over the next two years of the project.

'We have, at the end of the first year, and sooner than expected, already built the entire SCENENET pipeline based on current state-of-the-art components,' said Chen. Indeed, the accelerated computer vision algorithms they are creating for mobiles is a pioneering effort worldwide, and leading chipset manufacturers are following the project closely.

SCENENET involves several technological challenges: on-device pre-processing that requires immense computer power, efficient transmission of the video streams, development of accurate and fast methods for registration between the video streams, and the 3D reconstruction. All of these tasks have to run at near real-time rates.

'We believe that the various components that make up SCENENET, e.g. registration of images and 3D reconstruction, have great potential for mobile computing and cloud computing, Thus SCENENET offers a huge technological breakthrough — in its entirety and also via each of its components,' she added.

Moving beyond concerts

Myriad possible uses for SCENENET are emerging as the project develops. Rights and privacy concerns permitting, the technology might also be used to recreate other events in 3D, such as breaking news or sports, or in the tourism or surveillance sectors. The partners are also looking at shooting static, as well as active, objects from various angles, to create instructions that can be sent on to 3D printers. The mobile-cloud server model could also be used for a host of other applications, say the researchers. But for the moment they are concentrating on music fans.

'SCENENET revolves around mobile cameras and 3D vision. The invasion of mobile cameras and their continually improved quality has meant we are flooded with images we want to enhance and show off. Many devices

that 'understand' visual inputs are being developed — Google Glass, for instance — where most of this work is based on image processing and computer vision. 3D vision is becoming more important for better visualisation of the world on one hand, and easier analysis of the world on the other hand,' the coordinator explained.

SCENENET is a good example of collaboration in research between the EU and Israel. Some 1 600 Israeli scientists have benefited from the 7th Framework Programme in over 800 projects funded by the EC to the tune of EUR 634 million, in fields ranging from cutting edge research and ICT through nanotechnology to energy and health.

'This is an opportunity to be a part of the thriving European scientific and industrial communities, and collaborate with leading academic partners and companies in Europe,' Chen summarised.

SCENENET

★ Coordinated by SagivTech in Israel.
★ Funded under FP7-ICT.
★ http://cordis.europa.eu/result/story/rcn/13005_en.html
★ Project website: http://scenenet.uni-bremen.de

IMPROVING EVENT TRANSPORT MANAGEMENT

Large events such as the Olympics or the FIFA World Cup pose huge transport challenges for the organising city. Researchers have recently tested several technological solutions to these problems.

Transport is a complex and crucial part of a city's infrastructure, and it becomes even more so in the context of hosting major sporting events. This can consume up to about 20 % of the 'Local organising committee's' (LOC) budget, and requires massive organisation in a short space of time.

To address this, the EU-funded STADIUM (Smart Transport Applications Designed for large events with Impacts on Urban Mobility) project was set up. The project tested 'Information and communication technology' (ICT) systems at major sporting events. This included the 2010 FIFA World Cup in Cape Town (South Africa), the 2010 Commonwealth Games in Delhi (India), and the 2012 Olympic Games in London (United Kingdom).

In Cape Town, STADIUM tested a demand-responsive transport system in minibus taxis. The system used a control centre to reduce the 'down-time' of taxis and to improve efficiency. As a service, it was successfully integrated with the mass transport systems already operating in the city.

Delhi operations involved testing an integrated booking system that used a mobile application. The project linked public transport (trains and buses) with paratransit services (taxis and autorickshaws) using global positioning system tracking and forecasting tools to improve transit times.

In London, CCTV cameras were used to provide data for visual scene analysis. It was intended as an automated traffic and incident detection system that could alert operators to potential traffic problems and congestion. This reduced the workload of the operators while improving traffic control and overall travelling times, despite increased traffic.

"The project tested 'Information and communication technology' (ICT) systems at major sporting events."

© Anna Stowe/LOOP IMAGES/Loop Images/Corbis

The STADIUM project has compiled the results of these demonstrator projects into a guidebook for transport management at future events. This will enable LOCs to better coordinate travel requirements without disrupting public transport during major sporting events.

STADIUM

★ Coordinated by ISIS in Italy.
★ Funded under FP7-TRANSPORT.
★ http://cordis.europa.eu/result/brief/rcn/10266_en.html
★ Project website: http://www.stadium-project.eu

AUGMENTED REALITY: BRINGING HISTORY AND THE FUTURE TO LIFE

Have you ever wished you had a virtual time machine that could show you how your street looked last century? Or have you wanted to see how your new furniture might look, before you've even bought it? Thanks to VENTURI, an EU research project, you can now do just that.


© Venturi

'Très Cloîtres Numérique, due to be launched this summer, is a 'living memorial' to a neglected quarter of Grenoble,' says VENTURI (immersiVe ENhancemenT of User-woRld Interactions) Project Coordinator Paul Chippendale. The project was designed to appeal to people familiar with the neighbourhood as well as those who are interested in Grenoble's rich cultural heritage and human history.

