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SPECIAL FEATURE

## NEW TECHNOLOGIES FOR FIGHTING CRIME



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# EDITORIAL

*by the editorial team*

## TOWARDS A HEAD START ON SECURITY?

Citizen security has never been so high on the EU agenda. In fact, its well-named European Agenda on Security – which defines priorities for 2015 to 2020 – prioritises terrorism, organised crime and cybercrime as “interlinked areas with a strong cross-border dimension, where EU action can make a real difference.”

It’s a sign of the times. The past two years have shown us how terrorism was an immediate threat to our security, even within the EU’s most important capital cities. On the other hand, the shift to Web 2.0 and smart technologies is proving to be both a tremendous opportunity and a source of concern: living in a smart city is certainly reassuring from a security point of view, but it also raises concerns related to privacy and provides ill-intentioned hackers with worrying opportunities.

In the end, it is and always will be a race: one that opposes criminals on one side, to authorities, industry and involved citizens on the other side. The tools for winning this race are technological breakthroughs, innovation and

cooperation/widespread adoption. Although it may seem like this issue of the research\*eu Results Magazine focuses on the former aspect, it actually puts emphasis on all three.

As each project in our “special feature” section led us to conclude, technology can only make a difference when supporting valuable concepts, and cooperation/widespread adoption is key to its success. This is true for the use of virtual and mixed reality to train crime investigators, for participatory apps aiming at citizens; or even for

new technologies like smart sensors, voice recognition algorithms, next-generation walkie-talkies or software for visual analytics. And each of these projects seems off to a great start, which is certainly a source of optimism.

Our usual sections on health, society, energy, environment, aquatic resources, industry, information and communication technology, security and fundamental research are also featured in this magazine – which closes with a list of upcoming events hosted by or involving EU-funded research projects.

We look forward to receiving your feedback. You can send questions or suggestions to: [editorial@cordis.europa.eu](mailto:editorial@cordis.europa.eu)



**‘In the end, it is and always will be a race: one that opposes criminals on one side, to authorities, industry and involved citizens on the other side.’**

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The dawn of the  
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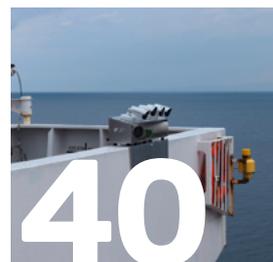
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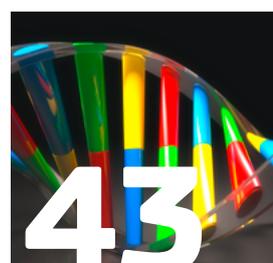
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## SPECIAL FEATURE

## NEW TECHNOLOGIES FOR FIGHTING CRIME



# VIRTUAL REALITY TRAINING TO HELP CATCH DRUG TRAFFICKING

By allowing investigators to develop cross-border cooperation with the help of virtual suspects and trainers, the LAW-TRAIN project hopes to contribute to the fight against international, organised drug crime.

World drug usage is growing significantly every year. So is its trafficking: although the value of this market is difficult to estimate, experts evaluate it at approximately USD 400 billion.

The amount of work this implies for investigators is mind-bending. It also means that, to be effective in their jobs, these investigators need to be well-trained in various disciplines, as well as have the means to cooperate with their peers in other countries. The LAW-TRAIN (Mixed-reality environment for training teams in joint investigative interrogation-Intelligent interrogation training simulator) project aims to fill existing gaps, with a virtual investigation training system jointly developed by universities, governments and relevant companies.

'We know that training by role-playing is very beneficial. But doing it with a team of senior law-enforcement personnel from different European countries is very difficult: all are very busy and located in different places,' says Prof. Sarit Kraus, coordinator of the project for Bar Ilan University in Israel.

Thanks to LAW-TRAIN, investigators will soon benefit from a virtual reality training platform that allows them to remain in their country while interacting with other team members across Europe.

Each training session consists of four phases: individual preparation, where the trainee receives information about the case; joint preparation, where the trainee can exchange information and shape a joint strategy with his or her peers; investigative interview, where one or two trainees get to interview the virtual suspect in the presence of an equally virtual lawyer; and debriefing/evaluation. The use of virtual reality (VR) is focused on phase three and makes use of the Oculus Rift headset.

'Recruiting a person to play the role of the suspect is difficult, so LAW-TRAIN provides a virtual suspect that the team

can interview,' Prof. Kraus explains. 'Besides, we provide various tools for the trainers: LAW-TRAIN supports many scenarios and enables the creation of new ones. It provides statistics on the trainees' performance and includes a virtual trainer who can comment on the trainees' performance and any deviation from the European ethical guidelines online.'

These aspects of LAW-TRAIN make for as many different modules, all developed by project partners and mediated by an exchange server. Each module was, of course, developed in close cooperation with end-users.

'They love it,' Prof. Kraus enthuses. 'The system was presented at the MILIPOL conference to dozens of end-users who were enthusiastic and are now awaiting commercialisation.' The system will be available on various platforms. All it requires for working is a fast local computer and a secure Internet site for activities such as video conferences and information analysis.

Before LAW-TRAIN makes it to the market, the team intends to continue testing the system with end-users and improving its modules until the project comes to an end in April 2018. 'We are also looking for even more innovation beyond the goals set in this project, hoping to develop them as well in the future,' Prof. Kraus says.

Since LAW-TRAIN has been designed as a generic engine, the development of scenarios for other types of illegal activities as well as other cross-border teamwork training is very likely.

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## LAW-TRAIN

- ★ Coordinated by Bar Ilan University in Israel.
- ★ Funded under H2020-SECURITY.
- ★ <http://cordis.europa.eu/project/rcn/194874>
- ★ Project website: <http://www.law-train.eu/>

# NOVEL VOICE RECOGNITION TECHNOLOGY COMPLETES INTERPOL'S LEGAL ARSENAL

Watching mainstream forensics-related TV shows could easily make us believe that there is no piece of evidence stronger than conclusive DNA samples or fingerprints. Yet, that would be forgetting the importance of voice recognition. Thanks to new Speaker-Identification technology and a large database of voices maintained by Interpol, the latter will now become much easier.

Imagine a criminal, face hidden, recorded by a security camera as he threatens one of his victims. Or a monitored phone conversation between a suspected drug trafficker and an unknown person who seems to be pulling the strings. In such scenarios, a 100% accurate voice recognition technology would be a game changer.

Although voice recognition can already be presented as legal evidence, there is still scepticism around its scientific grounds. The EU-funded SIIP (Speaker Identification Integrated Project) aims to discard these doubts with an innovative probabilistic, language-independent identification system. This system uses a novel Speaker-Identification (SID) engine and a Global Info Sharing Mechanism (GISM) to identify unknown speakers who are captured in lawfully intercepted calls, recorded crime or terror arenas, social media and any other type of speech source.

SIIP's strong point resides in the merger of multiple speech recognition algorithms related to speaker model, gender, age, language and accent provided by different vendors. This fusion results in highly reliable and confident

detection, keeping false positives and false negatives to the minimum.

By using this technology, Law enforcement agencies (LEAs) can overcome the two main challenges they have been facing up until now: the evasion problem, which consists in the use of hidden, fake and arbitrary identities by terrorists and criminals in phone or Internet-based conversations; and the difficulty in identifying an unknown conversation in a lawfully-intercepted call of a known speaker.

Once the conversation has been recorded, SIIP will enable the identification of speakers by comparing their voices to rich-metadata from various sources and enable information sharing with LEAs across the world via Interpol. This way, law enforcement agents can gather valuable intelligence to prevent a crime or terrorist activity, solve it if it has already happened, and use voice identification as a pre-forensic tool to create evidence for judges.

The system has already been demonstrated by the project's end user partners themselves in real cases, including identification of speakers on social media and information sharing between users. The consortium

indicated that the feedback was really positive, to the point where SIIP may actually join other Interpol central biometric databases such as fingerprint, face and DNA. This would not only enhance Interpol's global activity of information sharing between its 190 member states, but also improve and expedite investigation work.

Although the project ends in April 2018, SIIP's development phase is completed, and the consortium says that the system will be ready for commercialisation in a 'very short time'.

A budget should be allocated by the EU and Interpol to create a spin-off company that they would officially support and promote. This spin-off company will take care of marketing and sales, customisation to specific customers' needs, maintenance and future developments.

## SIIP

- ★ Coordinated by Verint Systems in Israel.
- ★ Funded under FP7-SECURITY.
- ★ <http://cordis.europa.eu/project/rcn/188607>
- ★ Project website: <http://www.siip.eu/>



## A CUSTOM-FIT APP FOR COMMUNITY POLICING

Apps allowing citizens to report crimes or incidents are now commonplace, but they generally fail to adapt local contexts, cultures and sensibilities. SecureU, a new app that addresses this shortcoming, is currently being tested in five European cities.



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The emergence of the web 2.0 has provided us citizens with a highway to higher participation in the society we live in. We can easily voice our opinion on a large-scale, but also potentially gather enough support to shape societal change, all this in record time. This applies to politics, for instance, but also to law enforcement.

Since 2010, smartphone apps enabling citizens to report crimes or incidents have been cropping up at an increased pace. In light of the predominantly Anglo-Saxon approach to these apps, however, the CITYCOP (Citizen Interaction Technologies Yield Community Policing) project set out to identify the reasons behind the lack of European alternatives before developing a solution of its own, reflecting the diversity of European cities and societies.

Prof. Dr Jeanne Pia Mifsud Bonnici, coordinator of CITYCOP for the University of Groningen, discusses the project's outcomes a few months away from its completion in May 2018.

### ★ How do you explain that user-generated content is becoming so important in crime reporting?

**Prof. Dr Jeanne Pia Mifsud Bonnici:** There are several reasons for that. Firstly, it's an innovative way to directly engage with police, and it gives community members a greater sense of contribution by providing them with more convenient options to report crimes, quality of life issues and suspicious activity. These have become essential components of the 21<sup>st</sup> century's policing.

Secondly, such methods of direct engagement and contribution help improve the efficiency of police operations, allowing more effort to be directed towards solving crimes and addressing community concerns.

### ★ The project aimed to explain why the EU is lagging behind. What did you find out in this regard?

The relationship between police and community members in the EU is unique. Our research showed that the definition of community policing varies greatly from country to country. Whereas some parts of Europe have decades of experience with community-oriented policing, for others, the concept is relatively new and just beginning to take shape in respect with cultural sensitivities and historical relationships with law enforcement.

Because of this, there cannot be a 'one size fits all' approach to technological solutions that support these programmes. Before innovation can take hold and bear measurable benefit, there needs to be a demonstrable commitment to engaging and building trust.

### ★ How does your app solve these problems?

SecureU takes the needs of both the community and police into account, by providing a local 'flavour' to each version of the app depending on where it is offered. Our research demonstrated that people desire more positive engagement with the police. Not only through increased visibility and interaction, but also with more police communication around issues that have a direct impact on their lives.

Our solution increases communication both ways, with a privacy-by-design approach respectful of national and EU regulations.

There are three main features. First, the police can send 'alerts' directly to the community, providing important information such as local events, traffic incidents and matters of public safety. Then, users can report selected quality of life and criminal incidents. Finally, the app provides

various forms of municipal information and a link to make emergency calls if necessary.

★ **How does it work exactly, from both the perspective of the user and officers?**

The users first download the app from Google Play or the App Store, then select a country, city and language. They are then presented with an intuitive interface allowing them to see the alerts that they have subscribed to, submit (and review previous) reports to the police and obtain information from important locations such as police, fire stations and hospitals. Users can register their personal information and share their location for ease of reporting – which is required in some locations – and in case of emergencies, which can be deleted or changed at any time.

For law enforcement, a web accessible dashboard provides several key features, the main ones being the creation, ranking and management of alerts; and the management of – and response to – reports from community members. All alerts, reports and emergencies are displayed on a map within the dashboard and can be exported to create reports for management and auditing purposes. The dashboard is easy to use, intuitive and can be used with minimal investment from participating agencies.

★ **What are your hopes in terms of commercial success?**

First and most importantly, we intend to provide a seamless transition for existing users, that is, project participants and early adopters of the technology who have contributed

greatly to its success. We want to ensure that upon the project's conclusion, there is no noticeable change in service that both the user of the app and supporting police agencies have come to enjoy.

With that being said, we will have a structure in place before the project concludes, through which new organisations and communities can adopt the CITYCOP solution. This includes the development of a toolbox summarising the results of our research, providing a framework for installation and reviewing best practices.

★ **What do you still need to achieve before the end of the project?**

We are currently conducting our pilot runs in Bucharest, Florence, Lisbon, Dublin and Kildare. Before the project concludes, we will take the results of these pilots and prepare them for presentation at our final conference in Florence in April 2018.

Our goal is not only to review and celebrate the successful conclusion of CITYCOP, but also to host an event open to residents and law enforcement agencies from throughout Europe, promoting our efforts and informing those considering our solution for use within their own communities.

#### CITYCOP

- ★ Coordinated by the University of Groningen in the Netherlands.
- ★ Funded under H2020-SECURITY.
- ★ <http://cordis.europa.eu/project/rcn/197273>

## POLICE AND FIRST RESPONDER TRAINING ENTERS MIXED REALITY

A serious game platform making the best of virtual and mixed reality technology for police and first responders training is getting close to the end of its development phase. Organisations from across Europe are already eager to implement it in their routines.



The number of different threats security staff and first responders will face over the course of their career is astounding, and they keep evolving with technological advances and political changes. Generating real-life training scenarios for all these threats would simply

blow out allocated budgets: some scenarios are just too complex and dangerous to be practiced in real life.

Enter serious game which makes use of virtual reality (VR), augmented reality (AR) and their combination: mixed reality (MR). Put on a VR headset, and

virtual reality elements merge with real ones, providing a whole new world of possibilities. It's a godsend for police, paramedics and firefighter trainers.

Developers are starting to realise this potential, while BMT and its 13 partners from across Europe are hoping to shape the new market with their AUGGMED (Automated Serious Game Scenario Generator for Mixed Reality Training) platform. 'AUGGMED has been developed in close collaboration with end-users,' says Jenny Rainbird, coordinator of the project. 'It provides a safe, flexible training environment that can be accessed from any location by multiple agencies. Trainees can assume a variety of roles, making AUGGMED a cost-effective solution when compared with live training exercises.'

AUGGMED benefits from an automated game scenario engine, which defines game logics based on team

and individual objectives set by the trainer and generates crowds randomly. With this, the trainer can customise many aspects of the scenario, and trigger events such as explosions, evacuations or suspicious bags. The trainer can also, of course, monitor the progress of the training session, provide feedback and assess performance.

The AUGGMED solution was tested in three controlled pilots by over 130 professional users in total. It is divided into three modes: basic VR, immersive multimodal VR and immersive MR. It makes use of the game engine Unity, which is being used for most HoloLens experiences.

'The response has been overwhelmingly positive, with the vast majority of users indicating that a tool such as AUGGMED would complement current training, whether this takes place in the classroom, in synthetic environments or on a physical training ground,' Rainbird says.

## The path to commercial success

Despite these early signs of success, AUGGMED will not be the sole offering out there, at least not for VR. So, what exactly sets AUGGMED apart from alternatives? 'It goes a step further, as the trainees are able to interact with the simulated crowd, and even be affected by fire and toxic gases. Crowd behaviour, along with fires and explosions, are based on the best available models, which also increases the perceived realism and hence the system's immersiveness,' Rainbird explains. Furthermore, AUGGMED is 'doctrine neutral', meaning that organisations can train and assess their staff using their own training needs, procedures and protocols.

With the project's end now in sight, the AUGGMED team is beginning to focus on their exploitation plan, which harnesses the 'Gate Governance' approach of project exploitation lead Serco. Three critical questions will be addressed: How do we keep partners

engaged after the project ends? How do we keep momentum after funding finishes? How do we move from a prototype to a practice (commercial) application?

The final stage of development is currently under way, and field trials of the MR system will take place in spring 2018. 'To the best of the partners' knowledge, the MR prototype training system will be the first of its kind specifically developed for police training. Commercial interest has been encouraging and the partners are committed to taking AUGGMED further, bridging the gap between a prototype and a fully functioning commercial product,' Rainbird concludes.

### AUGGMED

- ★ Coordinated by BMT in the United Kingdom.
- ★ Funded under H2020-SECURITY.
- ★ <http://cordis.europa.eu/project/rcn/194875>
- ★ Project website: <http://www.auggmed-project.eu/>

## VISUAL ANALYTICS FOR BRIGHTER CRIMINAL INTELLIGENCE

The benefits of data visualisation for crime prevention, intervention and solving are well documented. Thanks to four years of intensive research, the VALCRI project will be turning it into a must-have.

**B**ig data, its dizzying volumes of information flowing from multiple sources and the lack of perspective on these sources means it's really difficult to make sense of information in moments of urgency. As Andrew Parker, Director of the MIS once explained, 'we only ever have fragments of information, and we have to try to assemble a picture of what might happen, based on those fragments.' This problem started coming to light with the 9/11 terrorist attacks, and has been plaguing investigations up until the most recent attacks.

However, a solution is now presenting itself. The VALCRI (Visual Analytics for Sense-making in CRiminal Intelligence analysis) project consortium is in the final development stages of a criminal intelligence analysis system based on visual analytics and cognitive engineering.

'The cognitive engineering approach provided us with insights about how analysts think, rather than just what analysts do,' explains Prof. William Wong, coordinator of VALCRI. 'The idea is to tap into the right resources for each task: humans for reasoning and sense-making with ambiguity; and machines for the heavy-lifting, to search through millions of records distributed across many different databases and present semantically similar information within the same visual field of view.'

Concretely, cognitive engineering implies a workspace split into three parts: the Data Space, which enables the analyst to see what data they have and how they are related; the Analysis Space, to perform various computations in order to understand trends, patterns, relationships and other significant behaviours; and the Hypothesis Space, where the analyst collates, assembles the data and formulates hypotheses and arguments that they can test scientifically.

The latter process, called storytelling, is particularly important. Prof. Wong compares it to archaeology: 'Using fragments of broken pottery and other artefacts, then using their knowledge of the history of the time, archaeologists



construct narratives that explain what society might have been like at the time,' he explains.

### Relieving analysts

To help analysts, the VALCRI team studied how they think and work, and quickly identified the finding and assembly of related or relevant information as a major issue. 'Manually searching different databases for such information in the case of a simple crime requires an estimated 73 separate SQL queries. It can take three to five days,' says Prof. Wong.

With VALCRI, this process can be performed with a single click. The system uses dedicated engines to identify similarities, performs associative searching and comes up with reports in the same area and timeframe, but not necessarily of the same crime type. VALCRI even searches for possible associations between unconnected data to compare solved and un-solved crimes, which can prove very handy in quickly generating a list of potential suspects.

Every aspect of VALCRI was designed with user-friendliness and efficiency in mind. The interaction design, for instance, is based on tactile reasoning – the direct manipulation of information objects in the user interface. As Prof. Wong explains: 'We believe that when one is presented with a set of information that can be freely moved, manipulated, grouped and rearranged in a visuo-spatial manner, it helps discover meanings or relationships.'

The police analysts who could test VALCRI were impressed by this aspect, saying that it helped them develop, and maintain

an overview of, their analytic process whilst keeping track of status, identifying oversights and remaining tasks.

VALCRI also put emphasis on privacy protection. The data access control security software specifies which faces a user can or cannot see, whilst video anonymisation blurs out the faces of those specified. The consortium actually solved a common problem with security-related projects: the lack of realistic data. 'We developed anonymised data based on over 1.5 million actual records from one of our police partners,' says Prof. Wong. The dataset is currently being validated and – if proven impossible to de-anonymise – it will be released to the scientific and research community.

By the end of June, Prof. Wong and his team intend to deliver an integrated, multi-function system at TRL-5. The VALCRI prototype is currently being deployed at the premises of the project's police partners. 'Current efforts are focused on ensuring an accurate ingestion of the data, and if time and resources permit, we hope to be able to demonstrate VALCRI's capability to solve actual crime cases,' Prof. Wong says.

