ISSN 2599-8293

European Commission

CORDIS Results Pack on

reducing the R&I divide

A thematic collection of innovative EU-funded research results

May 2019

Research and Innovation

Contents

Editorial

It is an undeniable fact that economic growth and increased competitiveness in Europe can only happen by investing in Research and Innovation (R&I). Major benefits can be achieved by tapping into Europe's unexploited potential in R&I through increased participation in the Horizon 2020 framework research programme coupled with greater commitment from low R&I performing Member States (MS) and Associated Countries (AC).

This focus allows the European Research Area (ERA) to function in a more efficient and homogeneous way, where the individual strengths of each country may be optimised. This will be achieved by encouraging organisations in participating countries to further develop and take greater advantage of their R&I potential through several specific measures involving mentoring, networking, communication and partnering activities.

Making the most of European potential

The 'Spreading Excellence and Widening Participation' programme of Horizon 2020, therefore, aims to help close the R&I divide by improving the participation rate of low performing R&I countries. This will enable them to fully realise the potential of Europe's gifted researchers and ensure the benefits of an innovation-led economy are both maximized and spread across the EU.

Entities from 15 MS (Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Luxembourg, Malta, Poland, Portugal, Romania, Slovakia and Slovenia) are currently eligible for Widening support as project coordinators. A number of AC to Horizon 2020 are also eligible for specific support.

Widening consists of three key actions: Teaming, Twinning and ERA Chairs. In Teaming, a MS that performs less well in R&I is partnered with an advanced institute to create a new (or update an existing) centre of excellence.

Twinning means linking a university of research institution in a MS that is underperforming in R&I with at least two internationally-leading counterparts in Europe. Activities supported include short-term staff exchanges, networking seminars as well as communication and outreach activities.

ERA chairs will bring outstanding researchers to universities or research institutes in Widening countries that have a high potential for research excellence.

Major benefits for participants

Research institutes in Europe, commonly referred to as 'Advanced' partners in teaming and twinning are encouraged to participate and expand their traditional networks for future strategic collaboration. All projects can benefit from working with an emerging pool of talented researchers. They can also access emerging markets, where those institutions that are currently catching up may play a key role in the future. Hence, developing these synergies will increase efficiency and positively impact jobs, growth and competitiveness across Europe.

This CORDIS Results Pack therefore focuses on 10 projects that are spearheading the Widening Participation instrument under the EU's Horizon 2020 research programme.

Estonia at the forefront of educational innovation in Europe

An EU-funded project is leading the way to bring education into the 21st century by providing new ways to support evidence-based education and conducting educational research.

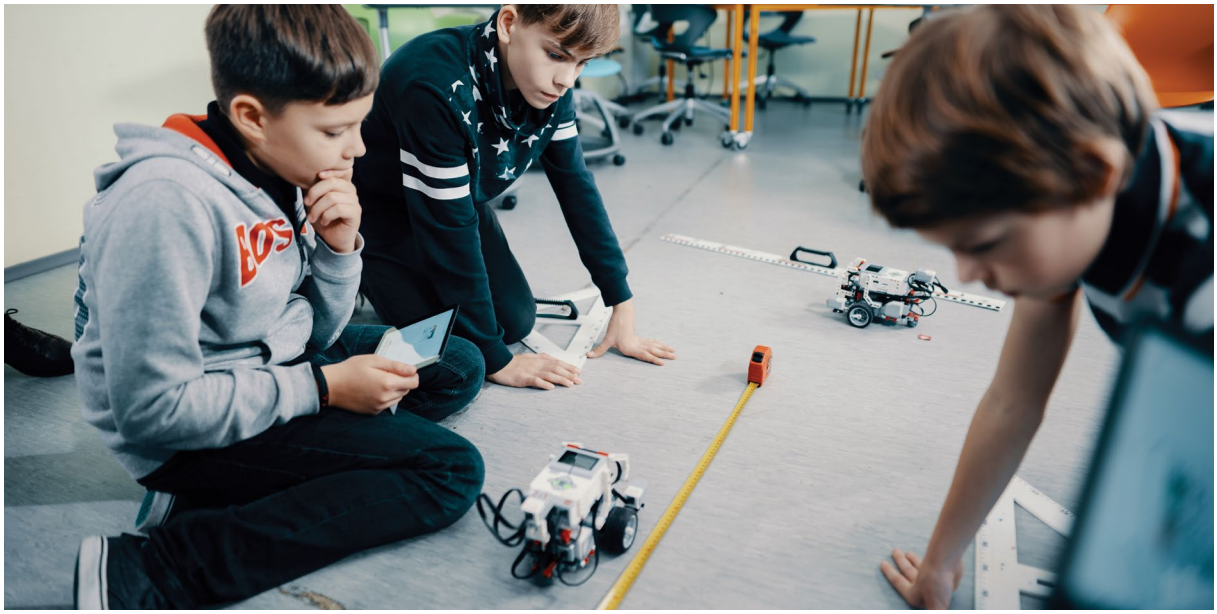
The Estonian Lifelong Learning Strategy 2020, in alignment with the strategic framework for European cooperation in education and training, calls for a change in current approaches to learning and teaching. It envisions a digital turn in both formal and informal education leading to a shift in the learning paradigm towards more self-directed, creative and collaborative learning.