Participants can use a tablet or smartphone to look at the city through a virtual lens. The modern-day scene that they can see through their device's camera is overlaid with historical photographs and 3D reconstructions of ancient buildings, allowing the users to look at their surroundings, going backwards through time. Local schoolchildren have collected photographs and souvenirs from their parents and grandparents in order to preserve their memories for future generations.

Beyond smartphones and tablets: wearable 'augmented reality' (AR)

Whilst Très Cloîtres Numérique is ambitious, it still relies on the user looking through the screen of their smart device. 'But rather than having to view the world through your device,' says Mr Chippendale, 'it should be possible to experience an augmented environment seamlessly through smart glasses, watches and earpieces.

'The customary 'letterbox' paradigm of AR — holding up your smartphone and using it as a magic looking glass — certainly makes AR accessible to the masses, but in my opinion it is not a comfortable experience. Even though I work in this field I still do not use AR Apps in my everyday life,' says Mr Chippendale. 'They are just too generic and do not give me the information that I need according to where I am, what I am doing and what I enjoy.

'However, I do believe that this is about to change. In VENTURI, we have been exploring cutting edge 'reality sensing' through computer-vision and sensor fusion, and have tied this together with intuitive 'world augmentation' through 3D audio, Smartwatch interaction and HMDs like Google Glass.

'The aim of the VENTURI project is to create augmented reality applications that blend seamlessly with the user's interaction with the real world.' Rather than needing to stop to look at their smartphone or tablet, users would receive information that enhances their experience of the world around them through an earpiece or smart glasses.

Using AR to help customers

It's not only virtual history galleries that can be created using the VENTURI project's augmented reality systems. Companies like Volkswagen, Audi and IKEA are working with project partner Metaio to create exciting new tools. For example, Audi customers can take a virtual tour of their new vehicle to learn about its features, while Volkswagen allows users to customise a car before ordering. IKEA and Mitsubishi both allow clients to see how their products would look in their homes or offices, before buying.

"Companies like Volkswagen, Audi and IKEA are working with project partner Metaio to create exciting new tools."

By working with Metaio and Sony, the VENTURI project is creating what they believe will be the first generation of ubiquitous AR tools. According to Paul Chippendale: 'Thanks to Sony's participation in VENTURI, we have had privileged access to their future vision of wearable devices, ranging from smart life logging bands (wrist-worn devices that log a user's activity) to advanced head mounted displays. We have been using this insight together with Metaio's strong market knowledge, to create personalised AR content according to a user's social profile, the current environment and what it is that they're currently doing.'

VENTURI

- Coordinated by the Bruno Kessler Foundation in Italy.
- Funded under FP7-ICT.
- http://cordis.europa.eu/result/story/rcn/13004_en.html
- Project website: https://venturi.fbk.eu
- http://bit.ly/QZwjyb

INDUSTRIAL TECHNOLOGIES

MODULAR, FLEXIBLE, SUSTAINABLE: THE FUTURE OF CHEMICAL MANUFACTURING

Picture a chemical plant. How would you describe it? You're probably not thinking along the lines of compact, nimble or adaptable — but that's about to change. Europe's chemical industry is innovating in order to survive and thrive in the face of rapidly changing market demands and fierce global competition. New technologies will enable the industry to manufacture products faster, more flexibly and more sustainably, and EU-funded research is providing the solutions.

COPIRIDE (Combining process intensification-driven manufacture of microstructured reactors and process design regarding industrial dimensions and environment) and F³ FACTORY (Flexible, fast and future production processes) are two of the projects that have developed innovative technologies to support the shift towards greater versatility and smaller environmental footprints. They have produced new technologies, processes and manufacturing concepts that will feed into the design and operation of innovative chemical plants. The results of their work have the potential to provide the chemical industry with a much-needed competitive boost.

Small plants, huge potential

The achievements of COPIRIDE include patents on gasification, a catalyst system and reactor fabrication technology.

'COPIRIDE has contributed to improving the competitiveness of the European chemical industry and will help to secure jobs by providing smart, moveable and flexible chemical plant concepts,' says project coordinator Dr Patrick Löb, head of the Mixing and Fine Chemistry Department at the Institut für Mikrotechnik Mainz.

'For example,' he adds, 'a chemical plant embedded in a 3-by-12-metre container is more capable of adapting to market trends and bringing process and product innovations faster to market.'

The team developed novel miniaturised reactors (micro-reactors)

— designed to fit inside these garage-sized plants — that give operators far better control over chemical reactions. This advance will lead to more sustainable processing, with fewer inputs of energy and raw materials.

Tried and tested

To ensure that COPIRIDE's findings were relevant across the industry, the project's research teams were grouped around specific chemical processes. 'Piloting activities were carried out to demonstrate results and show improvements in the chemical process itself,' explains Dr Löb.

One demonstration involved a chemical factory embedded in a special flexible and moveable container. The move from drawing board to bricks and mortar required two different facilities, each equipped for a different process step. Once up and running at an industrial site in Germany, the plants were able to produce a large batch of a particular chemical.

"We were able to boost the efficiency of various process steps by orders of magnitude."