#### VALCRI

- ★ Coordinated by Middlesex University in the United Kingdom.
- ★ Funded under FP7-SEC.
- ★ <http://cordis.europa.eu/project/rcn/188614>
- ★ Project website: <http://valcri.org>

## SMART SENSOR-BASED CAMERAS FOR FORENSIC EVIDENCE GATHERING

Video surveillance is increasingly popular within Law enforcement agencies (LEAs). But although device sophistication has reached an all-time high, state-of-the-art technology is still expensive, energy-greedy and difficult to set up. Conscious of these problems, the FORENSOR team has been working on a new generation of evidence-gathering, autonomous sensors.

Things have been moving fast since 2005. At the time, members of the FORENSOR (FOREnsic evidence gathering autonomous sensor) consortium were faced with a lack of surveillance technology targeting forensic applications. Now, Lazaros Gymnopoulos, research assistant at Hellas and coordinator of FORENSOR, speaks of a dramatic increase in the availability of equipment.

'Historically, covert deployments were accessible only to specialist units dealing with serious and organised crime. They are now widely available. Video quality got better, devices got miniaturised, and autonomy increased,' he says. However, cost, energy consumption and complicated use mean there is still need for a smart sensor that can get the job done at a minimum cost and effort.

'What is still missing is an autonomous, intelligent sensor: A small, secure, smart device with multiple capabilities,



easily concealable and intelligent enough to record only when predefined events occur. This would minimise cost, complexity, installation time and reliance on often unavailable infrastructure,' Gymnopoulos says. Whilst such smart devices are progressively entering households (smart, battery-powered cameras equipped with motion sensors and infrared vision are

slowly breaking through), LEAs need more robust solutions, capable of providing irrefutable evidence.

With this in mind, FORENSOR is bringing about two main innovations: a CMOS imaging sensor with built-in intelligence (the Vision Chip) to filter out irrelevant events (repeating pattern movements such as moving trees,

## SPECIAL FEATURE

shadows, illumination changes, etc.) and detect only moving objects of interest (such as humans or cars); and a smart Vision Sensor, including the Vision Chip, which can identify higher-level events of interest based on the movement of detected objects. In other words, FORENSOR can operate in an ultra-low-power hibernation state most of the time and be woken up by the Vision Chip only when an object of interest has been detected.

As Gymnopoulos points out, the uniqueness of FORENSOR lies in how this 'surveillance intelligence' has been squeezed into ultra-low-power electronics and hardware. Of course, this required some trade-offs: 'There is an everlasting struggle to achieve a compromise between the likes of: large transmission distance and power consumption; high video quality and high

transmission speed; the large amount of stored evidence and small sensor size, etc.,' Gymnopoulos explains. But the choices made by the consortium seem to have paid off, with initial customer feedback being largely positive.

The protection of privacy, personal data and other important ethical concerns were also at the heart of the project. An impact assessment approach called DaPPECL was set up, and Gymnopoulos is confident that this approach contributes to 'the development of a legally and ethically sound system which fosters evidence gathering and protects various social values at the same time.'

With FORENSOR now entering its third year, the focus is placed on exploitation. 'We already know that FORENSOR has very good potential for exploitation on both system and sub-system

level,' Gymnopoulos explains. 'Besides our core market of LEAs, we are also looking at adjacent security markets like the protection of critical infrastructure, transport and logistics companies. Indeed, we see that the core innovation of the project has the potential to be transformed into competitive B2C and B2B solutions for these markets. Even at component level, there is a strong focus on commercialisation as some partners have already incorporated project results into their products.'

**FORENSOR**

- ★ Coordinated by CERTH in Greece.
- ★ Funded under H2020-SECURITY.
- ★ <http://cordis.europa.eu/project/rcn/194854>
- ★ Project website: <http://forensor-project.eu/>

## PARTICIPATORY APP MAKES CITIZENS FEEL SAFER IN TOWN

The CITY.RISKS ecosystem, which allows citizens to share safety-critical information with authorities by means of a dedicated app, is getting close to commercialisation. Pilots are being run in London, Rome and Sofia.



When put together, increased urbanisation, recent terrorist attacks and instant information make for a bitter cocktail. According to the 2016 report on the 'State of EU cities', homicides may have dropped by 40% from 2002 to 2014, yet a growing number of city dwellers feel insecure.

For Socrates Costicoglou, IT, Applications and R&D Director at Space Hellas, it's a sign of the times: 'Rapid urbanisation provides many opportunities for deviant or criminal behaviour, and many such behaviours instil fear in citizens. Engaging the community can revert this trend, and technology can prove an excellent means to this end, providing

deterrence and protection from criminal events whilst working effectively against urban decay.'

This is precisely the purpose of CITY.RISKS (Avoiding and mitigating safety risks in urban environments) – an ecosystem of mobile and web applications developed by Space Hellas and its partners under the project of the same name. The system provides a continuous stream of real-time information about incidents, allowing citizens to navigate these risks and share their own reports. Enough, says Costicoglou, to make citizens feel safer and reduce the effects of crimes and other menaces to urban security.

'The aim is to give first-hand responsibility to citizens,' he explains. 'CITY.RISKS leverages a set of innovative technologies like augmented reality, smart sensors, the Web and the social media, but more importantly uses the citizens' smartphones as a tool for increasing their personal and collective sense of security.'

Concretely, the CITY.RISKS ecosystem comprises: a central platform that includes the Risk Management and Response Engine (RMRS) and the Data Management layer; a number of front-end client applications – namely the CITY.RISKS mobile application and the CITY.RISKS web app; a front-end client for the city operator (communities, city authorities); and the CITY.RISKS operation centre. 'As part of the project, we have also developed an innovative Participatory Sensor System to protect citizens' personal belongings empowered by crowd sensing,' Costicoglou adds.

### Getting users on board

The CITY.RISKS app is being piloted in London, Rome and Sofia and, as we wrote these lines, the team were still awaiting responses to their first set of surveys. But setting up these pilots generated useful insights: Providing overly technical information, for example, made recruitment more difficult than initially expected. Then, the fact that the app sometimes sent too many push notifications probably contributed to some users being put off.

'An obvious lesson learnt is to make sure that the technical aspects of the app are as "complete" and functioning as possible. Another one is that, for a technological pilot to be successful, offline preparatory work is key. For example, it is apparent that the clear articulation of what the app does, its uses and its limitations need to be clearly exposed to participants, jargon-free and in a transparent manner,' Costicoglou explains.

Privacy, another key concern for citizens, was also a major concern of the team. 'Although geolocation means that utter privacy can almost never be guaranteed, the CITY.RISKS platform is designed to enable citizens to collaborate in a primarily anonymous way. They can choose what personal information they wish to submit to the system,' Costicoglou says.

CITY.RISKS is already gathering 'a lot of interest' from potential customers like cities and city authorities. Partners like Space Hellas have already started integrating some of the project's results in existing commercial offers related to security and smart cities. Furthermore, the consortium has received requests for the participatory sensor scheme to be deployed in other settings like child protection in malls.

#### CITY.RISKS

- ★ Coordinated by Space Hellas in Greece.
- ★ Funded under H2020-SECURITY.
- ★ <http://cordis.europa.eu/project/rcn/196894>

## INTERVIEW

# WALKIE-TALKIES STEP UP THEIR GAME

Walkie-talkies were invented 70 years ago. One could be forgiven for ever thinking that the advent, rise and now omnipresence of mobile phones would sound their death knell. But the truth is, in 2018, walkie-talkies are still being used. Now, a Finnish company proposes to enhance them with the mobile broadband technology we find on our smartphones.

**A**INA calls its technology a 'PTT Voice Responder'. Rather than submitting to a regular walkie-talkie design we've been used to seeing for years, the company created a brand new device that all those who need their hands free in order to do their job can clip to anything – from a carabiner to a keychain or parachute cord.

Using the device is simple. Connect it to a smartphone via Bluetooth, and you're good to go: with a few programmable buttons, essential functions such as push-to-talk, phone calls, channel switching and emergency alerts can be accessed. The rationale, in the case of police officers for instance, is simple: you cannot chase a criminal and operate a touch screen phone simultaneously.

Maximilian Leroux, CEO of AINA Wireless, discusses the PTT Voice Responder along with three other technologies developed under the IPCOM (Next generation IP-based smart Push-to-Talk communication device for public security) project, and

their potential for driving the convergence of walkie-talkie radios and mobile broadband technology.

#### ★ Why is it important to provide an alternative to walkie-talkie radios?

**Maximilian Leroux:** Our product is rather an enhancement of a walkie-talkie

than an alternative. We aim to provide public safety officials and industrial users with a solution to maintain their habits of pushing a button to open a talk channel, so none of that changes.

What we do is adding all modern communication technologies to it, along with their enhanced capabilities



## SPECIAL FEATURE

like geo-location, man-down and emergency alarms, telemetry, and direct mode communication in case a network is failing. We take something that is old and make it new, without changing the core functionalities.

★ **How do you explain that no such alternative has managed to convince stakeholders yet?**

Professional communication is an old school industry with long lasting contracts between big players and governments. Here, the macro-economic perspective where a disruptive technology changes everything doesn't apply on its own: It also requires a government decision.

When the United States decided to build a broadband network – FirstNet – for first responders, and the United Kingdom turned off Tetra to make room for the Emergency Services Network (ESN) in 2020, it shifted the momentum. Now it's not a technology or a pitch for more efficiency in communication: it's going to be a law! We will see more of this to come, and by starting early, we can build our brand and run field trials before the market is crowded.

★ **Is it really safe for such organisations to resort to mobile broadband, especially for situations where no Internet is available?**

Our standalone Push-to-Talk devices connect to any wireless network, therefore you will always be able to use roaming.

The last fallback for cases where there is no network at all. With our direct mode, you will be able to speak from device to device in a mesh network. As long as you are within range of a team member, you will stay connected. This is also important especially for first responders.

★ **Can you tell us more about the different devices you developed?**

We have developed the AINA PTT Voice Responder – a Bluetooth speaker-microphone, for PTT apps with a smartphone in mind. It's a 2nd generation wireless speaker-microphone since it allows the user to keep their phone in a safe place, yet still remote control all functions their app includes. We also developed a Bluetooth Low Energy device featuring two PTT buttons, an emergency alarm and an accelerometer which can be programmed to trigger an alarm such as man-down.

In a next step we will be launching a product that allows audio over

Bluetooth LE to achieve the same short latency people are used to from walkie-talkies, and already add the direct mode as a fallback. This new device will be important for people who are using phones and tablets for other things as well, not just push-to-talk. They will always need their smart device plus speaker-microphone.

Ultimately there will be a new generation of our LTE stand-alone PTT device which will replace the need for walkie-talkies altogether. We expect a high demand for it, because it combines simplicity and ease of use with state-of-the-art technology: Just load any PTT app directly onto the speaker-microphone and you are ready to go.

★ **What has been stakeholders' feedback so far?**

Quality prevails. We are aiming for the high-end and our largest customers and partners are very satisfied with our products. This raises the bar for ourselves, but also customer expectations. AINA Wireless is not in business to compete with Far East manufacturers. The feedback has been 100% positive and the market seems to look forward to our next move.

★ **What are your commercialisation plans?**

We plan to launch at least one new product every six months. With this cadence we can maintain the highest quality while handling government approvals, test plans and field trials to ensure reliable products at market entry.

Anyone can buy and receive our product, even a single unit, from anywhere in the world within about week. Of course, our main focus is placed on partnering with large distributors, mobile operators, two-way-radio manufacturers and the leading developers of PTT apps. This way we have access to large customers and ensure that the whole solution works exactly the way end-users are expecting it to.

★ **What do you still need to achieve before the end of the project?**

About a million things, but they start coming together. We have a great team and good partners. By the second half of 2018 we want to be able to present something to the public.

The longest part is always research: What are you trying to do and how? Once you figured out your concept it's all execution. This is why we have a few engineers that don't have a real job description, their work is to just come up with ideas. Then we have a whole other team who takes the concepts and puts them into the workflow of product development.

**IPCOM**

- ★ Coordinated by Paumax/AINA Wireless in Finland.
- ★ Funded under H2020-SME.
- ★ <http://cordis.europa.eu/project/rcn/205767>
- ★ Project website: <https://www.aina-wireless.com>



MAXIMILIAN LEROUX

HEALTH

# NOVEL THERAPY FOR A RARE IMMUNE DISEASE

Haemophagocytic lymphohistiocytosis (HLH) is a rare immune disease with no approved available therapy. A novel orphan drug is expected to revolutionise treatment and improve patient clinical outcome.

HLH is characterised by abnormal immune responses and hyperinflammation, that can result from impaired cytotoxic T cell function due to genetic mutations (primary HLH) or present in the context of rheumatic diseases, infections and cancer (secondary HLH). The primary forms of the disease, pHLH, typically arise during infancy and are invariably fatal if left untreated.

Emapalumab is the first drug specifically developed for the treatment of HLH. Currently, there are no drugs approved for the treatment of HLH. However, given the severity and high mortality rate of the disease, HLH management takes place through the use of off-label drugs. Patients undergo induction therapy with a combination of corticosteroids, chemotherapy and immunotherapy, followed by haematopoietic stem cell transplantation, which is the only curative treatment for primary forms. Induction therapy has not been formally developed for treating HLH and carries significant short and long-term side effects, exposing patients to a high risk for morbidity and mortality.

## Interferon-gamma (IFN- $\gamma$ ): a key driver of HLH

Emerging evidence indicates a key pathogenic role for IFN $\gamma$  in HLH. IFN $\gamma$  is one of the most potent and pleiotropic cytokines of the immune system. Armed with many diverse effects, it is also associated with the pathogenesis and the maintenance of inflammatory diseases.

Researchers used animal models of primary HLH where knockout of the molecule perforin and infection with Lymphocytic

choriomeningitis virus (LCMV) replicates the characteristic features of the human disease. 'In [these] animal models, neutralisation of IFN $\gamma$  with a monoclonal antibody reverses the disease and rescues animals from death. Similar results have been obtained in animal models of secondary HLH. In support of IFN $\gamma$  neutralisation as a therapeutic target in HLH, a correlation between levels of IFN $\gamma$  and disease severity has been reported in HLH patients,' states project coordinator Dr de Min.

To target IFN $\gamma$  in patients with HLH, scientists of the EU-funded FIGHT-HLH (First Targeted Therapy to FIGHT Hemophagocytic Lymphohistiocytosis (HLH): A novel approach to HLH) project have generated and characterised a fully human monoclonal antibody (emapalumab) that neutralises the biological activity of human IFN $\gamma$ . The key objective of FIGHT-HLH was to advance emapalumab through clinical trials and evaluate its safety and efficacy in patients with primary and secondary HLH to create the first targeted therapy for this disease.

In a murine model of HLH secondary to infection, researchers discovered that the amount of IFN $\gamma$  present in tissues was much larger compared to the amount in circulation. In addition, the hyperproduction of IFN $\gamma$  in tissues is intimately associated with disease progression, therefore supporting the pathogenic role of IFN $\gamma$  in HLH. Similar to findings in other models of HLH, reducing IFN $\gamma$  activity improved HLH clinical and laboratory parameters, further supporting

IFN $\gamma$ -targeting as a promising treatment strategy.

## IFN $\gamma$ -targeting antibodies: a new orphan drug

In the context of the FIGHT-HLH project, emapalumab successfully obtained orphan drug designation both in Europe and in the United States. 'Also, based on the encouraging pre-clinical and initial clinical results, emapalumab received priority medicine (PRIME) designation from the European Medicines Agency (EMA),' adds de Min.

The clinical trial in primary HLH ran in 13 sites distributed in six European countries and in eight sites in the United States. The team initially recruited patients who had relapsed after having responded to an initial treatment. During the pivotal phase of this trial, newly diagnosed primary HLH patients could be recruited. Recently, a study in children suffering from secondary HLH has also been initiated.

Overall, the targeted nature of emapalumab is expected to deliver efficacy with less toxicity compared to existing treatments. Long-term, the incorporation of this strategy as an induction treatment will improve the clinical outcome of HLH patients.

### FIGHT-HLH

- ★ Coordinated by Novimmune in Switzerland.
- ★ Funded under FP7-HEALTH.
- ★ <http://cordis.europa.eu/project/rcn/105319>

## RE-EDUCATION FOR THE IMMUNE SYSTEM TO FIGHT DIABETES

Type 1 diabetes is an autoimmune disorder associated with destruction of the insulin-producing cells. Reducing the immune response that causes this damage is a promising alternative to lifelong insulin administration.

Currently, there are more than half a million type 1 diabetes sufferers in Europe, a disease with no cure or means to prevent its onset. Destruction of insulin-producing beta cells is a gradual process and most patients at diagnosis still have some residual insulin production. Evidence from the Diabetes Control and Complications Trial (DCCT) indicated that individuals with residual insulin had better glycaemic control, reduced rates of hypoglycaemia and lower risk for long-term complications.

Most treatment approaches are designed to efficiently replace the low or absent insulin levels in patients. However, the low efficiency rate of this strategy suggests that preservation of even small amounts of endogenous insulin production could serve as an alternative to improving glycaemic control. This will reduce not only hypoglycaemia

but also long-term complications such as impaired vision, kidney failure and foot ulcers.

Scientists of the EU-funded EE-ASI (Beta cell preservation via antigen-specific immunotherapy in Type 1

Diabetes: Enhanced Epidermal Antigen Delivery Systems) project proposed an Enhanced epidermal antigen specific immunotherapy (EE-ASI) approach to re-educate the immune system to stop destroying pancreatic beta cells. This innovative system delivers peptides present only on beta cells in gold nanoparticles. As project coordinator Prof. Dayan explains, 'The nanoparticles are efficiently taken up

by dendritic cells leading to presentation of the peptide in a non-inflammatory context, which promotes regulatory T cell generation.' A second tolerogenic payload such as Interleukin-10, in addition to the antigen, is included to promote regulatory T cell production.

### Nanoparticle distribution

Although the EE-ASI approach resembles vaccination, it aims to switch off autoimmune responses by activating regulatory T cells. These are known for recognising self-proteins and acting protectively to suppress any attempts by the body to develop immune responses to self-proteins.

In EE-ASI, partners loaded the proinsulin peptide C19-A3 into gold nanoparticles with very high efficiency. 'Gold is very inert and has anti-inflammatory properties that seem to be beneficial,' Prof. Dayan continues.

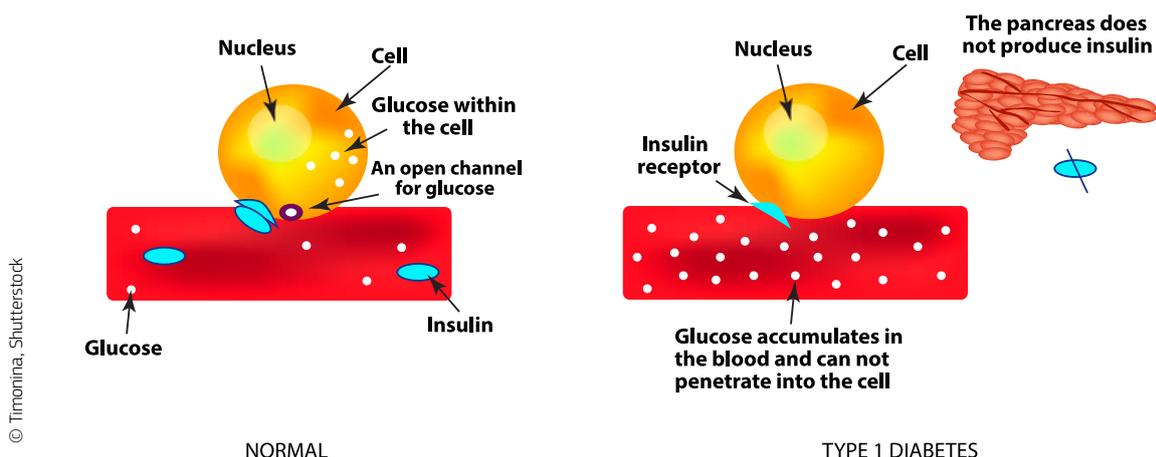
When delivered *ex vivo* on human skin with microneedles, these peptide-loaded nanoparticles diffused into the epidermis and were taken up by Langerhans cells. To do so, their size had to be five nanometres in diameter as bigger particles do not follow this diffusion pattern. Pre-clinical experiments in mice demonstrated diffusion to distant lymph nodes more rapidly than peptide alone. Toxicology studies validated the safety of the approach and led to a patent application and a phase I clinical study within four years of the start of the project.