Such a shift requires creativity, entrepreneurial approaches and evidence-based policies at all levels of education. It further necessitates teaching methods and a learning environment that considers each learner's individual and social development and capabilities.

The project led to higher levels of adoption of digital technologies in Estonian schools and to an increased number of student-centred learning scenarios and methods.

The road ahead

Achieving these results is no easy task however. Often, curricular reforms are decided upon without incorporating teachers into the change process and new technology is usually brought into schools without adequate evaluation as to how teaching and learning would benefit. Furthermore, a wider take-up of proposed innovative methods by teachers or projects does not always occur.



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The CEITER project set out to facilitate structural changes in Estonia. "We sought to improve the take-up of evidence-based teaching and learning innovations in schools, including use of digital technologies in teaching and learning," outlines Prof. Tobias Ley, head of the project.

Additionally, the project aimed to integrate research and practice in education, allowing for it to be more directly applicable in schools and for schools and teachers to adopt evidence-based practices. Alongside this, the project looked at building a Centre of Excellence in Educational Innovation at Tallinn University to connect research on digital technologies in learning, teacher education, psychology of learning and different subject didactics.

Achieving educational innovation

As well as creating a Centre of Excellence, CEITER built a new method to conduct research in education called EDUlabs. "The EDUlabs method is a way to co-create, introduce and scale educational innovations in the Estonian school system," explains Ley. It is a systematic research, training and development method that is integrated into teacher education to spread evidence-based innovation in schools. The project has tested and demonstrated the feasibility of the method by applying it into several EDUlab cases which commenced in 2017 and are currently ongoing.

These cases include the robomath EDUlab which integrates robotics into Maths education. The outdoor learning EDUlab uses technology in natural sciences education. The digimath EDUlab utilises digital learning materials in secondary education to support teaching methods and the smart schoolhouse EDUlab helps to raise student's interest towards technology and solving real life problems. "These cases are mainly implemented through long-term continuous teacher development programmes and through school development projects," notes Ley.

The project's impact

"The project led to higher levels of adoption of digital technologies in Estonian schools and to an increased number of student-centred learning scenarios and methods," reports Ley. Another result is higher levels of competence with teachers, who felt a sense of ownership of the new methods in the classroom.

The creation of a toolset for data collection that is used in education practice was also achieved, making available easy to administer data collection, analysis and presentation tools for teachers and researchers. Additionally, the project "was able to popularise the approach widely in Estonia through teacher education programmes and in the professional press," explains Ley.

Estonia has shown it is an excellent test bed for technology-learning solutions on a national scale and its results are expected to have a significant impact on educational policy nationally and in Europe.

PROJECT
CEITER – Cross-Border Educational Innovation thru Technology-Enhanced Research

COORDINATED BY
Tallinn University, Estonia

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/197327

PROJECT WEBSITE
ceiter.tlu.ee/home/about-the-project/

The rising profile of CEITEC

An EU venture is helping to upgrade a Czech university and the association of organisations in which it is a key participant.