Another demonstration addressed the need for lower production ranges. This required a modular multi-purpose 'mini-plant', the construction of which was led by a consortium partner from the small and medium-sized enterprise (SME) sector.

A separate demonstration plant was set up to allow researchers to explore the feasibility of producing biodiesel from waste oils in supercritical conditions. The demonstration targeted cost efficiency, greater competitiveness and improved sustainability compared to other starting materials and processing conditions.

The gasification of biomass to produce chemicals and ammonia (which can then be processed into fertiliser) was also trialled. In addition, the project team sought to improve processing approaches. They looked into a concept known as 'Novel Process Windows', which aims at reducing reaction time through a highly intensified approach that better exploits chemical reactivity.

'Quite unique to the COPIRIDE project has been that, from the beginning, simplified cost analysis and life cycle assessments have been performed to judge the different processing or production options,' says Dr Löb.

A wide variety of partners were involved in the project, establishing pan-European cooperation that should help ensure widespread dissemination of the outcomes throughout Europe's chemical industry.

Cleaner, leaner, faster processes

The F³ FACTORY project's vision for the chemical plant of the future focused on reconciling the seemingly conflicting requirements of flexibility and resource efficiency. This translated into the development of a standardised, modular type of plant designed for easy deployment throughout the industry — a 'plug-and-play', container-based production facility. In addition to their work on the equipment, the partners designed software to facilitate and streamline the design of new processes.

The outcomes offer intriguing possibilities. The partners estimate that their technology can, for example, reduce time-to-market by up to 50 %, cut operating expenses and capital expenses by as much as 20 % and 40 % respectively, and potentially halve the environmental footprint of individual processes.

The team's work aimed at a modular and container-based platform providing the prerequisites for a variety of chemical process types (e.g. polymers, healthcare and agrochemicals), in contrast to conventional bulk processing technology that is tailored to just one type of feedstock or process, but cannot readily be used for another.

To optimise their innovative plant, the participating chemical companies, academic organisations and equipment manufacturers also seized opportunities for process intensification. 'We were able to boost the efficiency of various process steps by orders of magnitude,' says project coordinator Dr Sigurd Buchholz of Bayer Technology Services.

Consensus for change

'In addition, they harmonised production practices among the participating industrial partners sufficiently to ensure that the resulting technology would work for them all. This open and enthusiastic cooperation among major chemical companies,' says Dr Buchholz, 'was one of the project's main assets. The project,' he adds, 'was a strategic endeavour for all participants.'

'The fascinating thing,' he notes, 'was that people left the competitive environment and got together in a joint environment, to develop technology that they could all enjoy.' He is convinced that this collaborative approach could hold the key to similar advances in other industries.

To demonstrate that its production technology could place the EU's chemical industry ahead of the curve, F³ FACTORY moved from theory to practice by building a model factory — the INVITE Research Center.

Located in Leverkusen, Germany, this standardised platform was trialled successfully by the industrial partners involved in the project. 'We had seven different major chemical companies preparing their processes and operating these in the respective process containers on one single site,' Dr Buchholz reports.

What does the future hold for the F³ FACTORY technology? Further work is being carried out to prepare it for widespread deployment, and a number of partners are planning to adopt it alongside existing facilities. The model factory INVITE is now being operated by a separate legal entity, and remains available for open innovation and any company to use.

Like COPIRIDE, F³ FACTORY ended in August 2013, leaving a legacy of innovation that will help to take the EU's chemical industry another step ahead.

COPIRIDE

- Coordinated by the Mainz Institute of Microtechnology in Germany.
- Funded under FP7-NMP.
- http://cordis.europa.eu/result/brief/rcn/6696_en.html
- COPIRIDE website: http://www.copiride.eu

F³ FACTORY

- Coordinated by Bayer Technology Services in Germany.
- Funded under FP7-NMP.
- http://cordis.europa.eu/result/brief/rcn/6215_en.html
- http://ec.europa.eu/research/infocentre/article_en.cfm?artid=31476
- F³ FACTORY website: http://www.f3factory.com/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COMPOSITE PATCH CRACKS AND CORROSION

Degradation of large steel structures used in aerospace, shipping and civil engineering can have catastrophic consequences. EU-funded scientists have developed advanced repair technology to address the issue.

Conventional techniques to address fatigue and corrosion involve re-welding, applying bolted or welded plates, or even replacing entire panels. Recently, composite patches have been effectively exploited in the aerospace industry to reduce the maintenance time and cost associated with repair or reinforcement. Scientists employed experimental and numerical techniques to explore their use in ships and bridges with the EU-funded project CO-PATCH (Composite patch repair for marine and civil engineering infrastructure applications).

The team began by defining the regulatory framework for both applications to ensure compliance. They developed a defect inspection and classification procedure to determine which defects are candidates for composite patch repair. Non-destructive testing techniques were evaluated for monitoring the integrity of the patch once applied, and some were shown to be suitable for automated monitoring. Numerical modelling techniques were developed to simulate the behaviour of patched structures.

Based on this, the team developed best practice guidelines and application procedures covering evaluation of damage, patch design, composite patch application and repair monitoring. The guidelines also covered regulatory considerations as well as recommended personnel training.