### Clinical efficacy

The EE-ASI clinical study represents the first in-man study on the effects of delivering a proinsulin peptide conjugated to nanoparticles. Results revealed that when given intradermally, the gold stays in the skin for more than six months along with a local lymphocytic infiltrate that warrants

*"The nanoparticles are efficiently taken up by dendritic cells leading to presentation of the peptide in a non-inflammatory context, which promotes regulatory T cell generation."*

## TYPE 1 DIABETES



further investigation. Additional studies will also determine if the peptide remains associated with the gold. Furthermore, the consortium is 'exploring other tolerogenic molecules as well as incorporation of DNA molecules to express self-peptides in the skin,' Prof. Dayan points out.

Although efficacy studies are pending, encouraging the body to recognise insulin and stop its immune destruction seems like a valid approach for treating type 1 diabetes. Given the ease of application, the EE-ASI approach promises better patient

compliance and fewer complications than hormone replacement therapy. In turn, this will lead to a better clinical outcome and an improved quality of life for diabetes patients and their families.

#### EE-ASI

- ★ Coordinated by Cardiff University in the United Kingdom.
- ★ Funded under FP7-HEALTH.
- ★ <http://cordis.europa.eu/project/rcn/105252>
- ★ Project website: <http://bit.ly/2DfGYOT>

## PANDRUGS: GENOMIC DATA ANALYSIS TO BETTER TREAT CANCER

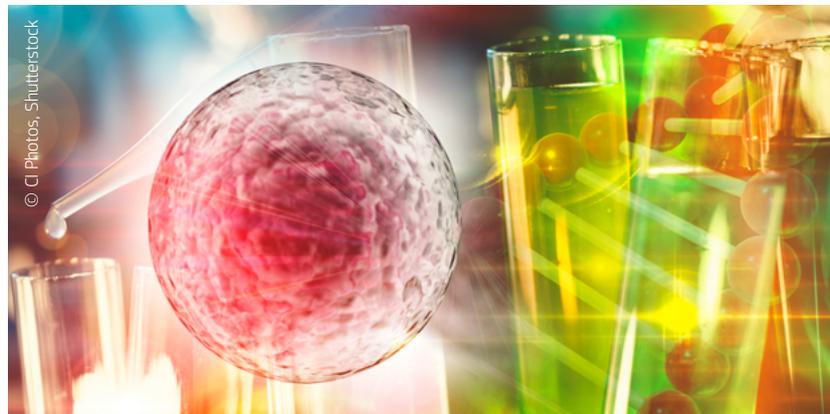
Cancer genomics analysis is a promising approach to predict drug response and outcome. With PanDrugs, the PERSMEDOMICS project provides an innovative bioinformatics methodology to guide the selection of therapies based on individual patients' genomic profiles.

PanDrugs is one of the missing links between the potential of biomarkers as predictive tools for treatment outcome and their actual use in clinical settings. Combined with adequate computational infrastructures for data processing and storage, and put in the hands of qualified in-house bioinformaticians, the new platform will guide the selection of therapies from the results of genome-wide studies in cancer disease.

'Most clinical trials currently evaluate the efficacy and safety of a new drug by analysing its effects on largely unselected populations of patients,' observes Dr Fatima Al-Shahrour, coordinator of PERSMEDOMICS (Bioinformatics and Integrative Genomics for a Novel Personalized Cancer Therapy) for the Spanish National Cancer Research Centre (CNIO). 'By using genomic profiles instead within "basket trials", we could bring more accurate diagnosis and treatments based on multi-biomarkers, safer drug prescription, better disease prevention and, consequently, a reduction in healthcare costs.'

Of course, personalised cancer treatment is still in its infancy. Before it can become the norm, hospitals will need quick, reproducible, easy to perform and low cost testing methods. Molecular and clinical data sharing should be promoted, a complete understanding of tumour biology is required, and current therapeutic and pharmacological limitations should be overcome.

'The latest studies have also shown that personalised medicine requires information from thousands of patients for accurate decision support. Unfortunately, even if all the above-mentioned problems were solved, the



computing infrastructures that are currently found at healthcare institutions would still be ill-prepared to efficiently process such volumes of data,' Dr Al-Shahrour deploras.

In this context, the development of fast and cheap technologies linking patient data to other known information is desperately needed. PanDrugs might be part of the solution: By using it, bioinformaticians can analyse and integrate genomic data (mutations, copy number variations or gene expression levels), functional data (protein essentiality), and pharmacological data (sensitivity or resistance to antitumour drugs) – so as to identify actionable molecular alterations.

'PanDrugs' goal is to evaluate big data generated by cancer patients' genomic profiles, according to their biological and clinical relevance and their susceptibility to be pharmacologically-targeted, in order to assist clinical decision making. Additionally, our group has been working on a new drug repositioning methodology to predict sequential treatments in cancer using transcriptional signatures,' says Dr Al-Shahrour.

*"By using genomic profiles instead within 'basket trials', we could bring more accurate diagnosis and treatments based on multi-biomarkers, safer drug prescription, better disease prevention and, consequently, a reduction in healthcare costs."*

The PERSMEDOMICS team has already obtained very promising preliminary results. Their tools have notably been used to analyse Pancreatic ductal adenocarcinoma (PDAC) patients sequencing data and prioritise those that may have therapeutic implications.

'In the context of clinical research projects and clinical trials, PanDrugs has been integrated as a new module in the sequencing analysis pipeline to categorise patient tumours and match them to effective drugs or treatments,' Dr Al-Shahrour enthuses. 'So far, we have analysed data from more than 500 patients and this new pipeline has allowed us to identify actionable mutations in nearly half of them.'

One example of this work is a study on 25 patients that consisted in the integration of sequencing data and Patient-derived xenografts (PDXs) mouse models. Using PanDrugs, the team could identify putatively actionable tumour-specific genomic alterations in most cases, whilst experimental testing of candidate treatments in PDXs models helped to select empirical treatments in patients with no actionable mutations. 'In 2015, we started testing this strategy under an ERC Advanced grant, in a prospective randomised clinical trial on

150 patients with resistant metastatic pancreatic cancer. Our aim was to test the hypothesis that an integrated personalised treatment approach improves survival compared to the conventional treatment strategy,' says Dr Al-Shahrouh.

With PanDrugs providing a solution to study molecular profiles in patient populations, public healthcare systems can now focus on gathering the infrastructure, software and expertise required to store, mine, process and analyse such information. PanDrugs is open source, which

means that all algorithms and methods are public and freely accessible. The project consortium has already established collaborations with public entities and private companies in the health sector to promote the usage of their tools.

#### PERSMEDOMICS

- ★ Coordinated by CNIO in Spain.
- ★ Funded under FP7-PEOPLE.
- ★ <http://cordis.europa.eu/project/rcn/108398>

## FIGHTING RARE DISEASES WITH NEW METHODS FOR CLINICAL TRIALS

The EU-funded INSPIRE project has developed new methods for the design and analysis of clinical trials in rare diseases.

In Europe, nearly 30 million people suffer from a rare disease – or one that affects less than one in 2 000 of the general population. In such settings where numbers are scarce, the large clinical trials typically used to evaluate new drugs and treatments are infeasible – if not impossible. As a result, new approaches for designing such studies, along with improved methods of data analysis, are needed.

To answer this need, the INSPIRE (Innovative methodology for small populations research) project brought together international experts in innovative clinical trial design from across the globe. Together, they helped develop new methods for the design and analysis of clinical trials in rare diseases and small populations defined, for example, by a rare genetic marker.

'This project developed methods that enable more reliable results to be obtained from clinical trials more quickly, ultimately leading to improved healthcare for these small population groups,' says project coordinator Nigel Stallard. 'New methods include the combination of trial data with information from other studies, adaptive trial designs that allow the most efficient use of the data and optimal decision-making processes that allow a conclusion to be made as quickly as possible.'

### Designing a better study

The INSPIRE project developed novel statistical methodology in the two broad areas of efficient study design and

improved analysis and evidence synthesis. Within the first area, researchers focused their attention on two specific problems: a) determining optimal designs for confirmatory studies using decision-theoretic and value of information approaches, and b) the design of confirmatory studies for personalised medicines. In the second area, researchers shifted their attention to developing new methods for incorporating pharmacokinetics (PK) and pharmacodynamics (PD) data into early-phase dose-finding studies and for meta-analysis methods in small trials or small numbers of trials.

'In the area of efficient study design, we developed analysis and optimal design approaches for trials that assess targeted treatments based on genetic features or other biomarkers,' explains Stallard. 'These trials enable the simultaneous identification of subgroups of patients for which the benefit/risk balance of a treatment is positive and confirms the treatment's effectiveness for these patients without compromising statistical or scientific integrity.'

Stallard adds that the project also developed new decision-making methods for small population clinical trials. 'In particular, we explored the use of a Bayesian decision-theoretic framework to compare the costs of clinical trial evaluation with the potential benefits to current and future patients, assessing how the cost-benefit balance differs between large and small patient populations, which let us optimise our design approaches,' he says.

### A new method for analysis

On the analysis side of the equation, the project developed improved meta-analysis methods for synthesis of evidence from a small number of trials as would be common in a small population. These methods can be used to support the planning, analysis and interpretation of a trial, as well as enable extrapolation between patient groups. The novel approaches have already been applied in a review of studies on sporadic Creutzfeldt-Jakob disease.

'We have also worked on innovative designs for early phase clinical trials and for extrapolation from adult to paediatric studies, developing methods that enable the use of PK and



PD data to help determine which doses to use both in the study as it progresses and for further evaluation,' explains Stallard. 'Our new methods in this area let us better estimate the dose-response curve parameters without increasing the number of patients in the study who receive sub-optimal doses.' This work has led to a novel design for an ongoing clinical trial in prevention of seizures in neonates.

#### INSPIRE

- ★ Coordinated by the University of Warwick in the United Kingdom.
- ★ Funded under FP7-HEALTH.
- ★ <http://cordis.europa.eu/project/rcn/110064>
- ★ Project website: <http://bit.ly/2mGVO4E>
- ★  <http://bit.ly/2Bag491>

## SUPPORT FOR INDIVIDUALS WITH INTELLECTUAL DISABILITIES TO OVERCOME BARRIERS TO PHYSICAL EXERCISE

Individuals with intellectual disabilities (IDs) are important consumers of healthcare, partly due to high prevalence rates of inactivity-related health conditions. EU-funded research has found that these individuals have to contend with physiological barriers to physical activity, underlining the need for a new approach to better support this population in an active and healthy lifestyle.

Physical activity interventions for individuals with IDs have to date returned poor results. Focused mainly on behavioural and organisational aspects, associated studies have not allowed for physiological aspects such as cardiorespiratory capacity or energy cost of activities, or they were assumed to be similar to the general population. Yet, research with small samples of this population, mostly in people with Down syndrome, has demonstrated abnormalities in the autonomic response to exercise and higher energy cost of activities.

The ID PHYSIOLOGY project therefore investigated physiological barriers that influence physical activity and exercise in people with IDs. More knowledge on these barriers is needed to better help this population avoid fatigue, injury and lack of motivation, which in turn lead to loss of functioning and health conditions. 'The wider implications of this project can affect public health issues and societal and economic aspects of this specific population,' notes Dr Thessa Hilgenkamp, a human movement scientist and fellow on the project.

### Individuals with ID respond differently to exercise

Research used various sympatho-excitatory tasks (e.g. grip strength exercise and aerobic exercise) to study the autonomic cardiorespiratory response of

people with IDs. The team also measured oxygen uptake at different walking speeds to determine if there was a correlation between the relative demand of walking and individual level of physical activity.

Analyses during a maximal exercise test compared an initial sample of 10 participants with IDs to a control group, revealing significant differences in maximal heart rate and oxygen uptake. ID PHYSIOLOGY further found significant differences in the systolic blood pressure and heart rate response to changes in body position from supine baseline to standing (active orthostasis) to supine recovery.

The project's overall key finding is that ID individuals do have physiological barriers to being physically active. 'Their heart rate cannot increase as much as in the control group, resulting in a decreased exercise capacity, and a higher relative energy expenditure during everyday tasks, such as walking,' explains Dr Hilgenkamp.

### A personalised approach to physical activity

Insights gained from the research and findings highlight the need to adapt guidelines for this population with regard to both testing and prescriptions for exercise. Action is also needed to increase awareness among professionals and the general public about ID individuals' physiologically limited ability to exercise. 'By understanding what the cause of the lower physical activity levels in individuals with ID is, and to what extent these are impacted by physiological barriers, physical activity programming can be further personalised and adapted to their needs and possibilities,' states Dr Hilgenkamp.

Preliminary results have been presented at three different conferences – one in Australia and two in the United States. Other dissemination activities include meetings and talks with healthcare professionals involved with the clinical practice of ID care as well as care



providers, parents and personnel at sports clubs. The Marie Curie project has also been presented at the Department of General Practice Erasmus MC University Medical Centre and Department of Rehabilitation Erasmus MC University Medical Centre. Supervision of bachelor and master students at this institute and Radboud University Medical Centre Nijmegen in the Netherlands was also part of the ID PHYSIOLOGY remit.

'This project will continue to build on the knowledge base of autonomic dysfunction in individuals with ID, and how to better apply this knowledge to support an active lifestyle in this population,' concludes Dr Hilgenkamp. As such, ID PHYSIOLOGY findings can help contribute to improved quality of life for people with IDs as well as their carers.

#### ID PHYSIOLOGY

- ★ Coordinated by Erasmus MC in the Netherlands.
- ★ Funded under FP7-PEOPLE.
- ★ <http://cordis.europa.eu/project/rcn/192601>

SOCIETY

# NOT FIT FOR REPRESENTATION? EXPLORING THEATRE CENSORSHIP IN EARLY MODERN BRITAIN

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The notion of censorship of the media and arts, even in democratic countries, can still be an extremely polarising issue and one that has existed since the very first political societies. One EU-funded project has recently examined the history of censorship of the theatre in Britain during the eighteenth and early nineteenth centuries, highlighting valuable insights into the evolution of a political tool of coercion that is still prevalent in today's world.

The EU-funded THEATRE CENSORSHIP (The Censorship of British Theatre, 1737-1843) project sought to bring together two archives, one in the US and one in the UK, to provide a chronological survey of theatre censorship between two key pieces of legislation: The Stage Licensing Act 1737 and the Theatres Act 1843.

The project highlighted that theatre censorship was on one level highly irregular because the system depended on just one official, the Examiner of Plays, who was not always consistent, but also systematic in that personal attacks, political critique and material that was sexual in nature were often removed.

'We took censorship to broadly include the statutory censorship imposed on patent playhouses – theatres licensed by the crown – which meant that new plays needed to be submitted to the Examiner of Plays, appointed by the Lord Chamberlain's office,' explains coordinator Professor David

O'Shaughnessy of Trinity College Dublin. 'But we also took it to include forms of informal censorship where playwrights, theatre managers, and sometimes even actors, had a tendency to self-censor their own material so as not to provoke the Examiner's ire.'

As was the case throughout the twentieth century, censorship in the early modern period was often heightened during times of political unrest or international conflict, with the last quarter of the eighteenth century being dominated by the French Revolution and its enormous ramifications that quickly spread across Europe. Another of the seven highlighted plays, 1795's 'The Whim' by female playwright Lady Eglantine Wallace, fell victim to the anxieties provoked by these cataclysmic events.

'In this comedy, Lord Crotchett throws a Saturnalian feast in which the servants are made the masters of the house. As they give full rein to their opinions on the ruling classes – who are shown to

be dissolute, degenerate, tyrannical and corrupt – it is not surprising that the play was refused a licence,' explains Prof. O'Shaughnessy. Enraged, Lady Wallace published the play with a lengthy preface which lambasted the office of the Examiner of Plays and defended her work before leaving the country for mainland Europe.

Two sets of manuscript sources were instrumental in the success of the project. The first was the Larpent Collection in the Huntington Library, Los Angeles, which is the most important collection of eighteenth and nineteenth century British theatre manuscripts in the world, containing approximately 2 600 playtexts or related items from the period. 'You can even see the comments and excisions of the Examiner in the text and its margins,' says Prof. O'Shaughnessy.

The second was the Lord Chamberlain's Plays archive in the British Library, London, which is the British Library's largest manuscript collection. 'However,

it's not fully catalogued,' comments Prof. O'Shaughnessy. 'The collection in the British Library is simply enormous – it's difficult to know how many plays are in it but there are tens of thousands of manuscript leaves. We also used secondary sources to examine a wide array of plays and work out which ones best illustrated the various reasons why plays were censored during this period.'

During the project, two international conferences were planned, one that has already taken place in Dublin in February 2017 and the second due to take place in Los Angeles in January 2018. He is also currently working on another Marie Curie project 'The History Play and the British Enlightenment, 1750-1815', which developed directly from THEATRE CENSORSHIP. 'This is because we

found in THEATRE CENSORSHIP that history plays were often subject to the censor's attention,' concludes Prof. O'Shaughnessy.

#### THEATRE CENSORSHIP

- ★ Coordinated by Trinity College Dublin in Ireland.
- ★ Funded under FP7-PEOPLE.
- ★ <http://cordis.europa.eu/project/rcn/107208>

## DEAF PEOPLE CAN BOOST THEIR JOB OPPORTUNITIES WITH BETTER TRAINING

An EU-funded project looks to export its successful job training for deaf people across Europe, improving work prospects and social inclusion of Europe's 1 million deaf people.



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Integrating deaf people into the job market is a key challenge; more than 50% of the 1 million deaf people in Europe are unemployed, and those who are employed are often in low-skilled and low-paid jobs. Today, the education on offer for people with acute hearing difficulties in Europe is sparse, and heavily focused on school and apprenticeships, rather than long-term employment.

Austrian company equalizent has created a business model offering job-related education and employment for deaf people. With EU funding, it is hoping to export its concept across Europe, boosting training for people with hearing difficulties, helping them to find jobs and contributing to the EU's commitment to integrate deaf people as part of its European Disability Strategy 2010-2020.

'There is not enough education available for the deaf, and the education that exists is often of limited use. This generates social inequalities, social exclusion and poverty for people with hearing difficulties,' says Monika Haider, equalizent and SIGNS FOR EUROPE Project Manager.

Equalizent has developed specialised training for deaf people using sign language and professional training targeting students from the age of 16 through to adults. More than 70% of people who have attended the courses available in Austria have found a long-term job.

The project SIGNS FOR EUROPE now aims to replicate this successful business model currently running in Austria all over Europe via a franchise network. To do this, project researchers have carried out a detailed market analysis for all 28 EU countries and Israel.

'A franchise network could provide 65 000 deaf Europeans with training every year and allow at least 45 000 of them to obtain a long-term job, with some of them accessing higher salaries in the tertiary sector,' says Haider.

#### Tailored training packages

Today, most trainers of deaf people can hear normally and do not have any involvement in the world of deaf people. They have few or no skills in sign language and poor understanding of how deaf people absorb and process information, explains Haider. With equalizent, most trainers are deaf themselves and are fluent in sign language.

Moreover, many deaf people do not live close to big cities with access to appropriate education – a situation which can be addressed with equalizent's online webinar education system.

The project has also developed a set of best practices for managing a training school for deaf people, including how to deal with the often-complicated relationship between deaf and hearing staff.

SIGNS FOR EUROPE has already identified potential franchise opportunities in Germany. As a next step, and with further funding, the project hopes to put a German franchise in place, find more partners across Europe, develop 'train the trainer' seminars and become an inspiration to deaf people by showing them that it is possible to develop a professional career.

#### SIGNS FOR EUROPE

- ★ Coordinated by equalizent Training and Consulting GmbH in Austria.
- ★ Funded under H2020-SME.
- ★ <http://cordis.europa.eu/project/rcn/207966>
- ★ Project website: <http://bit.ly/2DqLoFK>

## JOURNALISTS ACTING AS 'REFEREES' COULD PREVENT THE SPREAD OF FAKE NEWS

With fake news, alternative facts and false beliefs currently damaging our social and political landscape, EU researchers are examining whether journalists can be effective as adjudicators, pointing out untruths and separating facts from fiction.