Founded in 1919 in Brno in the Czech Republic, Masaryk University is one of the most respected higher education institutions in Central Europe. It is also a prominent founder member of the Central European Institute of Technology (CEITEC), a scientific centre for life sciences, advanced materials and technologies. This centre is at the forefront of development thanks to EU funding.

"The CEITEC_ERA project aims to transform the University and CEITEC through the recruitment of a key research leader to fill the European Research Area (ERA) chair and through the establishment of a research group," explains Roman Badik, project coordinator. These activities aim to help increase CEITEC's international scientific profile.

Inspiring positive change – the ERA Chair

"The recruitment of the new group leader, Professor Mary O´Connell, was completed in 2014 as a result of an open selection procedure," confirms Badik. Prof. O´Connell has started to organise principal investigator meetings with a focus on cross-disciplinary areas for all group leaders at CEITEC. Initially, these meetings were not well-attended nor able to attract a greater audience. However, Prof. O'Connell's initiative has been instrumental in ensuring that leading scientists have been rewarded for their lectures.

"The ERA Chair project has also helped with increasing the visibility of CEITEC and Masaryk University," adds Badik. One way the chair was able to do this was through three international conferences that took place in Brno between 2016 and 2018. These conferences brought together over 100 researchers and more than 16 invited speakers. In addition, Prof. O'Connell hosted and invited several speakers to a series of International Mendel lectures and events where the primary focus was on strengthening links with industries and other stakeholders. Also, grant support has increased the number of successful H2020 projects.

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A spotlight on other achievements

At the beginning of 2019, CEITEC was awarded the logo of HR Excellence in Research. This combined with the regular events that develop scientific vision and talent, helped to create a more open and dynamic scientific environment.

The regular event, Grants Week, together with the regular grant preparation sessions for newly recruited researchers and trainings of grant managers increased the percentage of successful H2020 projects. They also improved the visibility of Masaryk University and CEITEC as a scientific institute. In addition to this, "Grants Week has started to provide information about H2020 and national grant possibilities with an engagement of Masaryk University's senior researchers, representatives of

The CEITEC_ERA project aims to transform the University and CEITEC through the recruitment of a key research leader to fill the European Research Area (ERA) chair and through the establishment of a research group.

the selected national grant programmes and special trainings lectured by foreign speakers," reports Badik.

Adding to the project's achievements, Badik notes: "There is now a weekly department seminar series for postdocs and graduate students to present their work and another one for principal investigators". The series of internal seminars aim to increase internal communication and collaboration.

Prof. O'Connell also became a member of the European Molecular Biology Organisation (EMBO). She represents the first woman in the Czech Republic to become an EMBO member as well as the first member from Masaryk University.

The project has helped CEITEC improve its potential and shift the culture of the scientific community at Masaryk University.

PROJECT
CEITEC_ERA – The ERA Chair Culture as a Catalyst to Maximize the Potential of CEITEC

COORDINATED BY
Masaryk University, Czech Republic

FUNDED UNDER
FP7

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/185729

PROJECT WEBSITE
N/A

Slovakia obtains research excellence in plasma physics

Slovakia's renowned Comenius University in Bratislava has established excellence in electron and plasma physics with part EU funding and a twinning framework.

ELEvaTE is the first Slovak project in the twinning framework. Twinning aims to significantly strengthen a defined research field in a university from a Widening country by linking it with at least two internationally leading research institutions in other Member States or Associated Countries.

In partnership with the University of Innsbruck's Institute of Ion Physics led by Professor Paul Scheier from Austria and the Open University's Molecular Physics Group led by Professor Nigel Mason in the United Kingdom, ELEvaTE sought to improve the Electron and Plasma Physics Laboratory (EPPL) of the Faculty of Mathematics, Physics and Informatics at Comenius University. The goal was to make EPPL a European centre of excellence with an international impact.

Bringing Slovakia closer to EU projects

A support structure within universities is key to success. Building networks, sending people abroad to other institutions, and improving skills must be encouraged at all costs to increase excellence.