CO-PATCH researchers successfully demonstrated the ability of composite patch repairs to reinforce steel structural members through full-scale tests. The technology is environmentally stable, can be classified as a permanent repair, and is equally suitable for marine vessels and civil engineering infrastructures. Implementation will significantly reduce maintenance costs and, in the case of metal bridges, prolong service lifetime. This has important implications for our safety and the competitiveness of related EU industries.

"CO-PATCH researchers successfully demonstrated the ability of composite patch repairs to reinforce steel structural members through full-scale tests."

CO-PATCH

- Coordinated by the National Technical University of Athens in Greece.
- Funded under FP7-TRANSPORT.
- http://cordis.europa.eu/result/brief/rcn/9999_en.html
- Project website: http://www.co-patch.com

GIVING WORKPLACE INJURIES THE SLIP

Slipping is responsible for more than 40% of workplace injuries. A recent project has developed tools for footwear and flooring manufacturers to help improve anti-slip features.

Footwear manufacturers have, in the past, often relied on intuition and previous experience to design soles for shoes. This approach has contributed to the large number of accidents caused by slipping, and also makes the design process more expensive and time consuming.

The EU-funded ULTRAGRIP (Development of a high grip designing tool) project aimed to produce a range of software tools and guidelines for footwear and flooring manufacturers to design better soles and flooring. The project also developed several technological tools.

Researchers produced two documents that contain recommendations and requirements for improving slip resistance under different conditions. These were intended to improve on current government legislation regarding this topic.

The project also developed a 'wear and tear' simulator to allow manufacturers to investigate the durability of their anti-slip designs. Another technological tool created was high-speed image acquisition and the accompanying software. This allows manufacturers to study in great detail the interaction between sole, floor and various slippery substances.

Lastly, several design tools were advanced and tested. These include slip behaviour prediction software and a tool to correlate the slip testing methods used in the two industries.

The ULTRAGRIP project will improve the competitiveness of the two manufacturing sectors by streamlining and improving the design process. In the long-term, the work done here will help to make the working environment a safer place.


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ULTRAGRIP

- Coordinated by INESCOP in Spain.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/13039_en.html
- Project website: http://www.ultragrip.eu

CAPTURING CARBON DIOXIDE IN FLUE GASES

The EU is dedicated to reducing its carbon dioxide (CO_2) emissions. EU-funded scientists have demonstrated the feasibility of retrofit post-combustion calcium looping CO_2 capture technology that exhibits both low cost and very high efficiency.


© Andrés Sánchez-Biezma Sacristán, Provider's image

Long-term energy goals include meeting a significant portion of energy demands with renewable sources. During the transition period, carbon capture and storage is a promising way to reduce greenhouse gas emissions from the combustion of fossil fuels. The EU-funded project CAOLING (Development of postcombustion CO_2 capture with CaO in a large testing facility) worked on scaling up post-combustion calcium looping technology as a necessary prerequisite for a pre-industrial demonstration plant.

Calcium looping is a limestone (calcium carbonate ($CaCO_3$))-based process that relies on 'Fluidised bed reactors' (FBRs) that are common and thus inexpensive to install. $CaCO_3$ is an excellent and cost-effective sorbent for CO_2. Calcium looping using flue gases from a commercial coal power plant is therefore an extremely attractive option compared to other technologies.

The first FBR is a carbonator that captures CO_2 from the combustion flue gas as $CaCO_3$, releasing a tremendous amount of heat in the process. Solids from the carbonator are channelled to a fluidised bed calciner where oxy-fired combustion of coal produces high temperatures to calcine the $CaCO^3$ back to calcium oxide (CaO) and CO_2. The latter is at a very high concentration and thus facilitates easy recovery. The high temperatures and heat produced by both reactors significantly increase the process efficiency. This is because the heat can be used to generate steam that can drive a turbine to produce electricity. Furthermore, purge material with high CaO concentrations can be used to make cement for other applications.

CAOLING developed new sorbents and techniques to enhance sorbent performance as well as simulation tools for the scale-up process. Scientists successfully demonstrated the feasibility of the technology with a 1.7 Megawatt thermal power plant. It had a low efficiency penalty and was suitable for retrofit in existing coal combustion power plants. Very high CO_2 capture efficiencies (over 90 %) were demonstrated on three different rigs by identification of appropriate conditions and parameters.

"Very high CO_2 capture efficiencies (over 90 %) were demonstrated on three different rigs."

CAOLING is the biggest initiative in the world to test calcium looping for post-combustion capture from flue gases and thus its success should position the EU as a leader in the field.

CAOLING
- Coordinated by Endesa Generación in Spain.
- Funded under FP7-ENERGY.
- http://cordis.europa.eu/result/brief/rcn/10235_en.html

TINY HOLES THAT INCREASE PROTECTION

Anodisation of metals such as aluminium (Al) produces a protective coating of metal oxide, aluminium oxide (Al_2O_3) in this case. EU-funded scientists have investigated the controlled growth of nano-structured pores in the coatings to enhance performance and durability.