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Misperceptions, fake news and false beliefs are everywhere today. They have the power to distort public opinion and can have a major impact on policymaking and government decisions. According to a recently published paper by the EU-funded DEBUNKER (The Problem of European Misperceptions in Politics, Health, and Science: Causes, Consequences, and the Search for Solutions) project, however, journalists can help change that. The project, which focuses on investigating misperceptions and false beliefs, found that journalists could help prevent the spread of false beliefs by taking a more assertive role in their reporting. They can adjudicate arguments by fact checking the information presented and revealing any untruths, and still be perceived as unbiased by their readers.

### Facts over fiction

As part of the experiment, a news article about a relatively neutral issue was given to participants to read, featuring viewpoints from two rival political parties. The article also contained a fact-checking paragraph, where the journalist investigated

the accuracy of both sides' claims, giving the readers a clearer picture of the story.

The scientists feared that the fact-checking paragraph could cause staunch party supporters to become even more strongly attached to the fake statements issued by their preferred political representative. Previous research has shown that, often, corrective actions actually make misperceptions worse, not better. But in fact, they found that participants on the whole believed the journalists rather than the politicians.

The reason that journalists often fail to include these fact-checking and analysis points is because they fear being accused of bias. However, the study revealed that the readers still considered the journalist to be impartial. In addition, they thought themselves to be better informed about the issue than those in a control group that had received a regular 'he said, she said' article, that presented the two opposing views but with no commentary, fact-checking or further analysis.

### Fake news and politics

The finding means that journalists should have the confidence to call out

misperceptions and 'alternative facts', according to the researchers. False beliefs are much more difficult to shake once they have taken hold, so conscientious and critical reporting could be one way to slow down or prevent their spread. However, as the study only involved a relatively neutral issue, the results may not hold true for more controversial and polarised topics.

The DEBUNKER project particularly focuses on misinformation being spread about climate change, vaccinations and immigration. Its scope involves assessing the levels of misperception in Europe, developing approaches and techniques for tackling false beliefs and figuring out effective strategies to correct them. The findings can then feed into future policies and strategies.

### DEBUNKER

- ★ Hosted by the University of Exeter in the United Kingdom.
- ★ Funded under Horizon 2020-ERC.
- ★ <http://cordis.europa.eu/project/rcn/204137>
- ★ Project website: <http://bit.ly/2FOUjLt>

# CONFLICTS IN THE CAUCASUS

In-depth research into different countries in the Caucasus and their relationship with Russia has unveiled valuable insight on the topic.

Flanked by the Black Sea and the Caspian Sea between Eastern Europe and Western Asia, the geopolitically strategic Caucasus region has seen its fair share of conflict and instability. Armenia, Azerbaijan, Chechnya, Georgia and Russia are some of the region's countries that have witnessed conflict, poverty and outright war in recent decades.

Against this backdrop, the EU-funded CASCADE (Exploring the security-democracy nexus in the Caucasus) project investigated the political, social and geographical dynamics that have defined the region. It considered elements that were academically overlooked, focusing particularly on local perceptions of democracy and security.

The investigation revealed that the links between democracy and security vary significantly from country to country within the Caucasus. Semi-democratic or authoritarian states with weak institutions and elite interests

display state-sanctioned violence. However, democratisation has often led to breakdowns in state building and has impacted stability. While external actors – namely Russia – can lead to both security and insecurity, the latter is also brought about by a state that relies on violence, coercion or ineffective socioeconomic policies.

These developments are very important for the EU, which strives to encourage stability in this neighbouring region. Migration, which many of the region's citizens resort to in order to escape poverty and insecurity, has also created concern among EU actors.

Moreover, the project team showed how Russian hegemony can undermine local development and the economy. To illustrate this, large-scale modernisation projects implemented by Russia in the north Caucasus have negatively impacted the livelihood of small local producers and have helped depopulate mountain areas.

Such top-down approaches not only underline the friction between Russia and the West, but also disempower the region's nations in shaping their geopolitical environment. In parallel, the project team demonstrated how domestic actors respond to external actors' policies and contribute to shaping them.

CASCADE has produced insights and recommendations for the EU to help battle impoverishment, enhance dialogue with Russia and improve ties with the region. The project's outcomes, publications and workshops have not only initiated debate on the topic, but also laid the foundation to promote energy security, political stability and trade in the region.

## CASCADE

- ★ Coordinated by FMSH in France.
- ★ Funded under FP7-SSH.
- ★ <http://cordis.europa.eu/project/rcn/111239>
- ★ Project website: <http://bit.ly/2DcT8I8>

*“While external actors – namely Russia – can lead to both security and insecurity, the latter is also brought about by a state that relies on violence, coercion or ineffective socioeconomic policies.”*





ENERGY

# PILOT CASE TO SPEED CARBON CAPTURE, TRANSPORT AND STORAGE IN EUROPE

Carbon capture, transport and storage (CCS) technology is key to mitigating global warming, but there are several hurdles to overcome. CCS is not profitable under the current energy regime, and future deployment will depend on regulatory frameworks, incentives and emission costs.

CCS prevents large amounts of carbon dioxide (CO<sub>2</sub>) from fossil fuels entering the atmosphere. According to the International Energy Agency, CCS is the third most important measure to limit global warming by two degrees Celsius.

For many industries, CO<sub>2</sub> capture is the only technology that can be retrofitted to existing assets to improve their carbon footprint. The limits to energy efficiency and electrification of industrial processes mean that CO<sub>2</sub> capture will be needed until new re-engineered processes and low-carbon materials are available to society.

To meet the agreed longer-term climate targets of an 80%-95% reduction in CO<sub>2</sub> compared to 1990, CCS will remain a key mitigation solution across the industrial and power sectors. 'The GATEWAY project demonstrates how to get CO<sub>2</sub> from sources in Europe to a central storage in the North Sea in a simple, safe and cost-effective way,' says Marie Bysveen, project coordinator for the EU-funded GATEWAY (Developing a Pilot Case aimed at establishing a European infrastructure project for CO<sub>2</sub> transport) project.

## Getting the ball rolling on CCS deployment in Europe

GATEWAY developed a business case for a potential Project of Common Interest (PCI). In doing so, it addressed risks, proposed measures for de-risking, assessed the technologies, policy and regulatory aspects, public perception and funding needs, and proposed possible financing mechanisms. These

are key factors that can be applied to other similar projects and boost CCS development. 'Industry and government will have at their disposal the first-of-its-kind available business case for a cross-border infrastructure for CO<sub>2</sub> transport,' explains Bysveen.

Such efforts led to the submission of the Rotterdam Nucleus PCI application – GATEWAY's most significant achievement. The PCI made it on to the European Commission's priority list in October 2017. As Bysveen stresses, 'This could be a pivotal step towards CCS deployment in Europe.'

Rotterdam Nucleus will provide the basis for a high-volume CO<sub>2</sub> transportation infrastructure system from mainland Europe to CO<sub>2</sub> storage locations in the Dutch and United Kingdom sections of the North Sea. The infrastructure is designed to be over-sized, capable of providing CO<sub>2</sub> transport capacity for pre-commercial and commercial phase CCS deployment in Rotterdam, as well as possible future links to industrial areas of third-party countries. Bysveen adds that the infrastructure 'will have significant impact on the speed of CCS deployment in neighbouring countries, as the foundations for high-capacity CO<sub>2</sub> transport and storage in the North Sea will be realised.'

## Meeting the need for a CO<sub>2</sub> transportation infrastructure in the North Sea

Bysveen and project partners came to realise that coordination and support action projects can be extremely efficient and impactful. 'Workshops and bilateral discussions with

stakeholders have strongly contributed to a mutual understanding of both challenges and viable solutions related to cross-border infrastructure for CO<sub>2</sub> transport to be developed in the North Sea region.'

Rotterdam Nucleus' official status as a PCI project is important for work towards planning the actual construction of a CO<sub>2</sub> infrastructure in the region. This helps to provide accelerated permitting procedures, improved regulatory conditions and possibly eligibility for financial support from the Connecting Europe Facility.

'GATEWAY is paving the way for real CCS deployment on the European continent in the near future,' concludes Bysveen. 'It

also laid the foundation for a high-volume infrastructure system for the transportation of CO<sub>2</sub> from mainland Europe to CO<sub>2</sub> storage locations in the North Sea.'

#### GATEWAY

- ★ Coordinated by SINTEF in Norway.
- ★ Funded under H2020-ENERGY.
- ★ <http://cordis.europa.eu/project/rcn/195421>
- ★ Project website: <http://bit.ly/2Dp74ly>

## HIGH-EFFICIENCY ENGINE TURNS WASTE HOT WATER INTO ELECTRICITY

New engine technology that generates electricity from an often overlooked source – waste hot water – could reduce energy consumption for thousands of homes and businesses in Ireland, while also cutting harmful carbon emissions.

**F**actories, power plants, data centres and cargo ships release waste heat that could be a useful source of energy. Finding an efficient and cost-effective way to capture and use this waste heat can lead to both significant fuel savings and reduced CO<sub>2</sub> emissions. There are methods to harvest both high-grade and low-grade waste heat (below 100 °C) but efficiency drops and cost increases as temperatures dip.

Now, the EU-funded project THE EXERGYN DRIVE (THE EXERGYN DRIVE™ – An engine that runs on hot water) has developed technology that can efficiently use waste heat below 100 °C. The newly developed groundbreaking energy-efficient engine runs on nothing but hot water.

### Smart materials for energy harvesting

What unlocks the whole process for creating electric or mechanical power from low-grade waste heat is the use of a shape memory alloy called nitinol. This material undergoes a phase transition when heated at temperatures typically less than 100 °C and reverts to its original shape when cooled.

'In the engine core, nitinol wires attached to a piston are flushed with hot and cold water, expanding and contracting the wires to create a piston movement. Cyclic heating and cooling of multiple strands of nitinol in the engine core create a thrust that works a hydraulic system which spins a generator to make electricity,' explains Dr Kevin O'Toole, Director of Research and Development at Exergyn

Ltd. The engine produces 10 kW of electricity from around 200 kW of thermal energy in the waste hot water.

A great deal of effort was dedicated to perfecting the design and modifying the material so that it will keep working for millions of cycles. To date, researchers at Exergyn have tested a single nitinol wire that reached 10 million cycles without any degradation in performance, thus fundamentally proving the long-term viability of the engine.

### Game-changing technology

Current heat recovery systems typically use Organic Rankine Cycle (ORC) technology to generate power using waste heat from manufacturing plants. Although the technology works well for temperatures around 200-300 °C, its ability to generate electricity from low-grade heat in the form of hot water at temperatures as low as 100 °C is rather low.

'Depending on the conditions, our system can outperform ORC by a factor of 3 to 6 at temperatures below 100 °C, making it commercially viable. In addition, this technology does not rely on the use of heat exchangers, which means that the engine can be more compact, and there is no need to use toxic gases,' says Dr O'Toole.

### Making a difference

The amount of waste heat produced worldwide every year is equivalent to 12 years of electricity consumption in the EU. There is currently no other good technology that can make effective use of low-grade waste heat. If fully deployed, THE EXERGYN DRIVE's

cutting-edge engine will capture and make use of waste hot water to reduce cost and also cut global carbon emissions by 2%.

THE EXERGYN DRIVE project estimates that a commercial solution could make the global market for such engines reach EUR 440 billion over the next few years. In addition to harnessing waste heat from the biogas industry, project partners hope that the engine could soon expand the geothermal energy as well as the marine market.

#### THE EXERGYN DRIVE

- ★ Coordinated by Exergyn in Ireland.
- ★ Funded under H2020-SME.
- ★ <http://cordis.europa.eu/project/rcn/197157>
- ★ Project website: <http://bit.ly/2FLZKi5>



# EU AND THE RUSSIAN FEDERATION COOPERATE OVER NUCLEAR ENERGY EDUCATION

A supply of high-level graduates to the VVER nuclear field is now ensured, thanks to the Euro-Russian collaboration efforts of an EU-funded project in collaboration with the European Nuclear Education Network (ENEN).



The ENEN-RU II (Strengthening of Cooperation and Exchange for Nuclear Education and Training between the European Union and the Russian Federation) project has worked with partners from the Russian Federation to strengthen cooperation in the field of nuclear education and training. Linking with high-level Russian stakeholders in the nuclear sector, the initiative built on the earlier ENEN-RU project to further enhance bilateral nuclear energy activities and benefit both regions. With this goal in mind, the project partners analysed the nuclear energy landscape in the EU and Russia to identify barriers and opportunities for sustainable collaboration.

Project coordinator and Secretary General of ENEN, Pedro Dieguez Porras, says: 'The objective was to harmonise education and training programmes between both regions at the Master's degree and PhD level, as well as for young professionals.' Opportunities for cooperation were identified and taken up through joint collaboration at the Master's level through credit system agreements, joint courses and university exchanges. This included the study of a joint EU-Russian Federation MSc certificate in the field of nuclear engineering. In addition, PhD level students conducted joint lines of research based on established doctorate stages, whilst young professionals took part in joint training programmes.

## Mutual recognition of education and training

The project's opening meeting discussed the importance of nuclear safety culture and training for Generation III and IV systems as well as cooperation in the field of research reactors. Joint training courses and summer schools were also carried out during the project's lifetime. They included engineering aspects of nuclear fuel manufacturing, which provided a better understanding of nuclear fuel properties

and the manufacturing techniques achieved in the Russian Federation. Other courses addressed multiphysics simulation of nuclear systems, as well as engineering computer modelling.

Agreement on credit systems, online databases and the coordinated sharing of information through the forum and the website was achieved through the knowledge management framework. This provided the basis for the mutual recognition of education and training (E&T) programmes between the EU and the Russian Federation and extended the scope of the student, researcher and young professional exchanges. 'This offered nuclear research centres and industry a wider basis for human resources and promoted cooperation in nuclear energy development,' explains Mr Dieguez Porras.

## Cooperation is the key to success

Sustainable mechanisms for short-term and long-term cooperation were established through a permanent E&T Forum. This was reinforced by several bilateral collaboration agreements among the participants and an online database of infrastructures and E&T facilities. Coordination was successful through the sharing of information on the website. 'The main objective was to map E&T facilities, laboratories and equipment for exchange purposes in the EU and Russia, as well as clarify access rules and procedures. Furthermore, the database offers the possibility of storing and accessing all this information in a structured way,' comments Mr Dieguez Porras.

The database is already available to all the ENEN-RU II project partners. Upon request, access can be granted to students of nuclear engineering from EU countries and Russia. Representatives of any E&T facilities, laboratories and equipment from the EU and Russia can also acquire access to the database, enabling them to check and add relevant information to ensure the high quality of the collected data.

ENEN-RU II will improve the mobility of personnel researching nuclear energy, as well as enhance access to facilities, laboratories and equipment for European and Russian students. By addressing the shortage of first-rate graduates in the field, the project will ensure a more advanced, modernised and secure nuclear sector that can meet growing energy needs and concerns.

### ENEN-RU II

- ★ Coordinated by ENEN in France.
- ★ Funded under FP7-EURATOM-FISSION.
- ★ <http://cordis.europa.eu/project/rcn/188525>
- ★ Project website: <http://bit.ly/2B90FnB>

# A GAME CHANGING ACTUATOR FOR THE MATERIAL AND ENERGY MARKETS

The EU-funded SMARTACT-2-3 project has developed efficient electric motor technology, which could drastically reduce the amount of energy necessary to power a wide range of daily applications.

The SMARTACT-2-3 project was set up to build on the success of SMARTACT-1, coordinated by The Smart Actuator Company in the UK. Phase 1 had successfully developed smart, electrically powered actuators (RIFT Driven® actuators), the first of which was delivered to market in early 2013.

Reduced Induction Field Torque (RIFT) technology is a patented energy efficient electric motor design, that saves up to 85% of the material components of a motor and is up to 75% more energy efficient than competitors. The system has also been demonstrated to use 25% less copper and be 80% lighter than typical alternatives.

RIFT works by combining several small motors around a central shaft as an alternative to having one large motor. Crucially, it is scalable for a diverse assortment of devices using electric motors. The potential applications range from electric cars to small wind turbines which could be attached to houses to supply household energy (especially useful in the developing world).

Early success has meant that the first two years of production are sold to 90% capacity, as the technology is already replacing electric motor drives in many applications.

## Building on success

The SMARTACT-2-3 project was set up to develop two additional products based on the RIFT technology. These were a small actuator for the range of small valves in the market (covering torque output 0-40 newton metres) and a large version (covering 100-400 newton metres torque output). The existing product covered torque output from 40 -100 newton metres.

As the project coordinator Mr Jerry Brown explains, 'The project allowed us to compress our 10-year company plan into a two-year reality. It also highlighted the requirement for us to increase our product range, which has quickly opened new opportunities.' Additionally, it has had the knock-on effect of spurring on other companies to also develop new product ranges.

Part of the success of the project's Phase 1 came from the so-called Voice of the Customer Survey (VOCS) which allowed the team to develop products that match the expectations and requirements of end-users. Phase 2 has updated this work through regular stakeholder meetings, at both workplaces and trade shows.

As Mr Brown summarises, 'This follow-up effort demonstrated that the VOCS was valid and introduced us to new

customers. It was also good for due diligence in our offer, identifying and addressing business-related issues and weak areas, which allowed us to evolve and grow as a company.'

## Delivering a game-changing range of benefits

The technology has been shown to deliver a range of benefits. These include: reducing the energy required to automate daily tasks in many applications, reducing the volume of raw materials, including copper and magnets, used to manufacture automated systems and reducing weight, thereby also decreasing fuel use in logistics and shipping. These benefits also lower the attendant carbon footprint.

One of the additional benefits that Mr Brown cites is that of reducing the need to source manufacturing capability from outside Europe. As he puts it, 'This allows repatriation of manufacturing to the EU, which will increase jobs in key manufacturing sectors, and input transferable skills into the workplace, benefiting the wider economy.'

Looking to future opportunities, Mr Brown mentions subsea applications around the world as a new marketplace for further exploration. Indeed, the team are currently working with Marine Power Systems who have developed an underwater renewable power generation platform and required a lightweight, low energy subsea actuator.

However, he goes on to say that, 'The holy grail has got to be energy efficient motor and generator drive systems that will benefit all and this market is unlimited.'



© Smart Actuator Company

### SMARTACT-2-3

- ★ Coordinated by The Smart Actuator Company Ltd in the United Kingdom.
- ★ Funded under H2020-SME.
- ★ <http://cordis.europa.eu/project/rcn/198010>
- ★ Project website: <http://bit.ly/2EPCSME>
- ★  <http://bit.ly/2EPJuve>

ENVIRONMENT

# WASTE WATER TREATMENT IS NOT MONEY DOWN THE DRAIN

EU-funded scientists have developed technologies that can turn expensive waste water treatment plants into resource-recovery facilities by increasing treatment efficiency and by recycling and recovering water and valuable materials.

Scientists from the EU-funded R3WATER (Demonstration of innovative solutions for Reuse of water, Recovery of valuables and Resource efficiency in urban wastewater treatment) project worked with 12 partners, including SMEs, from seven European countries to develop technologies for more efficient recycling of waste water, recovering valuable materials from sludge and treating pharmaceutical residues.

A dozen different technologies were developed or improved to upgrade treatment plants. 'The idea is to support wastewater treatment plants to become more of a production facility for energy, nutrients and water for reuse rather than just treatment plants that avoid waste water emissions,' says project coordinator, Uwe Fortkamp of the IVL Swedish Environmental Research Institute.

Many of the technologies were demonstrated in treatment plants in Sweden, Spain and Belgium with some now ready for market, according to Mr Fortkamp. For example, Innowatt, a device developed by project partner the Catalan Institute for Water Research, uses software to gather real time and historical data on energy consumption patterns at a plant to optimise contracted power and save on costs.

## Water reuse

The project scientists also developed an automated control system for disinfecting water flow in variable conditions. The amount of disinfectant such as chlorine and ultraviolet treatment can then be reduced to avoid overdosing, which can sometimes result in by-products, thus lowering costs and the environmental footprint.