Comenius University explored ways to improve the EPPL's scientific and innovation capacity so that it can participate in Horizon 2020 projects. Tapping into the know-how and best practices of the partner institutions was an essential step to address the networking gaps and deficiencies between the Comenius University and the internationally leading EU counterparts in the field.

Various activities included training stays at partner institutions, joint summer schools, participation in international conferences and workshops, and the organisation of several scientific events. There were intensive exchanges of research and managerial staff between partner universities.

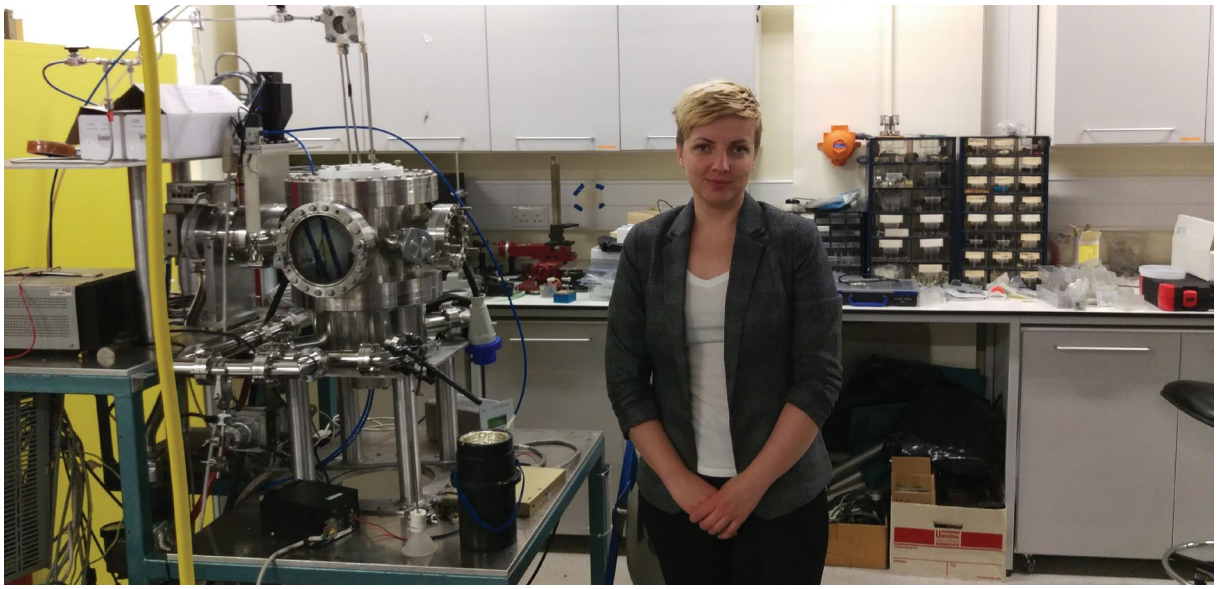
Project coordinator Stefan Matejcik mentioned that legislative and organisational changes should support the emergence of the university's own multidisciplinary research areas and platforms, the enhancement of competencies and facilities of project centres, knowledge transfer, and international cooperation – factors key for becoming a university of excellence. Project manager Viera Bordoy also highlighted that infrastructure is not just about laboratories but also about people. "A support structure within universities is key to success. Building networks, sending people to foreign institutions, and improving skills must be encouraged at all costs to increase excellence," Bordoy explains.

Since project launch, EPPL has signed new cooperation agreements with research institutes and the industry, and, importantly, increased participation in Horizon 2020 projects.

Important research activities

Early-stage researchers conducted research in the field of electron- and ion-driven processes, which lies at the intersection between physics and chemistry. The results produced are especially important to planetary science, materials science, biomedicine and agriculture.

An important project outcome was the collaboration of EPPL with astrophysicists involved in the European Space Agency's Space mission Rosetta. It resulted in a new research programme on the electron emission spectra in water, oxygen and nitrous oxide molecules that are found in comet atmospheres. Another important boost for EPPL was the collaboration with the Europlanet consortium. This will lead to the development of a transnational laboratory facility for studying electron-driven processes in the planetary atmospheres.