The Al_2O_3 coating is very hard and non-reactive, enhancing durability and preventing corrosion. The metal-oxide layer is highly porous, also facilitating adhesion of subsequent layers for colouring or sealing. Exquisite control of pore formation and geometry can significantly improve the performance and lifetime of anodised aluminium. Such nano-scale control is not possible with current industrial anodisation processes.

EU-funded scientists working on the project NANOCOAT (Nano-structured aluminium oxide coatings) investigated the requisite nano-structuring process for large-scale applications. Researchers studied process materials and parameters for anodisation of pure Al, Al alloys and Al with inclusions.

Scientists obtained a well ordered structure on pure Al and some Al alloys (those with high copper content are more problematic). Computational fluid dynamics models were used to model the circulation system for anodisation in order to optimise parameters for the prototype and scale-up system.

Results at lab scale were reproduced in an industrial environment for the first demonstration of nano-structured oxidation of Al alloys at industrial scale. In addition, the black colouration obtained without opening

pores was uniform after a double anodisation procedure with constant micro-hardness of the oxide.

"Results at lab scale were reproduced in an industrial environment for the first demonstration of nano-structured oxidation of Al alloys at industrial scale."

A simplified life cycle analysis was carried out to address production issues related to environmental legislation. A complete techno-economic assessment compared energy consumption of the NANOCOAT process with conventional oxidation processes. Despite higher energy requirements and capital expenditures than conventional processes, these novel coatings are well suited for application in high-performance optics, aerospace and space components, and high-value consumer products.

NANOCOAT has made important advances in controlling the growth of highly organised, nano-structured Al_2O_3 coatings for enhanced performance and durability. The surface finishing industry is dominated by 'small and medium-sized enterprises (SMEs) that supply a wide range of products to numerous industries of strategic importance to the EU economy. Project technology will thus have a major impact on the competitive positions of both SMEs and their customers.

NANOCOAT

- Coordinated by International Project Management, Plating and Materials in France.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/13022_en.html
- Project website: http://www.nanocoat-project.eu
- http://bit.ly/1nYJf68

PLASTIC WELD JOINTS — NON-DESTRUCTIVE TESTS

Plastic piping has replaced metals and concrete in many applications, but standardised 'Non-destructive evaluation' (NDE) techniques are lacking. EU-funded scientists have developed the technology to detect every type of flaw that can occur in welded joints in 'polyethylene' (PE) pipes.

Plastics have better resistance to chemicals and corrosion than metals. In addition, they are lightweight, have long predicted service lives and are more resistant to leakage — all of which decrease installation and maintenance costs, not to mention reduce environmental hazards.

Scientists working on the EU-funded project TESTPEP (Development and Validation of an Automated Non-destructive Evaluation (NDE) Approach for Testing Welded Joints in Plastic Pipes) have developed an automated phased-array ultrasonic NDE system for volumetric analysis of welds in PE pipes, either during production or retrospectively.

The team successfully developed and optimised all the main system components, including probe/wedge assembly, scanner and flaw detector, and carried out validation trials on the prototype inspection system both in the laboratory and in the field. Researchers completed the characterisation of ultrasound propagation for both medium density and high density PE pipe materials. Procedures were then developed to insert planar flaws and particulate contamination into both butt fusion and electrofusion welds.

Following this, numerous welds with various types, sizes and amounts of flaws were manufactured in order to develop both the inspection procedures and the flaw acceptance criteria, based on both short-term and long-term mechanical performance. Researchers designed and manufactured novel phased-array probes and different probe holders and attachment mechanisms for the modular scanning system, which can inspect welds in PE pipes of diameters ranging from 180 to 710 millimetres.

TESTPEP's ultrasound-based NDE technology for welds in plastic piping fills a critical industry need for standardised flaw detection and acceptance criteria. Commercialisation will reduce leaks, disruptions due to repairs and the environmental risks of catastrophic failures. Increasing confidence in the use of plastic piping will also enhance the competitive position of plastics manufacturers.

"Commercialisation will reduce leaks, disruptions due to repairs and the environmental risks of catastrophic failures."


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TESTPEP

- Coordinated by TWI Limited in the United Kingdom.
- Funded under FP7-SME.
- http://cordis.europa.eu/result/brief/rcn/13027_en.html
- Project website: http://www.testpep.eu
- http://bit.ly/1mN9rP3

SPACE

USHERING IN A NEW ERA OF SPACE FLIGHT

Many children dream of becoming an astronaut, yet only a few ever see that dream realised. That may soon change, thanks to the EU-funded project FAST20XX. Run by a European consortium, which was led by the European Space Agency (ESA), the project investigated and developed technologies to conquer the grey zone between aeronautics and space in Europe.

The results achieved set the foundation for a new, long-term transportation paradigm, which would commercialise space flight and move it closer to within the general population's reach.