The demonstration projects in Sweden and Spain showed power consumption was reduced by up to 50% during ultraviolet treatment using this trademarked 'doscontrol' process, says Klara Westling, a researcher at IVL.

## Neutralising pharmaceutical and microbial contamination

Another technology, a fully-automated plug-and-play device developed under the project, uses software to create a dynamic fingerprint based upon the microbiological contaminants and debris in the effluent water. When the fingerprint deviates, the system automatically captures a water sample to be analysed to

identify pathogens, providing constant monitoring and saving on the need for sampling and testing.

With the long-term consequences for human health and ecosystems of exposure to pharmaceutical residues still unknown, ozone polishing safely removes most drug residues in the waste water and disinfects bacteria and other pathogens without the need for prior swift positive identification of each of the contaminants.

The project team was able to further optimise both ozone treatment and treatment by activated carbon to provide more cost-efficient removal of pharmaceutical residues and other priority pollutants, keeping the ozone dose to a minimum.

## Recovering valuables

At present, there is no energy efficient, environmentally-friendly and economically viable process for disposal and reuse of the 9637 000 tons of municipal waste water sludge produced in EU countries each year. Spreading sludge on agricultural land is the cheapest disposal method, but 'with very different regulations on how to handle the sludge, it is not an option in every country,' Mr Fortkamp says.

The project team also developed a treatment technology known as hydrothermal carbonisation (HTC), which results in better dewatering properties of the sludge and allows valuables such as phosphates to be recovered, while producing high quality biocarbon or activated carbon that can improve soil.

With less water to evaporate, energy used during thermal drying is lower. Digesting breaks down one third of the organic matter in the sludge, further lowering treatment costs. The phosphorus is extracted as phosphoric acid from HTC-treated carbonised sludge which can then be used as a fuel source for the cement industry.

### R3WATER

- ★ Coordinated by IVL in Sweden.
- ★ Funded under FP7-ENVIRONMENT.
- ★ <http://cordis.europa.eu/project/rcn/111409>
- ★ Project website:  
<http://bit.ly/29s5Sfm>
- ★  <http://bit.ly/2DlJpin>

# WHAT TELOMERES CAN TELL US ABOUT THE IMPACT OF URBANISATION ON BIRDLIFE

As most cities-dwellers know, urban environments offer both challenges and opportunities. But when it comes to birdlife, can telomeres provide an insight into which tips the balance?

Differences in phenotypic traits such as morphology, physiology and behaviour, have been reported between urban and rural wildlife populations before. However, as the authors of a recent study published in *Proceedings of the Royal Society B* contend, how these differences affect the fitness of individuals is largely unknown.

The study which benefited from EU-funding for a Marie Curie Career Integration Grant for the EUBITOX (European Urbanization and its consequences for Bird Health and Performance) project and a Marie Skłodowska-Curie grant for the URBANEPIGENETICS (The epigenetic basis of early-life effects in a wild bird exposed to urban environmental stress) project, looked specifically at telomere shortening in great tits. Given telomeres' suspected links to senescence and mortality, their length was taken as an indicator of individual fitness amongst the urban and rural populations. The researchers studied the great tit, common to both environments, to investigate the link between telomere length (TL) and survival in both early and later life.

## So what did the telomeres tell us?

Telomeres are strings of non-coding DNA at the ends of eukaryotic chromosomes and are known to contribute to maintaining genome stability. With each round of somatic cell division the telomeres shorten, and once they reach a critical length seem to influence the triggering of age-related decline.

The researchers in this study found that in both rural and urban habitats, TL was a strong predictor of post-fledging survival and subsequent recruitment into the population. However, crucially, they also found longer average TLs among the adult population in the urban environment, likely due to the selective disappearance of individuals with short telomeres early in life. They also found no difference between the urban and rural environments after recruitment, in terms of the link between TL and survival, possibly indicating that after its

negative impact during early life, urban benefits may outweigh their costs as adult birds become better adapted.

Sweden's third largest city Malmö, was selected for the urban study with the rural site located in a forest 37 km northeast of Malmö. For the urban study nest-boxes were distributed across four urban parks (10-45 ha) with a mix of coniferous and deciduous trees, grasslands, ponds and urban infrastructure, such as buildings and paved footpaths. Nest-boxes in the forest were distributed within a blend of forest patches (219 ha) dominated by Scots pine, oak and birch.

Blood samples were taken from nestlings at 15 days old, with parents caught and aged in the nest-boxes, when nestlings were 8-9 days old. Both nestlings and parents were also sexed, using DNA extracted from red blood cells in the case of nestlings and according to plumage characteristics for parents. In all, 217 urban and 327 rural samples were collected, between 2013 and 2015.

## Understanding the impact of urbanisation

Around the world increasing urbanisation is having a major impact on the ecology and evolution of species, populations and communities. Urban areas contain a range of environmental factors not found in rural habitats, related to noise, night illumination,

pollution levels, food resources, disease and predators. However, they present not only a range of challenges, but also opportunities in which some species, not only persist, but actually thrive. Food sources are available all year round and some bird species favour high-rise buildings as nesting sites.

Understanding the underlying mechanisms for variation in life-history traits will help teach us more about how species adapt to selection pressure. EUBITOX was set up to focus specifically on nutrition and pollution factors between urban and rural populations, using a range of state-of-the-art methods in genetics, physiology and ecotoxicology. The URBANEPIGENETICS project was the first field and lab study to investigate how oxidative stress may play a significant role in epigenetic modifications in response to pollution, affecting development, disease resistance and ageing.

### EUBITOX / URBANEPIGENETICS

- ★ Coordinated by Lund University in Sweden.
- ★ Funded under FP7-PEOPLE and H2020-MSCA.
- ★ <http://cordis.europa.eu/project/rcn/105086>
- ★ <http://cordis.europa.eu/project/rcn/195821>



## COMBINING TECHNOLOGIES HELPS HOTELS TO SAVE WATER

Hotels in the arid Mediterranean region can save up to 30-50% of their water by treating and reusing their water using a combination of innovative techniques. Building on the results of a demonstration at a hotel in north-eastern Spain, EU researchers are aiming to help make the tourism industry more sustainable.

EU-funded scientists and SMEs have shown how hotels in the Mediterranean region can use less water by combining innovative technologies to treat and reuse their own wastewater. The DEMAUMED (Demonstrating integrated innovative technologies for an optimal and safe closed water cycle in Mediterranean tourist facilities) project which ended recently had two aims: 'how to tackle water scarcity in the Mediterranean area, but also how to foster the tourism economy and take it in the direction of sustainability,' says Gianluigi Buttiglieri, DEMAUMED's scientific manager and research scientist at the Catalan Institute for Water Research (ICRA) in Girona, Spain.

Tourism is a thirsty industry, with academics estimating that a tourist uses an average of 300 litres of water per day, almost double the 160 litres typically used by a domestic consumer. Greywater (less contaminated water from showers, sinks and washing machines) and wastewater, from toilets, produced by hotels typically go straight into the sewerage system. 'What we wanted to do is to treat the contaminated water onsite and reuse as much of it as possible within the hotel itself,' says Dr Buttiglieri.

### Demonstration site

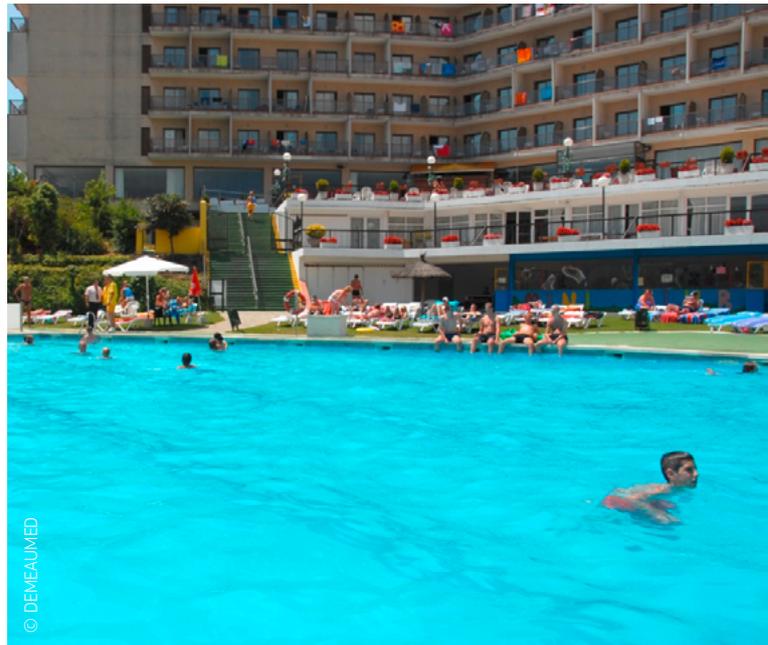
The team first collected information from 6 000 hotels in the region to get an accurate picture of their water cycle. This included the Hotel Samba, a 441-room, three-star hotel in Lloret de Mar, in north-eastern Spain and the site chosen for the DEMAUMED demonstration.

They combined eight technologies from project partners to treat the greywater and wastewater produced by the Hotel Samba over several months, as well as disinfecting pool water, and monitored the results.

In the greywater treatment line, for example, SmartAir, MBR, vertECO and SPEF performed beyond expectations in terms of output water quality, operating robustness and dealing with micropollutants, according to Dr Buttiglieri. Another technology, Plimmer, proved cost-effective for further treating greywater. Combined in a single treatment line, these technologies were able to remove 95%, 97%, 89% and 71% of conductivity, suspended solids, organic content and nitrogen as well as several pharmaceutical-active and endocrine-disrupting compounds.

### Closer to market

For the SME partners involved, the project provided a chance not only to test their technologies in a real-life installation, but also to bring them closer to market-readiness. One such example was vertECO, a vertical eco-system developed by Alchemia-Nova of Austria, which uses plants to remove pollutants from water without the use of chemicals. At the start of the project this system was still in the



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lab, 'but now they are in contact with a lot of hotels in Spain and other parts of Europe,' says Dr Buttiglieri.

Together with partners Wapure International GmbH and Radke Biotechnik, Alchemia-Nova has set up a joint venture to market their technologies and services in several European countries.

Meanwhile, ICRA has produced a decision support tool which allows hotel managers and water treatment technology companies to see which system would work best for any given scenario. This should also help encourage market uptake of the project's technologies.

Using a combination of the DEMAUMED technologies means a hotel could save up to 30-50% of tap water, Dr Buttiglieri says, but, due to technical reasons and also EU-wide restrictions on reusing certain types of water, closing the water cycle completely at the Hotel Samba was not possible. Changes in EU law which could allow this are imminent and the DEMAUMED team have used their real-life experiences to produce a detailed policy briefing with recommendations for the new legislation.

#### DEMAUMED

- ★ Coordinated by the Acondicionamiento Tarrasense Asociacion in Spain.
- ★ Funded under FP7-ENVIRONMENT.
- ★ <http://cordis.europa.eu/project/rcn/111410>
- ★ Project website: <http://bit.ly/2BacmvU>
- ★  <http://bit.ly/2mFVG9>

AQUATIC RESOURCES

# FULLY HARVESTING NOVEL BIODIVERSE PRODUCTS FROM MARINE ENVIRONMENTS

Oceans cover the great bulk of the Earth's surface with highly rich and diverse marine microbes yet to be fully exploited. The EU-funded SEABIOTECH project has developed innovative methods to find and store novel compounds and organisms from extreme marine ecosystems into new industrial products.

As we face increasing pressures and crises on land, converting our seas' potential into novel industrial products for the pharmaceutical (human and aquaculture), cosmetic, functional food and industrial chemistry sectors continues to attract much interest.

Marine biodiversity is known to be far greater than on land nevertheless, unearthing the world's sea resources remains largely unexploited and challenging.

With 71% of the earth's surface boasting an average depth of 3 800 m, the SEABIOTECH (From sea-bed to test-bed: harvesting the potential of marine microbes for industrial biotechnology) project team went about analysing, sampling, cultivating and storing highly adapted biodiverse organisms called 'extremophiles' for their rich and untapped potential.

'Because of their unique metabolic adaptations to their environment, the extremophiles are considered to have an enormous potential for unique biotechnological applications because they allow the performance of industrial processes even in harsh conditions, under which conventional proteins are denatured or inefficient,' shares SEABIOTECH project coordinator Dr RuAngelie Edrada-Ebel from the University of Strathclyde.

## Innovative approaches

In order to fully exploit this potential for industrial biotechnology, modern metagenomics strategies – the study of genetic material recovered directly from environmental samples – were employed to create marine biodiscovery pipelines and convert potential into new pharmaceuticals, cosmetics, foods and industrial chemicals.

'The consortium had access to unique marine biodiversity while utilising innovative culturing approaches, genomic and metagenomics analyses coupled with metabolomics, natural product chemistry, bioactivity evaluation and industrial bioprocessing,' stresses Dr RuAngelie Edrada-Ebel.

The project team, bringing together 14 world-leading organisations from across Europe, therefore standardised a unique

sampling process that collected microbes from extreme and untapped intertidal biotypes in Iceland, from vent fields and sea basins off the Eastern Mediterranean Sea and from Scottish coasts which guaranteed the quality of the marine resources collected.

Researchers were then able to establish a centralised databank to store this genomic, chemistry and bioactivity information on the collected microbes containing 3 209 samples. They also developed legal procedures with national, European and international stakeholders for a harmonised legal process related to the sustainable exploitation of marine genetic resources in accordance with the Nagoya Protocol.

## Main legacy

SEABIOTECH has certainly provided a current model to accelerate and gradually ensure Europe's position as a world leader in biotechnology. The centralised gene diversity repository of marine extract and compounds of marine origin in extreme environments now provides a valuable asset and basis for future R&D projects in such areas.

'Novel and underexplored species of marine microorganisms were investigated for the first time as potential sources of novel therapeutics and they provided positive indications that lead compounds can be isolated and progressed to address significant unmet medical needs (e.g., cancer, infections against, metabolic syndrome and inflammation) and threatening parasitic infections for aquaculture,' underlines Dr RuAngelie Edrada-Ebel.

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### SEABIOTECH

- ★ Coordinated by the University of Strathclyde in the United Kingdom.
- ★ Funded under FP7-KBBE.
- ★ <http://cordis.europa.eu/project/rcn/104332>
- ★ Project website: <http://bit.ly/2m0J0nr>

## DIVERSIFICATION IS KEY TO BOOSTING EU'S AQUACULTURE SECTOR

European aquaculture is a vital industry employing thousands of people and generating billions of euros in turnover. But there is scope for greater development.

According to the EU-funded DIVERSIFY (Exploring the biological and socio-economic potential of new/emerging candidate fish species for the expansion of the European aquaculture industry) project, European aquaculture employs 190 000 people and has a EUR 7 billion ex-farm value. But only 10% of the seafood eaten by consumers in the bloc is actually generated within the EU. The greater amberjack (*Seriola dumerili*) is a species that could help boost this percentage given their large size, their fillet yield, the short time to market and suitability for product diversification and development of value-added products.

These potential benefits are offset by a key challenge: inconsistent reproduction in captivity is preventing efficient marine cage farming of the species. Developing a deeper understanding of what the causes are, could help the EU improve production technologies, diversify products and enhance marketing aspects to boost the growth of the aquaculture industry.

The DIVERSIFY project is doing just this and a paper recently published in the 'American Society of Animal Science' set out some of the team's latest findings.

### What is holding up the farming of the greater amberjack?

The researchers built on recent studies, which have found that greater amberjack confined in sea cages exhibited scarce gonad development and early interruption of gametogenic activity, (the formation or production of gametes), during the reproductive season. The result is the impairment of spermatogenesis and so a lower reproductive rate.

Adult wild and captive-reared males were sampled during three different phases of the reproductive cycle: early gametogenesis (late April to early May), advanced gametogenesis (late May to early June), and spawning (late June to July).

The sperm quality of captive-reared fish was evaluated using computer-assisted sperm analysis and the project found captive-reared males exhibited seminiferous lobules of a smaller diameter. The lobules are located within the testes, and are where the male gametes, namely spermatozoa, are created.

The captive fish also showed an early and progressive decrease in spermatogonial mitosis and a high level of apoptosis (cell death) right at the start of the reproductive season.

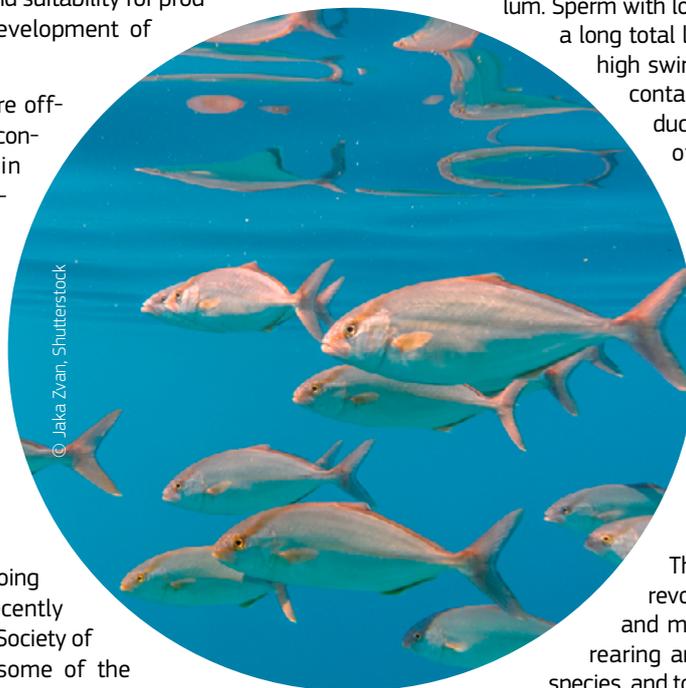
These characteristics are in keeping with a higher level of estradiol in the fish's plasma.

In addition to these barriers to rates of reproduction more in line with the captives' wilder relations, throughout the reproductive season the sperm that was produced showed a drastic decrease in motility, duration, velocity and adenosine triphosphate (APT). Sperm swimming velocity appears to be strongly influenced by sperm morphology, i.e. the size and shape of sperm components: the head, midpiece and flagellum. Sperm with long flagella, and consequently a long total length, tend to have relatively high swimming velocity. The midpiece contains mitochondria, which produce chemical energy in the form of APT. The reduction in APT could be impacting of the sperm's motility.

When it came to the spawning phase, an abnormal increase of sperm concentration as well as an increase of dead spermatozoa occurred, probably because of lack of sperm hydration and ejaculation and consequent sperm ageing.

The DIVERSIFY project aims to revolutionise scientific techniques and methodologies to optimise the rearing and production of new finfish species, and to establish the necessary marketing techniques to attract consumers. As the project says, 'The present study demonstrates the extreme susceptibility of greater amberjack to rearing stress, and underscores the need for improvement of the rearing and handling procedures to ameliorate gametogenesis dysfunctions in commercial aquaculture production.'

*"The captive fish also showed an early and progressive decrease in spermatogonial mitosis and a high level of apoptosis (cell death) right at the start of the reproductive season."*



#### DIVERSIFY

- ★ Coordinated by the Hellenic Centre for Marine Research in Greece.
- ★ Funded under FP7-KBBE.
- ★ <http://cordis.europa.eu/project/rcn/111185>
- ★ Project website: <http://bit.ly/2jL5Zb6>
- ★  <http://bit.ly/2FN00T2>

## IMPROVED DIET FOR FARMED SHRIMP LARVAE

SPAROS, a Portuguese SME, have developed a new feed that improves the growth and health performance of shrimp larvae, with important benefits for the aquaculture sector, consumers and the environment.



*“The MYSIS shrimp larval diet represents a major step forward for aquaculture, resulting in a more sustainable way to produce shrimp.”*

Shrimp is the second most popular type of seafood after salmon, and global demand for this tasty treat continues to grow. However, the shrimp farming industry is currently facing a number of challenges regarding its production methods and environmental sustainability.

The EU-funded MYSIS (A novel weaning diet to optimize performance of farmed shrimp larvae) project addressed these challenges through an innovative weaning diet for shrimp that targets shrimp hatcheries and nurseries around the world. Project coordinator Dr Luis Conceição says, ‘The feed involves a multidisciplinary approach based on advanced nutrition concepts and cutting-edge technologies such as cold extrusion and microencapsulation.’