In particular, the FAST20XX (Future high-altitude high-speed transport 20XX) team worked on two concepts: recreational suborbital flight (space flight that has less energy than needed for entering orbit) and point-to-point transportation (moving from one place to another). The first concept, ALPHA, is a vehicle that is air-launched from a carrier plane before it ignites its own hybrid rocket motor to climb out of the atmosphere and then glide back to Earth. Passengers on this recreational suborbital flight would reach an altitude of 100-120 km, crossing the Kármán line (the boundary between the Earth's atmosphere and outer space).

'Everyone who crosses that line can call themselves an astronaut,' says Rafael Molina from the ESA, who took over as coordinator of the three-year project in 2011.

The FAST20XX project team managed to develop the ALPHA concept to the point where, if resources allowed, its entire system — from the space-plane itself, to its hybrid propulsion and corresponding flight control system — could start being developed. Molina explains that, because ALPHA highlighted regulatory and technological problems, the concept was an important step for his team towards commercial, rocket-powered point-to-point transportation. These problems need to be solved before their second concept, SpaceLiner, is ready for development.

"Space flight is a dream for so many people. This project has made that dream a bit more attainable."

After that, the advanced form of point-to-point transportation, SpaceLiner, would 'allow a person to fly from Europe to Australia in two hours,' explains

Molina. The futuristic vessel is to be powered by a rocket engine and would take off vertically, and land horizontally. Although SpaceLiner is not yet ready for development, the project team has uncovered and solved numerous technical issues related to its design. For the first time, environmental aspects, such as sonic and chemical pollution of suborbital space flight, were also investigated.

'Space flight is a dream for so many people. This project has made that dream a bit more attainable,' adds Molina. The FAST20XX project also highlighted the need for an international regulatory framework for space flight. 'We have plenty of engineers capable of developing innovative suborbital transportation, so it is high time we develop an international framework,' believes Molina. Currently, only the United States has such a system. Its Federal Aviation Administration (FAA) has provided licences to build a number of spaceports across the country and has eased rules for selling suborbital flights to the general population.

So far, US suborbital tourism projects have been very successful. Richard Branson's Virgin Galactic, for example, raised over USD 40 million from ticket deposits and sales over the past three years, even though not a single flight has yet been scheduled. Molina believes a European competitor to US providers is sure to prosper. Because according to Molina, 'flying in space would be a life-changing experience for anyone. Who would say no to such a dream?'

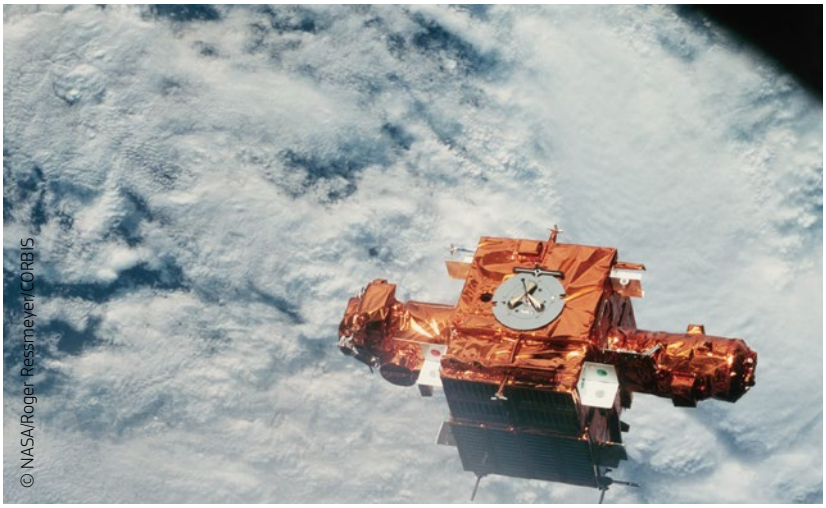
FAST20XX

- Coordinated by the European Space Agency in France.
- Funded under FP7-TRANSPORT.
- http://cordis.europa.eu/projects/rcn/92911_en.html
- http://ec.europa.eu/research/infocentre/article_en.cfm?artid=32036
- Project website: http://www.esa.int/Our_Activities/Space_Engineering/FAST20XX_Future_High-Altitude_High-Speed_Transport_20XX
- http://bit.ly/SagA0C

UNRAVELLING THE MYSTERIES OF OUR PLANET

Initially only a handful of spacecraft could observe the Earth's magnetosphere — the magnetic bubble that surrounds the planet — but their number has grown in recent years. Today, these spacecraft have begun to provide multi-point measurements to afford a better understanding of what drives changes in the magnetosphere.

The European Space Agency's (ESA) multi-spacecraft mission has been in orbit for more than a decade, investigating space weather events as they unfold, something that was impossible with a single spacecraft. The EU-funded project called ECLAT (European cluster assimilation technology) will provide an important upgrade to the ESA's 'Cluster active archive' (CAA). CAA is a state-of-the-art data repository that contains processed and validated multi-point measurements collected by the four Cluster spacecraft.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"Using information about the solar wind conditions will facilitate creation of a detailed 3D map of the Earth's magnetosphere."

CAA enables researchers to conduct detailed studies of the highest resolution cluster observations accumulated from different types of experiments. Although an invaluable resource to the space physics community, this multi-instrument data is difficult to mine and analyse, as it lacks supporting contextual data.

ECLAT scientists are upgrading the CAA by importing measurements from a variety of other space missions and ground-based observatories. Data mining, visualisation and analysis routines as well as a modelling infrastructure are also being added.

The software tools enable users to place spacecraft within the space recreated from ground observations, marrying the two datasets (space- and ground-based observations) for the first time. On the other hand, using information about the solar wind conditions will facilitate creation of a detailed 3D map of the Earth's magnetosphere.

By analysing the different characteristics of the observed magnetic and electric fields, this state-of-the-art database will lead to new insights into many natural processes — from those occurring deep inside the planet and affecting the Earth's magnetic field, to weather in space caused by solar activity.

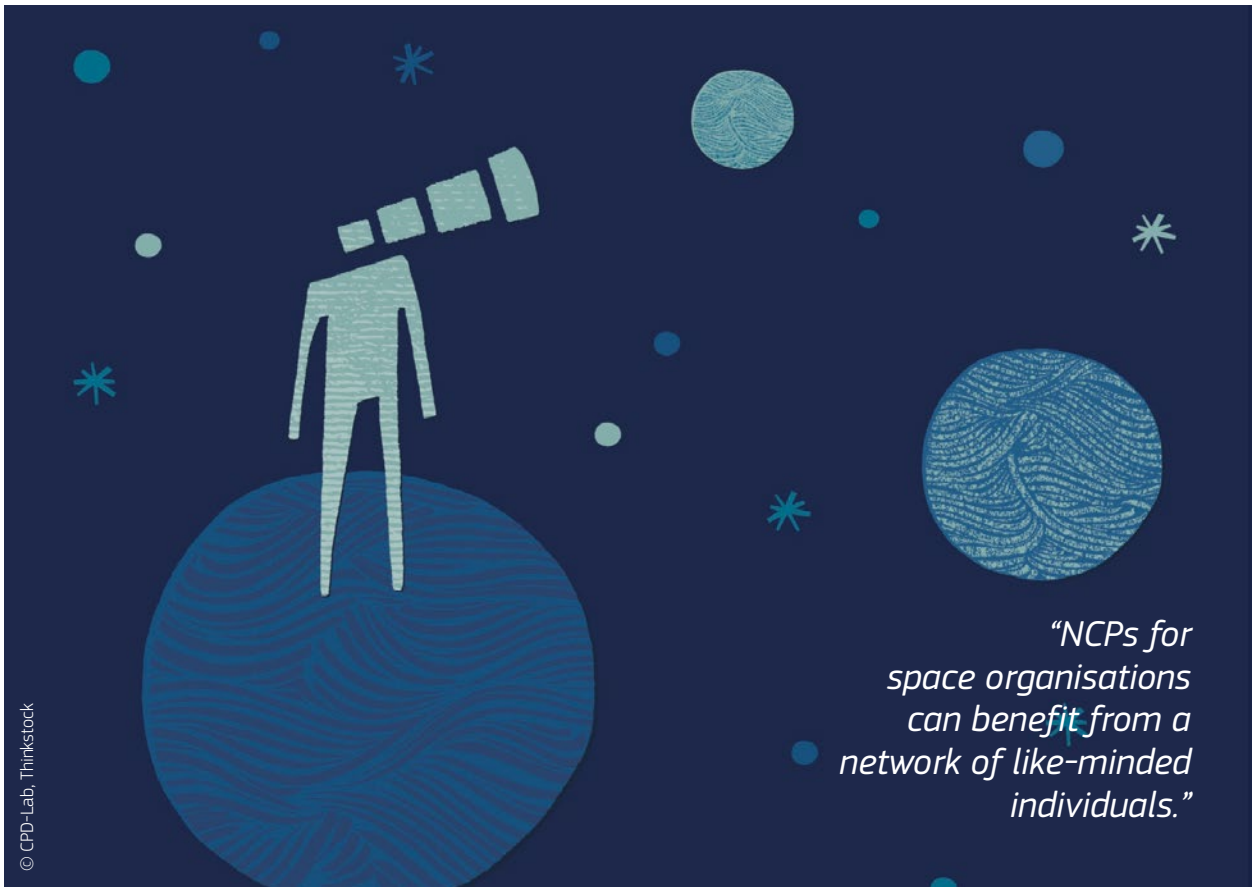
In turn, with this information on hand, researchers could watch space weather unfold in a way never before possible and, more importantly, improve the quality of forecasts of space weather events.

ECLAT

- Coordinated by the University of Leicester in the United Kingdom.
- Funded under FP7-SPACE.
- http://cordis.europa.eu/result/brief/rcn/9796_en.html
- Project website: http://www2.le.ac.uk/departments/physics/research/rspp/missions/eclat/eclat-european-cluster-assimilation-technology

FACILITATING EXCHANGE AMONG SPACE NATIONAL CONTACT POINTS

An EU project is aiding networking among space agency 'National contact points' (NCPs). This will help them share information and raise the standard of communication services.



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NCPs for space organisations can benefit from a network of like-minded individuals. This will help to balance and raise the overall quality of NCP services.