### New diet outperforms competitors

The technical viability of the MYSIS weaning diet was validated at laboratory scale. It was shown to outperform products that are already on the market by increasing the growth performance and survival of shrimp larvae and their long-term resistance to disease. ‘These benefits will allow producers to reduce the duration of an

extremely sensitive stage, increase the production of high quality juveniles and improve operational predictability representing enormous financial savings for users,’ explains Dr Conceição.

SPAROS also carried out a feasibility study to determine the size of the market, potential clients and competitors, legal barriers and regulatory issues. In addition, they examined issues related to intellectual property rights and developed a roadmap for launching the final product. It was revealed that the greatest challenge facing MYSIS concerns the entry of the product onto the two main international markets, China and India.

### Benefits for both producers and the environment

‘The MYSIS shrimp larval diet represents a major step forward for aquaculture, resulting in a more sustainable way to produce shrimp,’ claims Dr Conceição. Furthermore, the price will not be more than the average price of competing products, therefore offering a high value for money alternative to what is currently on the market.

Obvious beneficiaries of the MYSIS diet are farmers who will adopt the new

diet and feed it to their shrimps. However, by increasing production efficiency, MYSIS will also help to decrease the amount of land used for shrimp farming. An additional benefit is that the technology used to create the MYSIS diet will help to reduce the release of nutrients into effluent water.

MYSIS is therefore expected to have significant positive impacts on the aquaculture industry, the environment, the final consumer and society’s perception of the sector. It will also strengthen Europe’s position as a technology leader in the global aquaculture market. Dr Conceição concludes: ‘The project has enabled shrimp farming to become more sustainable and a good alternative to fisheries trawling for shrimp, which has a major environmental impact.’

#### MYSIS

- ★ Coordinated by Sparos in Portugal.
- ★ Funded under H2020-SME.
- ★ <http://cordis.europa.eu/project/rcn/208030>
- ★ Project website: <http://bit.ly/2EOZe11>

INDUSTRY

# EU MANUFACTURERS REGAIN MARKET SHARE THROUGH NEW BUSINESS MODEL

European manufacturers of packaging machines are fighting to win back and increase their share of the global market by taking a new approach to doing business based on common benefit.

China enjoys around 23% of the global packaging machinery market. Its competitiveness is based on low prices, which are a result of the inherently low cost of labour in the country.

This situation has reduced Europe's market share from 45% in 2007 to around 20% today, with the total loss of the low-end segment. Chinese success in capturing the market for low-cost packaging machines means it is now turning its attention to the rest of the sector. European manufacturers are responding by actively working to redress this state of affairs.

## A new way to do business

The EU-funded IDEA.K (Industrial design easy assembly kit) project is helping European industry regain its share of the economy packaging machine market by developing a new business-to-business model based on the sale of self-assembly kits to regional dealers and focused on a high quality packaging solution. Mr Fiorenzo Donetti, Managing Director of project coordinator Mac Due SRL, says: 'Redesigning machines as innovative "flat-pack" kits enables European companies to compete with low-cost non-EU manufacturers.'

Manufacturers like Mac Due traditionally designed, produced and delivered packaging machines for shrink wrapping products. The machine was supplied to a network of dealers, taking around 90 days from the original order to final delivery. Furthermore, if a technician was required to carry out servicing or other work, they needed to be flown from Italy, thereby incurring additional costs.

Thanks to IDEA.K, the client receives the machine direct from the dealer who assembles and delivers it within one week.

## Local dealers empowered

This approach enables the cost of assembly to be transferred to the dealers and automatically adjusted to the country of destination, thus circumventing the issue of labour cost. The dealership can now also service the machine after undergoing certified training in Italy with the company, thereby giving them a larger profit margin and upgrading their role also to that of a provider of post-sale services and maintenance.

Mr Donetti states: 'The company gets a local dealer everywhere in the world with a technician who can do the job, while local dealers can put their own brand name on a machine that boasts the quality of a manufacturer like Mac Due, who has over 35 years' experience in this field.' In addition, the idea of someone local who knows how to service the machines can be extended to other industrial and more complex services.

Not only is the kit less expensive to produce than using conventional business methods, it is also lighter, which makes it cheaper to transport and helps reduce its carbon footprint. Mr Donetti observes: 'Now we can put 20 kits in a shipping container instead of two assembled machines and the savings allow the manufacturer to maintain a competitive price.'

## Everyone benefits

A study conducted by Mac Due indicated there were no particular intellectual property barriers regarding the exploitation of the

IDEA.K packaging solution. It also showed that while unskilled assembly work will take place outside the EU, skilled manufacturing will remain in Italy, maintaining European industry's well-earned reputation for producing high-quality machines. 'Extending our network will help European business as the raw material is cut here using an automated laser cutting process, thereby providing a boost to the local economy,' Mr Donetti concludes.

IDEA.K therefore offers a reliable alternative business model to the EU packaging machinery sector, whose success paves the way

for new opportunities for the entire machinery industry. The final result is a European product at a competitive price and high quality that benefits the manufacturers, the dealers and the end users.

#### IDEA.K

- ★ Coordinated by Mac Due in Italy.
- ★ Funded under H2020-SME.
- ★ <http://cordis.europa.eu/project/rcn/208164>
- ★  <http://bit.ly/2DkDMFk>

## NANOMATERIAL RISK PROFILING PUTS SAFETY FIRST

With uncertainty around the risks of nanomaterials hampering the EU's innovative potential, researchers are working on a safety concept to better monitor this emerging technology.

Researchers are working on an industry-tailored strategy for the risk-assessment of nanoparticles and nano-enabled products. Their approach, as described in the *Journal of Chemical Health and Safety*, focuses on creating a risk profile for a given nanomaterial (NM), taking into account industrial needs across sectors. The process would determine which materials or processes pose risks, where in a material's life cycle these risks occur, and their impact on society.

The work is supported by three ongoing projects receiving support from the EU's Horizon 2020 research and innovation programme: INSPIRED (INDustrial Scale Production of Innovative nanomaterials for printEd Devices), HI-RESPONSE (Innovative High Resolution Electro-Static printing of Multifunctional Materials) and NANOENTOOLS (Developing and implementation of a new generation of nanosafety assessment tools).

### An evolving field

While the size, structure and properties of NMs offer significant technological advances, their development also brings potential risks to human health and the environment. Existing nano-specific legislation at an EU level is vague, the paper states; as a result the regulatory environment for industry is uncertain. With the field constantly evolving, the European Commission has identified appropriate management of nano-related risks as a vital issue for the success of nanotechnologies.

As NMs are considered a chemical substance, they are bound by the regulatory framework REACH and like other substances are required to be registered centrally. But some Member States have developed their own national registers, and in this context, getting NMs on to the European market has become

increasingly difficult. This hampers the region's potential for innovation and may affect consumer confidence in emerging nanotechnology.

Reliable information on safe levels of exposure to NMs is limited, and technical limitations make carrying out quantitative risk assessment of NMs unfeasible. The paper therefore describes the most sensible course of action as focusing on qualitative risk assessment at all stages of a material's life cycle, risk avoidance, and involving industry, risk managers and stakeholders.

The authors' main goal was to develop a safety strategy for industry workers who deal with NMs on a daily basis, to protect human health and the environment without stifling innovation. The proposed safety concept follows the general REACH approach applied to chemicals while moving towards a joint application of risk, safety and life-cycle assessment.

### So what steps can be taken to facilitate innovation?

The paper sets out a series of steps that can be taken to standardise an EU-wide approach. This includes

information gathering on nanomaterials and hazards through questionnaires and company visits. They suggest hazard assessments to be carried out by collecting all relevant information on a substance's properties and risk management measures based on exposure scenarios.

Risk characterisation and mitigation strategies would also play a key role through the use of the Organisation for Economic Cooperation and Development (OECD) Harmonised Tiered Approach.

#### HI-RESPONSE / NANOENTOOLS / INSPIRED

- ★ Coordinated by Precision Varionic International in the United Kingdom / Burgos University in Spain / Joanneum Research in Austria.
- ★ Funded under H2020-NMP / H2020-MSCA / H2020-NMP.
- ★ <http://cordis.europa.eu/project/rcn/194423>
- ★ <http://cordis.europa.eu/project/rcn/198840>
- ★ <http://cordis.europa.eu/project/rcn/194419>
- ★ Project websites: <http://bit.ly/2EOZz4m>
- ★ <http://bit.ly/2Dpks9j>
- ★ <http://bit.ly/2B91ej9>
- ★  <http://bit.ly/2B9b1Wi>



## A USER GUIDE TO HELP BOOST EUROPEAN INNOVATION

As innovation is a key driver of economic growth and employment, it follows that if we want to increase European business competitiveness, we must first understand better how innovation actually happens.

The last few years have witnessed a fundamental shift in the industrial characteristics of innovation. There is currently a wider array of flexible tools and approaches from which to draw, such as: open innovation, public/private partnerships, crowd sourcing and social media. While these can create dynamic innovation ecosystems, they can also present challenges for traditional innovation policy instruments.

The EU-funded IIT (Industrial Innovation in Transition) project set out to explore how companies are currently adopting new processes and management practice options across different sectors, around Europe. By also evaluating policy portfolios at the national and European level, the project was able to develop comprehensive best practice guidelines.

### Understanding the 'DNA' of contemporary innovation

The IIT project interviewed 700 companies in 11 countries and conducted a separate survey totalling more than 400 responses, to crosscheck the findings. The team chose five industry sectors: biopharma, manufacturing, agrofood, ICT and cleantech.

Explaining the rationale for this selection, project coordinator Professor Erkki Ormala says, 'These sectors cover a range of different business models and traditions and together they represent a major share of the European industry.' To illustrate the mechanisms by which innovation works in practice the team then applied further in-depth analysis to 10 case studies.

As the professor recalls, 'The next task was the huge job of codifying the collected data in such a way that we could really trust that the results were comparable and reliable.' Part of the challenge was the need to classify accurately companies within the various sectors. For example, cleantech is not a classical industry sector, but the team felt that as a growing industry it would offer insights that made it worth including in their taxonomy.

The project created an open database, which includes all the (codified and anonymised) research data. The work also resulted

*"Now we have a fuller evidence-based understanding about the challenges European industry faces when trying to innovate, grow and create jobs. Our study is also important for the design of FP9 and planning for mission-oriented research."*

in the production of a toolbox, which provided a detailed description of the research process with instructions for coding and analysis. This allows scientists working in the field to use the data for further analysis. It also means that innovation policy makers can replicate the study and compare their findings with other European experiences.

Professor Ormala reflects that, 'This kind of study should be done regularly to keep track of how innovation changes and to keep policies updated.' Already, three more countries have expressed interest in conducting a similar study.

### From analysis to recommendation

Crucially, the IIT project also produced a good practice guide to help European companies improve their innovation performance. Findings also included a list of the most critical barriers to innovation, as well as recommendations on how to eliminate these, both at the national and European levels.

Market access issues, provision of risk financing, Research & Development & Innovation funding instruments, inconsistency of policy and regulatory environment, are good examples of challenges at the European level. The challenges at the national level include a significant skill shortage, lack of effective public/private cooperation and open innovation, as well as financing constraints.

The work has already had significant impact. For example, high-level workshops have been held with policymakers in several countries and the EU Commission organised an internal workshop to learn how the findings could be used to improve the European innovation landscape. Indeed, the project has already changed the innovation policy portfolios in some member states, for example in Finland.

As Professor Ormala summarises, 'Now we have a fuller evidence-based understanding about the challenges European industry faces when trying to innovate, grow and create jobs. Our study is also important for the design of FP9 and planning for mission-oriented research.'

#### IIT

- ★ Coordinated by Aalto University in Finland.
- ★ Funded under H2020-SOCIETY.
- ★ <http://cordis.europa.eu/project/rcn/194573>
- ★ Project website: <http://bit.ly/2FKdLwK>



## KEEPING INDUSTRY RESPONSIBLE

Many companies want their research and innovation to benefit society, but how do they ensure this happens? The EU 'Responsible Research' project is providing a framework to allow them to benchmark their activities and work out how they can improve.



*"It soon became clear that our initial idea to develop an industry-wide, one-size-fits-all implementation plan would not work and we needed to develop a broader framework to allow companies to develop their own strategies."*

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Many companies formulate plans and strategies in areas such as risk management or gender equality – it helps their businesses run successfully. But, says De Montfort University Professor Bernd Stahl, 'this is not enough to ensure that the process and outcomes of their research and innovation are societally acceptable, desirable and sustainable.' Stahl calls this 'responsible research and innovation' and it has been the focus of his EU-funded RESPONSIBLE-INDUSTRY (Responsible Research and Innovation in Business and Industry in the Domain of ICT for, Health, Demographic Change and Wellbeing) project, which has spent the last three years trying to understand how to integrate such thinking into existing business infrastructure.

The project worked intensively with industry partners, focusing on companies using information and communication technologies for healthcare, demographic change and well-being – currently a growing sector. Such companies are designing technologies for assisted living like robots or communication aides. The team involved academic partners in seven EU countries, interviewed 30 industry experts and held 15 focus groups as well as a workshop for over 150 participants. 'It soon became clear that our initial idea to develop an industry-wide, one-size-fits-all implementation plan would not work and we needed

to develop a broader framework to allow companies to develop their own strategies,' explains Stahl.

In developing this, the RESPONSIBLE-INDUSTRY consortium looked at the sorts of difficulties and pressures that have prevented industry from considering responsible research and innovation. 'One much debated issue was the question of the motivation versus costs,' says Stahl: 'Companies want to ensure that their work is done responsibly, but this may require additional resources which need to be justified in profit-oriented organisations.' There are also some aspects of responsible research and innovation that are counter to established commercial principles, for example the idea of being 'open access' can seem to interfere with intellectual property interests.

The project has created a framework that recognises the positive impacts that responsible research and innovation offers companies, including enhancing their reputation, decreasing business risks and strengthening public trust in the safety of products. Getting companies to take these messages on board means starting at the top, according to Stahl. 'We therefore produced a document specifically aimed at the top leaders in a company, to give a quick overview of the values and benefits and including short case-studies, where these benefits had materialised in other companies.'

Part of the RESPONSIBLE-INDUSTRY project was testing the framework on four companies, two in Spain and two in Finland. The companies were asked to reflect on how useful the framework was for them. 'It turned out that the benefit was in allowing companies to identify places where they could improve and in several cases this led to change,' notes Stahl.

Whilst Stahl feels the project has made a good case for the benefits of responsible research and innovation, there can still be push-back from companies who are not thinking beyond immediate profit goals. 'If this is to be adopted more broadly, there need to be industry standards or other softer incentives,' he adds, 'one thing that became clear is that it is not something that will happen by itself. It requires the support of publicly-funded initiatives.'

### RESPONSIBLE-INDUSTRY

- ★ Coordinated by De Montfort University in the United Kingdom.
- ★ Funded under FP7-SIS.
- ★ <http://cordis.europa.eu/project/rcn/111212>
- ★ Project website: <http://bit.ly/2DIMyTS>
- ★  <http://bit.ly/2fMIExk>

INFORMATION AND COMMUNICATION TECHNOLOGY

# STRENGTHENED COMPUTING CAPABILITIES FOR EUROPE'S RESEARCHERS

An EU-funded project has developed the EGI Federation, the largest digital infrastructure in the world that allows researchers across all disciplines to have easy access to advanced computing, data and expertise in order to collaborate and achieve excellence.

This means that researchers, institutions and businesses can access the computer resources they need to run pilots, exchange expertise with the international community and tap into new technologies that can greatly facilitate their work. 'EGI-ENGAGE has supported key advances in many scientific fields from biomedical sciences to high energy physics, where international teams spearhead new discoveries,' says project coordinator Tiziana Ferrari, from the EGI Foundation in the Netherlands.

The LIGO-Virgo collaboration is a good example. A global team of some 1.250 scientists detected gravitational waves for the first time in 2016 and again in 2017, earning the Nobel Prize for Physics along the way.

It was thanks to distributed computing that the LIGO/Virgo collaboration was able to turn a massive amount of observational data into a new way of understanding the Universe.

## Making sense of complexity

The EGI Federation supports this growing demand for distributed computing grids dedicated to high energy physics research. 'You can see this increasing demand for distributed computing at every scale, from the theoretical chemist using 5 million core hours (CPUs) a year, through to major collaborations like WeNMR in structural biology, or the Large Hadron Collider, which bring together thousands of scientists and routinely transfer something like 50 petabytes (one petabyte = one quadrillion bytes) of data per month,' says Ferrari.

'In all these situations, distributed computing is needed to run analyses, store the data and share it seamlessly across borders.'

## Powering EU research

Launched in March 2015, the EGI-ENGAGE (Engaging the EGI Community towards an Open Science Commons) project sought to expand the backbone of these federated service capabilities in terms of storage, data, communication, knowledge and expertise. More specifically, EGI-ENGAGE worked on ensuring the continued coordination within the EGI Federation and the evolution of EGI services and business models. Thanks to the project's effort, the EGI Foundation became the first public e-Infrastructure to be certified to ISO service management standards.

To achieve its objectives, the project pioneered and piloted the idea of Competence Centres – distributed teams of experts where research groups and members of the EGI Federation co-develop new digital solutions for scientific challenges. The scheme delivered innovation in all fields, from a new web portal to study Bavarian dialects to a portfolio of digital tools to support structural biology.

EGI also collaborated directly with SMEs through a dedicated business programme, with over 10 use cases.

'The project has compiled a registry of over 80 impactful results,' says Ferrari. 'We are particularly proud of several key exploitable achievements, which include an improved service catalogue for researchers and businesses, the establishment

of the first large scale federated cloud infrastructure and the creation of the DataHub, a service to federate distributed core research datasets for easy access in the cloud.'

There is also the EGI Marketplace, an online platform where EGI-related services can be discovered, purchased and accessed and an Applications-on-Demand service where researchers can access the scientific software they need.

Though completed in 2017, the ground-breaking work of the EGI-ENGAGE project is being continued through the European Open Science Cloud (EOSC), which will become Europe's virtual

environment for all researchers to store, manage, analyse and re-use data for research, innovation and educational purposes. The EOSC is projected to become a reality by 2020.

#### EGI-ENGAGE

- ★ Coordinated by EGI in the Netherlands.
- ★ Funded under H2020-EINFRA.
- ★ <http://cordis.europa.eu/project/rcn/194937>
- ★ Project website: <http://bit.ly/2DlixdP>

## COGNITIVE VIDEO GAME CAN CREATE SMARTER FOOTBALL PLAYERS

In a football game, the most intelligent – and successful – players stand out for their ability to find space where there doesn't seem to be any, anticipate other players' future location and make fast decisions. ACE's IntelliGym technology promises to help mass produce these rare gems.

Few would argue against the idea that the best football players are those who combine great technique, physique, tactics and game intelligence. Yet, whilst the best players in the world can count on professional fitness coaches and expert dieticians to help them with the first three traits, there is no effective tool to enhance their game intelligence. The latter is rather considered as an innate gift.

The purpose of Applied Cognitive Engineering (ACE), an Israeli SME, is essentially to dismiss this assumption. Rather than a gift, its founders believe in game intelligence as another skill that one can acquire with appropriate training. They developed Football IntelliGym – a sophisticated brain-training software for competitive athletes staged as a video game – partly thanks to funding under the EU-funded BRAINPEER (Brain Performance Enhancement Revolution – Advanced Cognitive Training System for Football Players) project.

'Football IntelliGym addresses the brain skills that are found to be strongly related to player performance,' explains Danny Dankner, CEO of ACE. 'These include awareness, anticipation, ability to find open spaces and create such spaces, fast and effective transition game, positioning, and planning – that is, the capacity to know what to do with the ball before receiving it. Training these skills yields much better decisions, less mistakes and fewer injuries.'

Football IntelliGym relies on a patented training approach called 'Cognitive simulation', which Dankner says is the only existing technology that has been proven to enhance footballers' on-field performance. The same approach had already been used by the Israeli Air Force in



the 1980s and 1990s, resulting in pilot performance improvement by over 30%, and more recently by NCAA basketball players and Ice Hockey National Team players in the USA.