Aiming to achieve this is the EU-funded COSMOS+ (Continuation of the cooperation of space NCPs as a means to optimise services) project. The project brings together 21 scientific research agencies from around Europe.

The project's work will be structured into six 'work packages' (WPs), each with its own goal. The first, 'integration', aims to even chances for all Seventh Framework Programme (FP7) countries and regions. This includes equalising opportunities for additional countries, small and medium-sized enterprises, and both genders.

An exchange system promises to foster contacts among COSMOS+ partners. A mentoring scheme with developing countries will improve collaboration among key space players. Additionally, the project will improve the knowledge and skills of space NCPs, and provide them with current information about performing certain duties. COSMOS+ will also ensure the smooth transfer of space NCP services beyond 2013 funding.

The final goal is to provide information about COSMOS+ and to raise awareness about FP7 or Horizon 2020 space projects and related topics.

To date, the project's work consists of a kick-off meeting in June 2012. Non-member agencies were invited for a briefing. Prior to the project's official launch, the University of Surrey (United Kingdom) hosted an information day, informing over 160 participants from 24 countries about FP7's most recent space call. Training events (in Spain and Cyprus in 2012) allowed the network to participate in an EU space event, and improved partners' knowledge of space activities and organisations.

The project, and its planned future events, will support a smooth start to Horizon 2020. This will mean articulated space proposals, hopefully leading to successful projects.

COSMOS+

- Coordinated by DLR in Germany.
- Funded under FP7-SPACE.
- http://cordis.europa.eu/result/brief/rcn/12615_en.html
- Project website: http://ncp-space.net/

EVENTS

JULY 03▸04

London, UK

CONFERENCE

INTERNATIONAL CONFERENCE ON AGRICULTURAL, ECOLOGICAL AND MEDICAL SCIENCES

The 'International Conference on Agricultural, Ecological and Medical Sciences' (AEMS-2014) will take place from 3 to 4 July 2014 in London, UK.

The conference aims to bring together leading academic scientists, researchers and scholars to exchange and share their experiences and research results regarding all aspects of agricultural, ecological and medical sciences. Participants will also discuss the practical challenges encountered and the solutions adopted. Participants are invited to submit full-length papers, short papers, posters and abstracts that address the themes and topics of the conference, including figures, tables and references of novel research material.

For more information, please visit:
http://www.iicbe.org/2014/07/05/47

JULY 07▸09

Opatija, CROATIA

CONFERENCE

AIR POLLUTION 2014

A conference entitled 'Air Pollution 2014' will be held from 7 to 9 July 2014 in Opatija, Croatia.

Air pollution is one of the most challenging problems facing the international community. It is widespread and has known impacts on health and the environment. The goal of this conference is to bring together researchers who are active in the study of air contaminants to exchange information through the presentation and discussion of papers dealing with a wide variety of topics related to air pollution.

For more information, please visit:
http://www.wessex.ac.uk/14-conferences/air-pollution-2014.html

EVENTS

For more forthcoming events:
http://cordis.europa.eu/events

JULY 15▸18

Narvik, NORWAY

CONGRESS

ICNPAA CONGRESS: MATHEMATICAL PROBLEMS IN ENGINEERING, AEROSPACE AND SCIENCES

An event entitled 'ICNPAA Congress: Mathematical Problems in Engineering, Aerospace and Sciences' will be held from 15 to 18 July 2014 in Narvik, Norway.

The ICNPAA congresses bring together scholars, leading researchers and experts from diverse backgrounds and applications areas. Special emphasis is placed on promoting interaction between the theoretical, experimental, and applied communities, so that a high level exchange in new and emerging areas within engineering, aerospace, and all areas of sciences and applied mathematics is achieved. The biennial conference series attracts scientists, engineers and researchers from academia, government laboratories and industry across the world.

For more information, please visit:
http://icnpaa.com/index.php/icnpaa/2014

JULY 21▸25

Aveiro, PORTUGAL

CONFERENCE

MATHEMATICS AND ENGINEERING IN MARINE AND EARTH PROBLEMS

A conference entitled 'Mathematics and Engineering in Marine and Earth Problems' will be held from 21 to 25 July 2014 in Aveiro, Portugal.

The main goal of the conference is to provide a multidisciplinary forum where mathematicians, engineers and other scientists can engage and discuss the development of innovative scientific and technological tools for the study and exploration of the Earth and the Ocean.

Besides promoting demonstrations and discussions of recent advances in hot topics of research, the conference is expected to foster closer cooperation between theoretical and experimental practitioners leading to the emergence of new research agendas and providing guidelines for future work.

For more information, please visit:
http://c2.glocos.org/index.php/meme/main

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HorizonHealth.eu is a web portal that introduces research projects to patients, everyday science fans, school pupils, students, policy makers and the media. Scientists personally explain how collaborative research projects address our understanding of life and global health challenges.

HorizonHealth.eu is a spin-off of CommHERE (Communicating European Health Research), an FP7 Health project which aims to improve communication of EU-funded health research projects to the general public and the media. **www.commhere.eu**

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