Setting up the training is simple: It only requires a computer with an internet connection. 'Players participate in a video-game-like program for 30 minutes, twice a week, either at their club or at home,' Dankner explains. 'The game automatically adapts to the individual player's needs, whilst his/her coach receives progress reports. Tests on players conducted by the Cologne Sport University and the VU University Amsterdam have shown significant on-field improvement in decision-making performance compared to the control group, with results visible within two or three months.'

### Huge market potential

EU funding under phase 2 of H2020's SME Instrument was key to completing the development and testing of Football IntelliGym. It helped ACE adapt its technology to football as well as conduct

efficacy studies, which showed an improvement of 20% to 30% in the performance of players from five leading European football clubs. Extensive field trials engaging more than 600 football players were also conducted to review the product's usability and collect market data.

These add to the 30 000 athletes already using IntelliGym – constituting the world's largest database of players' cognitive performance and allowing ACE to keep improving the system. 'We have performance enhancement systems offered to elite clubs and associations, and IntelliGym is offered to both clubs and individual players who want to make it to the next level (B2C market). The potential is huge: there are 265 million football players worldwide, of which 60 million are in Europe,' Dankner enthuses.

ACE's CEO says the results are 'overwhelming', with clubs that used the system having already decided to fully adopt it for the years to come and players reporting very clear on-field results. 'We envision a future where a

brain workout session will be a standard routine for football players, just like physical training is. We strive to make such brain training affordable and accessible for football players of all ages and skill levels,' he adds.

Besides increasing the number of users, ACE is already focusing on

applications beyond sports. Dankner argues that his company's software is applicable to any domain where decisions have to be made under pressure with a lot of information involved, all the way from driving to training first responders and professionals in the healthcare sector.

#### BRAINPEER

- ★ Coordinated by Applied Cognitive Engineering in Israel.
- ★ Funded under H2020-SME.
- ★ <http://cordis.europa.eu/project/rcn/196481>
- ★ Project website: <http://bit.ly/2EPD5jX>

## VISIONARY SOLUTION FOR ONLINE DATA PRIVACY

The EU-funded VISION project has developed a visual privacy platform to help public entities deliver transparent and privacy-enhanced e-government services that meet the highest privacy standards and offer citizens personalised control over their data.

The solution, which was successfully trialled through a series of pilot tests (in Spanish and Italian hospitals for example), empowers citizens to gain control of their digital privacy through the creation and monitoring of a personal Privacy Level Agreement (PLA). This provides a clear visualisation of privacy preferences about data that can be managed by public institutions.

'Results obtained from these pilots confirmed that the platform improves citizen awareness of privacy and data protection issues and increases their level of control on data management,' says VISION (Visual Privacy Management in User Centric Open Environments) project coordinator Loredana Mancini from Business-e in Italy. The VISION Privacy Platform (VPP) was also shown to be an effective tool for strengthening the transparency and accountability of public administration operations, ensuring that they are in full compliance with online data privacy laws.

'We have already received requests from other organisations to start pilots based on the VISION solution,' says Mancini. 'While the platform was developed and tested for public authorities, the model can be easily enlarged to cover any type of organisation that shares and uses personal data.'

### Smarter government

Online technology has developed at such an impressive speed that it is sometimes hard to appreciate just how much our lives have been transformed. Expectations have also evolved; citizens now expect instantaneous internet connections wherever they go, and to be able to use their mobile devices to perform all sorts of functions such as banking, reserving flights and hotels and getting real time traffic information.

'We increasingly expect the same level of ease in accessing services from public institutions such as local government and healthcare,' notes Mancini. 'We also expect these services to be secure and that our data are protected.'

Delivering smart government services in a secure manner presents a challenge for the public sector. 'Achieving this means being able to integrate and share information between different public authorities, and sometimes private organisation as well,' says Mancini. 'What is needed is an open data model that enables citizens to securely access their information as well as public services in a seamless way, wherever they are.'

### Ready for regulation

To make this possible, the VISION project focused on the issue of privacy. This is a key challenge for public administrations, which often lack the tools and expertise to carry out privacy



analyses and integrate it naturally in their digital services. The introduction of the General Data Protection Regulation (GDPR), which comes into force in May 2018, introduces new stricter privacy related policies for any organisation holding information of EU citizens.

This Regulation aims to give control back to citizens over their personal data. 'The VISION platform provides support towards GDPR compliance through the creation of tailored PLAs, which take into account citizens' privacy needs and provides them with control over their data, and by providing organisations with methods and tools to achieve a privacy-by-design approach on their digital services,' explains Prof. Haris Mouratidis from the University of Brighton, UK, who led the development of the PLA and the privacy by design methods in the VISION project.

The VISION consortium believes that the project's platform taps into a growing public and private sector need to empower citizens when it comes to data privacy. 'To this end the GDPR could be a strong market booster, and many technology providers are keen to promote themselves as GDPR-compatible,' says Mancini. 'Our platform could give them the upper edge. We are looking at market analysis reports at the moment, and don't see a similar solution on the market.'

#### VISION

- ★ Coordinated by Business-e in Italy.
- ★ Funded under H2020-SECURITY.
- ★ <http://cordis.europa.eu/project/rcn/194888>
- ★ Project website: <http://bit.ly/29f500T>

## WORLD'S FASTEST 3D FOOT SCANNER PAVES WAY FOR FOOTWEAR REVOLUTION

EU researchers build advanced foot scanning technology that is now available on the mass market, helping people to find better fitting shoes all over the world.

Finding shoes that are a comfortable fit is a challenge that most of us face when shopping. At the same time, it is also a challenge for the footwear industry which must try to match the size of the shoes it puts on the market to the wide range of feet measurements that fall within one sizing category – a near impossible task.

All this could be about to change with the latest revolution in footwear – bespoke shoes. The EU-funded VSP (Volumental – The Cloud-Delivered 3D Scanning Service Supporting A Future Of Mass Customization) project has helped pave the way for the rise in bespoke shoes by taking advanced 3D foot scanning technology from a proof-of-concept stage to a successful commercial product.

‘Our product has had success with hundreds of 3D foot scanner systems sold to the world’s top footwear brands and stores used by hundreds of thousands of consumers. We are now known as the market leader in our industry,’ says Mikael Andersson, Senior Product Owner at Volumental and Project Coordinator.

Today, Volumental technology is available in 32 countries, helping thousands of customers to find better fitting

footwear on a daily basis. It is used by globally popular brands including Bauer Hockey and New Balance.

### Accurate 3D models of feet

During the project, researchers improved 3D foot scanning technology to make it more accurate, faster and market-ready. To do this they built novel 3D scanners using the latest camera technologies that can create accurate 3D models of feet, taking into account all the different measurements of feet, not just heel to toe length.

Using software algorithms to produce high-accuracy 3D models and inexpensive hardware linked to a cloud computing service, Volumental created a system that produces data that can be easily incorporated into mainstream 3D software systems.

Meanwhile, to test the technology, researchers scanned more than 10 000 people and found that there is a significant difference in heights and widths within one shoe size.

‘With accurate 3D foot modelling, bespoke footwear that matches all the measurements of the foot can be produced easily and everyone can benefit from better fitting footwear in the market as a whole,’ says Andersson.

*“Our product has had success with hundreds of 3D foot scanner systems sold to the world’s top footwear brands and stores used by hundreds of thousands of consumers. We are now known as the market leader in our industry.”*

The project also worked on enhancing user experience to make it fun and interesting for consumers. For example, customers can see their feet in 3D, making it easy to understand their foot shape and help them to select comfortable footwear.

Volumental is currently extending its reach to customers all over the world. The company is now looking to expand into the personal consumer experience by building a mobile app that can recommend footwear to people via their mobile devices.

### VSP

- ★ Coordinated by Volumental in Sweden.
- ★ Funded under H2020-SME.
- ★ <http://cordis.europa.eu/project/rcn/196660>
- ★ Project website: <http://bit.ly/2Dpml0h>



SECURITY

# INTELLIGENT SURVEILLANCE TECHNOLOGY HELPS SHIPS WARD OFF PIRATES

© Tom Cane

Piracy continues to be a major threat to shipping. An EU initiative has introduced a system for timely detection of piracy threats to support ships travelling in high-risk areas.

The resurgence in piracy forced the international community to provide a military presence. This was very costly, so now military deployment is being withdrawn.

There is a need to explore cost-efficient non-military options. Even such alternatives, when used inappropriately, can have disastrous consequences. 'IPATCH addressed the rise in piracy activity and the need for commercial shipping to have cost-efficient, non-lethal measures with which to defend themselves,' says Tom Cane, project coordinator for the EU-funded IPATCH (Intelligent Piracy Avoidance using Threat detection and Countermeasure Heuristics) project. 'A deeper understanding is also needed of the legal and ethical implications of using different types of countermeasures.'

## Making seas safer without the use of potentially lethal force

IPATCH analysed piracy incidents over the last five years and countermeasure data to gain knowledge of the most common patterns of attack and the associated risk of harm to a vessel and crew. The project also assessed the effectiveness of existing countermeasures, along with legal and ethical issues surrounding their use.

According to the International Maritime Organization, an effective lookout is the most important defence against attacks at sea. Where early warning of a suspicious approach or attack is assured, and where defences can be readily deployed, an

efficient watch is considered the single-most successful ship protection method.

In response to this finding, the project developed an automated onboard threat detection and decision-support system. Combining advanced video analytics with existing sensors, situation awareness and threat assessment algorithms to support crews, the system detects and advises crews how to respond to pirate attacks quickly and safely.

IPATCH successfully validated the prototype system on board a real oil tanker. Trials were held in Greece and small speedboats were used to simulate pirate attacks in order to evaluate how well the system could detect and track them, determine their threat level, and recommend appropriate actions to the captain and crew.

A maritime sensor data set was collected to support testing and development of the system. It consisted of synchronised data recorded from visual and thermal cameras, radar, an automatic identification system and navigation systems. The data set was prepared, annotated and released for use by academia and industry for further research.

## Real-time threat assessment and mitigation of piracy threats

'IPATCH has provided in-depth knowledge on piracy behaviour and use of countermeasures, particularly for East and West Africa which were our focus regions,' says Mr Cane. 'It demonstrated a proof of concept for an affordable, on-board surveillance and threat

detection system which can support the captain and crew when they are in dangerous sailing waters.'

According to Mr Cane, the system's individual components also have potential for use in other applications, such as port and harbour monitoring for safety/security, vessel traffic services systems, offshore infrastructure protection and general maritime domain awareness.

For direct end users of the onboard system, such as shipping companies, captains and crews, the expected benefits are increased early warning of attacks and reduced costs associated with incidents. 'The more time they have to prepare, the better,' says Mr Cane. 'The system will provide automated 24-hour, 360-degree surveillance, reducing the burden on crew members who keep watch.'

Project outcomes can also be extended to support the training of seafarers and for capacity building in coastal states in piracy regions. 'Early detection technology, together with the information needed to decide how best to mitigate threats, should dramatically improve the safety of ships and their crews,' concludes Mr Cane.

### IPATCH

- ★ Coordinated by BMT Group in the United Kingdom.
- ★ Funded under FP7-SECURITY.
- ★ <http://cordis.europa.eu/project/rcn/185487>
- ★ Project website: <http://bit.ly/2DrxPG6>
- ★  <http://bit.ly/2mFJbfe>

## RECYCLED TYRES TO PROTECT BUILDINGS FROM QUAKES, BLASTS AND FIRES



EU-funded scientists have shown that scrap tyres contain valuable materials that can be used to strengthen tunnels and make buildings earthquake, fire and blast resistant.

Rubber, steel and textile fibres from scrap tyres can be reused to strengthen concrete to make buildings more resistant to earthquakes and fires, protect walls against explosions, and help buildings or tunnels recover quicker after a fire.

The EU-funded ANAGENIS (Innovative Reuse of All Tyre Components in Concrete) project involved some 17 industrial and academic partners in eight countries, including the European Tyre Recycling Association in laboratory experiments and large demonstration projects to show that reclaimed materials from the 3 million tons of tyres discarded in the EU each year can be put to good use.

Tyres comprise roughly 80% rubber, reinforced with 15% steel wire and 5% textile fibre. Currently most of Europe's post-consumer tyres end up in landfill or are incinerated despite environmental concerns about this method of disposal.

### Rubberised concrete is flexible

Using recycled tyre rubber in concrete gives this rubberised concrete 40 times more flexibility than conventional

concrete and enables buildings and other structures to be extremely deformable. Rubber-reinforced concrete can be used at the bases of columns and structures to make them more quake proof, says project coordinator Kypros Pilakoutas, professor of construction innovation in the department of civil and structural engineering at the University of Sheffield, UK.

Large-scale tests at Imperial College London, UK, and shake table tests at the Technical University of Iasi, Romania, showed seismic resistance of structures can be enhanced 500% compared to conventional concrete. The rubberised concrete can be also sprayed on tunnel and steep slope surfaces to provide structural strength, as was done in demonstration projects in Croatia and Spain.

### Tyre wire increases strength

Recycled tyre wire can be blended with other steel fibres in concrete. 'Steel fibre from tyres looks like very thin piano wire. It comprises lots of very thin strands twisted into a cord that has 10 times the strength of conventional steel,' Prof. Pilakoutas explains.

Tests carried out by the project team found that the fibre can eliminate shrinkage cracking in concrete almost completely, he says. 'Even with minute amounts of tyre wire there are so many fibres that they spread throughout the concrete and help arrest cracks at the microscale,' Pilakoutas expands.

The team produced join-free concrete flooring in the UK, Holland and Bosnia and Herzegovina of up to 40 metres length with no reinforcements other than tyre wire.

### Polymer fibres make concrete blast resistant

The polymer fibre commonly used to reinforce passenger vehicle tyres is another strong, high quality material that can be recycled to control cracking at the early stages of concrete curing. The textile fibres also help prevent concrete crumbling and breaking up during fires, and can protect buildings against damage from projectiles or explosions.

In an intense fire 'polymer fibres provide strength at the initial stages when the concrete is expanding,' Professor Pilakoutas says. The fibres melt at around 200 degrees Celsius, the same temperature at which the expansion makes the concrete explode. 'On melting, the fibres create voids that allow steam to vent, releasing pressure in the concrete so it does not explode,' says Pilakoutas.

Fire tests show the fibres also eliminate crumbling and make the concrete highly blast resistant. 'The concrete will be damaged but the fibres prevent the concrete cover spalling explosively inwards, potentially saving lives,' says Professor Pilakoutas. This latter technology needs to be scaled up before it is market-ready, he adds.

#### ANAGENIS

- ★ Coordinated by the University of Sheffield in the United Kingdom.
- ★ Funded under FP7-ENVIRONMENT.
- ★ <http://cordis.europa.eu/project/rcn/111538>
- ★ Project website: <http://bit.ly/2DGOppK>
- ★  <http://bit.ly/2DqhkXu>

## PUTTING OUT FIRES WITH NEW, STATE-OF-THE-ART WATER JET

The EU-funded JET ANTI-FIRE project actively helps combat fires in a more efficient way, saving time, water and lives.

The world's growing population means bigger cities, bigger buildings and a bigger risk of fire. Although today's buildings come with modern requirements and state-of-the-art fire safety equipment, many of the buildings – and especially skyscrapers – built in the 1970s and 1980s lack the necessary fire-extinguishing equipment.

### The EU-funded JET ANTI-FIRE project set out to change that

The JET ANTI-FIRE (Industrialisation of a Disruptive Active Fire-Fighting System) project's system was developed to extinguish a

fire in half the time it takes when using conventional equipment – using half the required energy and water and at a fraction of the price. 'When fire breaks out in a building, time is of the essence,' explains the project's technical expert Fabio Bosetti. 'Being able to extinguish a fire quicker means not only saving lives, but also saving property and thus preserving business continuity.'

According to Bosetti, JET ANTI-FIRE answers a very specific need. It all started during the preparations for EXPO 2015 in Milan. The many new skyscrapers that were built for the EXPO had to satisfy national security standards. 'What we found was that none of the equipment available at that time met these

## SECURITY

stringent standards,' adds Bosetti. 'In this sense, JET ANTI-FIRE is not an evolution of an existing product, but an entirely new concept that does not have an equivalent.'

### A constant stream of water

Extinguishing fires faster means giving firefighters access to a constant and sufficient stream of water released at the right pressure. To achieve this, the JET ANTI-FIRE system uses two specific components: a hydrant tap and a water jet system.

The hydrant tap makes sure the water pressure is constant and balanced, while the jet system fractures and pulverises water into small particles. This creates a fog that breaks down the firefighters' surrounding temperature, enabling them to more effectively target and combat the fire.

### Big benefits

The result is a 50% increase in fire extinguishing efficiency, which also doubles the protection of all the civilians and structures involved. What's more, the system consumes half

the amount of water used by conventional fire-extinguishing equipment. 'Think of how much less space will be needed to allocate water reserves in historic city centres, or of the possibility to build fire-fighting facilities in areas with water scarcity that would otherwise be impossible,' adds Bosetti.

The fact that JET ANTI-FIRE uses low water pressure is a major benefit for the safety of the firefighters, as they can use and control the system themselves. It also enables the system to be connected to municipal water networks without the addition of electric pumps – another money saving feature.

The project's next steps are to make the necessary adjustments so the system satisfies the fire regulations of other countries.

#### JET ANTI-FIRE

- ★ Coordinated by Firing in Italy.
- ★ Funded under H2020-SMEINST.
- ★ <http://cordis.europa.eu/project/rcn/208764>
- ★ Project website: <http://bit.ly/2mF2t4g>

## STOPPING THE THREAT OF A ROGUE NUCLEAR ATTACK



The EU-funded NESPINT project is developing an innovative device that can detect whether nuclear material is being smuggled via luggage or a container.

operational environment. In addition, researchers prepared a realistic business plan, estimated the total and serviceable available market, studied the technical and financial risks associated with the project, ensured that the prototype satisfied international standards and promoted the project at various international events.

According to project coordinator Giacomo Manessi, one of the key challenges that researchers faced during this phase was finding a suitable testing environment. 'Testing the detector requires the setting up of realistic conditions, which in turn requires the use of SNM,' he says. 'As SNM is heavily regulated by strict laws limiting their use, transport and possession, our work had to be coordinated through national security agencies.'

At the same time, researchers also had to ensure that the detector system did not increase screening time or add additional steps to the already busy security process. For this reason, the NESPINT detector is designed to send a discrete alert to authorities, who can then remove the flagged luggage without disrupting the normal flow of passengers and luggage going through security screening.

### Stopping SNM in its tracks

The key project result, which is still a work-in-progress, is to have an innovative detector available for use at ports, airports and international borders for the detection of SNM smuggled by terrorists and criminals in their luggage.

Once finalised, the NESPINT detector will be integrated into conventional X-ray screening systems and installed in a number of European airports and at EU border crossings – particularly along borders near the Middle East and former Soviet Republics where most of the trafficking incidents occur.

'By providing results within a few seconds, the NESPINT detector will play a fundamental role in the global effort to stop the illicit trafficking of nuclear material,' says Manessi. 'Moreover, as the illegal trafficking of SNM is directly related to the potential preparation of a terrorist attack, this detector removes at the base the raw material needed to even start planning such an attack and thus reduces the likelihood of such an attack from ever happening.'

As the project moves into phase two, researchers are looking for potentially interested European partner companies for facilitating integration of the detector into a conventional X-ray hand luggage scanner. Simultaneously, they are working with ports and airports as potential users of the final system, along with looking at expanding the system's use to screen packages at freight and cargo sites.

#### NESPINT

- ★ Coordinated by Else Nuclear in Italy.
- ★ Funded under H2020-SMEINST.
- ★ <http://cordis.europa.eu/project/rcn/207642>
- ★ Project website: <http://bit.ly/2EPBdYo>

One of the biggest security threats facing society today is a terrorist attack involving the use of nuclear materials, such as in the form of a dirty bomb or nuclear weapon. This isn't just a theoretical threat. As terrorist organisations are becoming increasingly skilled at trafficking Special nuclear materials (SNM), it is actually very real. In fact, between 1993 and 2015, authorities confirmed 2922 incidents of illicit nuclear material trafficking across international borders, with 188 happening in 2015 alone.

To help fight this growing threat, the EU-funded NESPINT (NEutron Spectrometry to Prevent Illicit Nuclear Trafficking) project is working to develop an innovative SNM detector. Once complete, the NESPINT detector will be capable of recognising whether nuclear material is being smuggled via luggage or a container, thus significantly improving the security levels at borders and airports.

### From idea to prototype

During this initial stage of the project, researchers successfully developed a working prototype of the NESPINT detector, along with testing it within an

FUNDAMENTAL RESEARCH

# SELECTIVELY ASSEMBLING CHEMICAL BUILDING BLOCKS WITH THE HELP OF MAN-MADE CATALYSTS

The EU-funded ENOLCAT project has managed to control the synthesis of a diverse range of bespoke compounds from basic materials and using simple man-made catalysts.

Scientists have long been inspired by nature's ability, guided by evolution, to build complex and elegant biological structures from relatively simple materials. Synthetic chemists look to the design and performance of natural materials such as co-enzyme A, to learn how to emulate their ability to generate synthetic diversity (such as exists among polyketides and alkaloids).

The EU-funded ENOLCAT (Emulating Nature: Reaction Diversity and Understanding through Asymmetric Catalysis) project set out to optimise this biomimetic approach in order to exploit simple materials towards selectively rendering diverse products with high degrees of control. The team aimed to develop new organic catalysis strategies which were both specifically applicable, while also contributing to a more comprehensive mechanistic understanding of these underlying processes.

## Catalysts for change deliver 3D chemistry

Key to the work of ENOLCAT was the effective harnessing of catalysts, specifically a branch of chemistry where chemical complexity is associated with so-called molecular 'chirality'. This is a geometric property whereby a molecule is non-superimposable on its mirror image. As the term chiral comes from the Greek word for hand, it is usually explained in terms of the non-superimposability of a right hand over

its mirror image, the left hand – as witnessed by the inability to wear the left glove on the right hand.

ENOLCAT coordinator Professor Andrew Smith points out that chirality has very important consequences for synthetic chemistry. As he puts it, 'In terms of constructing molecules, selectivity is key; you need to control how you build them. You need to control if you build from the top or bottom, or left and right-hand sides of a structure, just like a LEGO building block, to decide the final outcome of putting these blocks together.'

This degree of control is referred to as 'regio and enantio-control'; ENOLCAT augmented the control of the reaction processes themselves, to achieve the desired balanced arrangement or 'stereochemistry' of the atoms in the resulting chemical products. Without this control chemical compounds such as pharmaceutical drugs can be ineffective.

In the laboratory the team succeeded in using man-made (isothiurea) catalysts, to achieve the transformation of a simple chemical building block (a carboxylic acid), in situ in a domino reaction sequence, into a diverse series of molecular architectures (equivalents of enol and acyl donor species) with control of their 3D-orientation. As Professor Smith enthuses, 'Seeing new reaction processes transform from the drawing board to being put into practice in the laboratory is always an exciting transition.'

## Following the path of chemodiversity

When selecting specific targets for ENOLCAT's work Professor Smith recalls that, 'We tried to choose targets according to need. Many pharmaceutical targets are made up of rings of atoms bonded together (carbo- and heterocycles) and so we concentrated on developing alternative and bespoke methods for preparing those.'

Improved catalysis enables industrial processes that are efficient, minimise energy, waste and harmful by-products, for the delivery of key products. Making its own contribution to these efforts, as Professor Smith concludes,

'ENOLCAT has provided bespoke catalytic solutions to problems of industrial relevance, some of which are being applied on large scale, to generate key bioactive target molecules that may be of long-term benefit to society.'

### ENOLCAT

- ★ Hosted by the University of St Andrews in the United Kingdom.
- ★ Funded under FP7-IDEAS-ERC.
- ★ <http://cordis.europa.eu/project/rcn/99735>

# TRACKING THE MOLECULAR ACTIVITY OF NATURAL PRODUCTS, WHILE ALSO ENGINEERING NEW VERSIONS

The EU-funded C-XAQ project applied the principles of synthetic chemistry to generate new to nature, medically relevant, bioactive natural products, as well as developing methodologies to tag and trace halogenated compounds in living systems.



Chemists sometimes refer to compounds and substances produced by living organisms as natural products (NPs). Understanding how these NPs are organically produced allows for their biosynthetic manipulation and modification. These processes are crucial for medical advances, as they are key for pharmaceutical development.

C-XAQ (Cross-Coupling (C-X): Pioneering Mild Aqueous Cross-Coupling Methodologies to Enable Selective Functionalisation and Diversification of Halogenated Natural Products) set out to contribute to these efforts, particularly focusing on using halogens as a tag within these molecules. The researchers have shown that the introduction of a halogen can be achieved by manipulating the natural assembly of these

molecules. Once introduced, the halogen acts as a reactive handle that can be modified. Using new, mild, aqueous and selective cross-coupling chemical procedures, the team were able to selectively diversify organic molecules enabling quick access to a diverse series of new to nature NPs.

### Designing the optimum conditions for modification

Tryptophan is an amino acid that is critical to the biosynthesis of proteins in organisms, necessary to sustain life. As it is also implicated in many medically important NPs, it had been thought that manipulating its protein folding, fluorescence and bioactivity processes could yield significant insights for medical science. Yet, whilst

there have been extensive studies of other aromatic amino acids, until the work of the Goss group which led to the C-XAQ project, there had been no comparable studies on tryptophan.

The C-XAQ project team developed chemistry enabling the replacement of a C-X (carbon halogen tag) with a diverse series of alternative chemistries. This has been carried out on X-tryptophan as well as on a 'new to nature' halogenated antibiotic, engineered from bacteria. As the project coordinator, Dr Rebecca Goss explains, 'This kind of control lets us intercept, label and modify bioactive molecules as soon as they are produced by the cells, and has the potential to enable compound tracking and ultimately the modulation of biological properties.'

Additionally, to better understand the potential of the antibiotic, the Marie Curie Fellowship Researcher Dr Cristina Pubill-Ulldemolins, together with members of Goss's ERC team, investigated the impact of water and air on the catalytic cycle, then assessed the effect on the growth media of the bacteria. The team also studied the toxicity effect of catalysts and reagents to the engineered bacterial cells which meant they were able to optimise catalytic conditions and new bacterial growth media was developed to promote antibiotic production while not compromising the catalysis.

According to Dr Goss this was the most challenging part of the project. As she recalls, 'It required us to develop media conditions compatible with living cells as well as suitable chemistry. We discovered the optimal methodology

which supported the growth of the microorganisms, production of halogenated natural products without compromising the efficiency of Suzuki Miyaura cross-coupling chemistry.'

The team found that ingredients commonly used in bacterial growth media like glucose, amino acids and even glycerol, adversely affected the outcome of the cross-coupling chemistry. They innovated by replacing conventional components with alternatives that could sustain organism growth but not compromise catalytic activity, for instance with the use of nitrate salts as a nitrogen source.

### Benefiting therapeutic drug R&D

The chemical procedures which C-XAQ fine-tuned have enabled the modification of sensitive NPs. Being able to do this in a living system ensures the turnover rate of molecules (metabolic flux) through the system, thus holding out the promise of continuous NP generation, to which can be added any necessary therapeutic modification.

The researchers are continuing to explore this methodology to track bioactive molecules within living systems. However, having developed chemistries for the modulation of halotryptophans,

they are currently extending their research to improve the bioactivity and bioavailability of natural products with pharmaceutical potential. The team are also attempting to engineer the actual shape of medically relevant peptides, to optimise their bioactivity potential as novel therapeutics.

#### C-XAQ

- ★ Coordinated by the University of St Andrews in the United Kingdom.
- ★ Funded under H2020-MSCA.
- ★ <http://cordis.europa.eu/project/rcn/195784>
- ★ Project website: <http://bit.ly/2DcOYjq>

## DNA – THE FORCE IS WITH YOU

DNA is the mastermind behind replication, mutation and evolution, encoding, as well as gene expression. The advent of new computers and software that simulate the structure of this incredible molecule promise to reveal how it achieves this level of multi-tasking.

Current simulation procedures using force fields to represent DNA have two major problems. Classical force fields designed to calculate the potential energy of a system of atoms have well-known biases, which limit their accuracy. Moreover, procedures are limited to study systems in the range of 100 base pairs whereas the simplest DNA molecule from prokaryotes, without a nucleus, is one billion times larger.

### The new gold standard for DNA simulation at the atom level

The EU-funded SIMDNA (Advanced multiscale simulation of DNA) project has developed a multiscale simulation technology that resolves the entire range of DNA scales – from the nucleobase at one ten-billionth of a metre to the human genome at the metre level. As Dr Modesto Orozco, research coordinator of the SIMDNA project outlines, 'The overall goals were to present a continuum of methodologies to represent DNA from the atomistic to the nucleosome level, including short chromatin fibres.'

The SIMDNA team made great progress during the five-year term of the project. At the atomic level, they have ousted the previous gold standard for DNA simulation with the new parmbsc1 force field. Causing a stir in the DNA structure and function arena, opening the facility to the community resulted in more than 350 citations in science journals.

### Coping with deformation and the mesoscopic model

DNA deformation occurs during the communication of DNA with other molecules, its so-called multimodality, as well as a result of epigenetic modifications that usually occur due to external environmental conditions. The researchers have developed and implemented a mesoscopic model to measure scales between atoms and molecules and materials in the order of micrometres during these distortions.

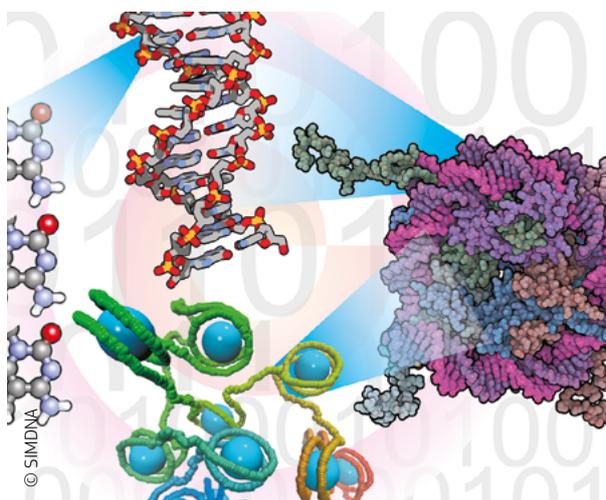
The mesoscopic model can also simulate reasonably long pieces of chromatin with nucleosomes, where unique packing ability ensures that the molecule can fit into tight spaces while

still being accessible to interaction with other molecules. An example of SIMDNA's research ingenuity in the face of problems emerged when working with the nucleosome structure. 'We found poor quality data available regarding the positions of nucleosomes in the fibre. And we partially solved the problem by collecting our own data for a small model system (yeast),' explains Orozco.

### Molecules as dynamic information carriers and significance for the future of medicine

DNA and RNA aren't the only way to transfer crucial information that ensures the switching on of the right gene at the right time. Other molecules that store vital data include proteins, in particular, enzymes. The SIMDNA project has also investigated the phenomenon of allostery, where an enzyme's activity can be modulated by interaction with small molecules, for example.

Allostery can make a world of difference where the action of an enzyme is concerned as its shape can be totally transformed. The researchers looked at several enzymes that act on DNA. One, called relaxase, is involved with the transfer of antibiotic resistance in *Staphylococcus aureus* during conjugation, when it can pass its genes to neighbouring bacteria. The paper has



been published in PNAS. Another two papers on allostereism are under consideration for publication in a high-impact journal.

Trying to find boundaries for the wide range of future applications for the SIMDNA technology in biomolecule simulation is difficult, there are literally so many. Orozco points towards a massive effect in the field of complex diseases. 'I think a point for the future application of these type of [simulation] calculations is the impact they might have on

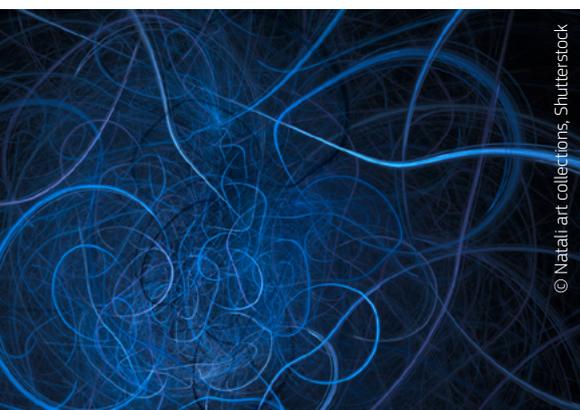
the better understanding of epigenetic-originated diseases, especially in complex pathologies such as cancer.'

#### SIMDNA

- ★ Hosted by IRB Barcelona in Spain.
- ★ Funded under FP7-IDEAS-ERC.
- ★ <http://cordis.europa.eu/project/rcn/103734>

## A QUANTUM LEAP FOR ULTRA-PRECISE MEASUREMENT AND INFORMATION ENCODING?

An EU-funded project working with ultrafast optics, furthers control over the spatial-temporal quantum states of light, advancing quantum information science.



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Quantum information science (QIS) holds out much hope for improved metrology as well as various Information, communications and technology (ICT) systems. However, the degree of control over quantum states necessary to render the approach superior to conventional techniques, makes the realisation of the technology's potential especially challenging. So called 'squeezed states in continuous-variable systems' have been posited as one approach which might bring success for better control of quantum states, partly because these systems are thought to be scalable.

The EU-funded QCUMBER (Quantum Controlled Ultrafast Multimode Entanglement and Measurement) project, explored the use of such squeezed states, or multiphoton states, in different temporal modes based on integrated optics devices. In a paper recently published in the journal 'Philosophical Transactions A' of the Royal Society, the researchers scope the current limits of waveguide squeezing and the loss limits in the conversion process.

### Entangling squeezed states

The paper's authors point out that over recent decades, significant progress has

been made on low loss waveguides, very efficient photon-number detectors and nonlinear processes. Additionally, thanks to the success of the non-linear optical process known as 'engineered sum frequency conversion', operation on arbitrary temporal broadband modes is now achievable. This opens up the spectral degree of freedom for information coding, often into the temporal modes of a single photon.

QCUMBER examined the prospect of combining, in a waveguide system, both squeezing and mode-selective frequency conversion. By creating an analogy between the Quantum Pulse Gates (QPGs – basic quantum circuits) and spatial networks, they enabled a visualisation of the process for entangling squeezed states or constructing complex multimode continuous-variable states.

Looking at the squeezing achievable in a KTP single-pass, single-mode waveguide, the team found that squeezing was possible up to 20 decibels, but the complicated behaviour of the process, resulted in significant degradation, limiting the conversion efficiency to below 90%. However, they point out that this is still promising for the future of the technology. They go on to argue that for applications where low conversion efficiency is sufficient, this doesn't present a problem and phase-matching can be engineered using a simple model without the need for pump-power.

In the spectral domain, the team also achieved the entanglement in a continuous-wave frequency comb structure of up to 60 temporal modes and around 10 modes in a pulsed, ultrafast system. They report that once the squeezing is able to reach certain thresholds, error correction for quantum computing becomes possible, which will drive the science forwards.

### Tapping extreme timescales and broad spectra

Ultrafast pulses of light offer opportunities to better understand underlying system dynamics at time scales of very short duration. The harnessing of light's quantum attributes has advanced the fundamental physics knowledge gleaned through experimentation and has been key to progress in quantum communication and quantum metrology. Indeed, high precision metrology has been enabled through the exploitation of the broad frequency comb structure that trains of ultrafast light pulses create.

QCUMBER was set up to further investigate opportunities that might exist within the relationship between the quantum properties of light at extreme timescales and over extremely broad spectra. Exploiting the structure of ultrafast quantum pulses will enable ever more precise time-frequency measurements and introduce innovation for scalable quantum information processing.

#### QCUMBER

- ★ Coordinated by the University of Oxford in the United Kingdom.
- ★ Funded under H2020-FET.
- ★ <http://cordis.europa.eu/project/rcn/197126>
- ★ Project website: <http://bit.ly/2EPDVND>

*"The harnessing of light's quantum attributes has advanced the fundamental physics knowledge gleaned through experimentation and has been key to progress in quantum communication and quantum metrology."*

# EVENTS

MARCH  
01 ▶ 02

Leicester, UK

CONFERENCE

## INTREPID FORENSICS FINAL CONFERENCE

The EU-funded INTREPID FORENSICS project will host its final conference in Leicester, UK, from 1 to 2 March 2018

The conference, entitled 'Innovation through collaboration', will both celebrate the end of the project and to showcase the added value of collaboration in forensic science.

As the INTREPID programme is all about developing future forensic researchers, this event is open to (but not limited to) students, academics, forensic practitioners, police, funding bodies, legal practitioners and those working in the commercial industry.

For further information, please visit:

<http://www.csofs.org/Events/INTREPID-Forensics-Innovation-through-Collaboration/50295>

## EVENTS

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

MAR.

21 ▶ 23

MARCH  
07 ▶ 09

Esch-sur-Alzette, LUXEMBOURG

CONFERENCE

## MOVE FINAL CONFERENCE & PRE-CONFERENCE

The EU-funded MOVE project will be organising its Final Conference & Pre-Conference in Esch-sur-Alzette, 7-9 March, 2018.

The conference will be a platform for exchange and discussion on youth mobility in Europe from different perspectives. It will reflect challenges, risks and benefits of youth mobility in Europe and The conference will focus on strategies of mobility, fostering and hindering factors of mobility, positive and negative effects, as well as emerging patterns of mobility within the EU.

For further information, please visit:

<http://move-project.eu/conference/about/presentation/>

MARCH  
13 ▶ 15

Munich, GERMANY

WORKSHOP

## FIRST HBP CURRICULUM WORKSHOP SERIES

The EU-funded Human Brain Project project will be organising its First Curriculum Workshop Series in Munich, Germany, from 13-15 March, 2018.

Cognitive systems are devices that are designed to mimic cognitive skills of higher developed biological organisms at varying levels of complexity and performance.

Models of these skills can be either abstract functional descriptions from the vast field of cognitive science or detailed simulations of brain circuits from neuroscience.

The goal of this workshop is to provide a definitive introduction to the theory of cognitive systems.

Drawing from advances in brain research, the topic is approached from a computational-neuroscientific perspective rather than an abstract-psychological one, bridging the gap between the physical structure of the brain and the logical organization of its cognitive capabilities. Special focus is put on the role of robotics as a means to ground cognitive function in bodies that physically interact within different types of environments.

Special focus is put on the role of robotics as a means to ground cognitive function in bodies that physically interact within different types of environments.

The workshop is open to the whole student community and early post-docs upon application. Applications from young female investigators are highly encouraged.

For further information, please visit:

<https://education.humanbrainproject.eu/web/cognitive-systems-workshop/general-information>

Bucharest, ROMANIA

POSTGRADUATE EDUCATION

## PREPARE PROJECT'S POSTGRADUATE EDUCATION COURSE

The EU-funded PREPARE project will be organising a postgraduate education course in Bucharest, Romania, from 21 to 23 March 2018.

The PREPARE (Preparing for (Re-) Emerging Arbovirus Infections in Europe) project is running a post grad course which aims to improve participants' knowledge of the identification and management of arbovirus (arthropod-borne virus) infections and outbreaks at local and European levels.

Course topics will include a review of arboviruses of importance to Europe, including endemic and travel-imported viruses. This will include an overview of symptomatology, diagnostics and interpretation of laboratory results and an update on prevention, vaccine and treatments for these viruses.

The course will also include an overview of surveillance systems, European organizations, laboratories and clinical networks involved in surveillance, control and outbreak response and practical sessions covering serology interpretation, case scenarios and outbreak response exercises. The course will be delivered by a range of European experts on arboviruses, through a dynamic mix of presentations, case scenarios and outbreak exercises.

The target audience would be 20 – 30 doctors, nurses and laboratory staff from South / South-East Europe who might be involved in the identification, diagnosis or treatment of patients with arbovirus infections.

For further information, please visit: <https://escmid.pulselinks.com/event/16710>

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A European market for climate services through innovative EU research



On the move for safer surface transport in Europe



eGovernment: delivering innovative public services for citizens and businesses



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