© Veronika Medvecka

Other research activities included the study of electron ionisation, in particular the interaction of low-energy electrons with organo-metallic molecules for nanotechnology applications. Researchers also made important advances in the field of low-temperature plasma. Results related to the plasma discharge breakdown proved relevant for biomedicine and agriculture applications. Lastly, researchers showed that ion-mobility spectrometry combined with mass spectrometry are excellent tools for detecting harmful substances – phthalate esters – in plastic food packaging and pharmaceutical products.

ELEvaTE enabled the EPPL of Comenius University to compete with other EU institutions and become a research centre for excellence. Increased partnership with other European centres and participation in EU projects should ensue.

PROJECT
ELEvaTE – Achievement of Excellence in Electron Processes for Future Technologies

COORDINATED BY
Comenius University in Bratislava, Slovakia

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/199327

PROJECT WEBSITE
elevate-h2020.eu/

Research and capacity building for better water management in Malta

Overexploitation, indiscriminate use and climate all play a major role in Malta's severe water scarcity. Nowhere is this problem more serious than with its primary user – the agricultural sector. An EU initiative has supplied know-how and hands-on tools to optimise water use for agriculture.

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"Water scarcity must be urgently addressed if agriculture is to survive in the Maltese Islands," says Malcolm Borg, coordinator of the EU-funded FOWARIM project. However, no research facility existed in Malta to investigate and test novel techniques, systems and technologies to deal with water shortage for irrigation. "Research on water use in Malta was largely non-existent. No institution undertook research related to water," Borg explains.

Water scarcity must be urgently addressed if agriculture is to survive in the Maltese Islands.

Recently, the Institute of Applied Sciences within the Malta College for Arts, Science and Technology (MCAST) established the Water Research and Training Centre (WRTC) to undertake research in fields related to water management. However, the use of this precious resource in agriculture wasn't on its radar. The WRTC holds great potential in sustaining Malta's agricultural sector, but it must invest in research

related to irrigation and water use in agriculture. This can't be achieved without first boosting its scientific and technical capacity.

Laying the groundwork for a water research culture

Backed by leading European centres of excellence in water and agriculture, the project team set up a research committee in Malta to discuss, analyse and plan research in agricultural water use. Comprising Maltese representatives, the committee discussed local needs and took stock of the physical and human resources available to come up with potential research lines.

Stakeholders from internationally renowned research institutions, a Scientific External Advisory Board and local actors also contributed to these lines. "This knowledge network created the right climate, conditions and framework for long-lasting sustainable research in the water field," says Borg. "The committee will be able to continue serving as a beacon of research potential in providing solutions to the local community."

The collaborative research and activities undertaken by Maltese researchers led to eight scientific papers. "They contain results that are very significant for Malta, with wide-ranging implications for the governance and management of water in the agricultural sector," he adds.

FOWARIM strengthened MCAST's research capacity through several targeted and advanced training courses for employees, short-term staff exchanges, summer schools and virtual training. "This capacity building has created a critical mass of local expertise that can sustain the research initiated," notes Borg.

Transferring knowledge and competencies to MCAST will accelerate the ICT adoption rate, helping to modernise agriculture and water training and research. MCAST has signed two memorandums of understanding with research institutions that will play a key role in maintaining and sustaining agricultural water use research.

Translating results to the farmers on the ground

Farmers are already benefiting from FOWARIM. Field experiments and demonstration sites explained how simple on-site technologies can be used to monitor and manage water more effectively. They have been educated on the role and importance of water for agriculture, and the agronomic, technical and engineering measures available to reduce water use and increase efficiency. Best practice examples also demonstrate how to reduce crop water demand.

"FOWARIM ultimately benefits the farmer," concludes Borg. "We have provided practical solutions to the real threats they face and to the viability of their agricultural businesses." The accumulated knowledge will also assist policy-makers in better understanding the situation and designing policies and legislation to better govern and manage Malta's precious commodity.

PROJECT
FOWARIM – FOSTERING WATER-AGRICULTURE RESEARCH AND INNOVATION IN MALTA

COORDINATED BY
Malta College of Arts, Science and Technology, Malta

FUNDED UNDER
H2020

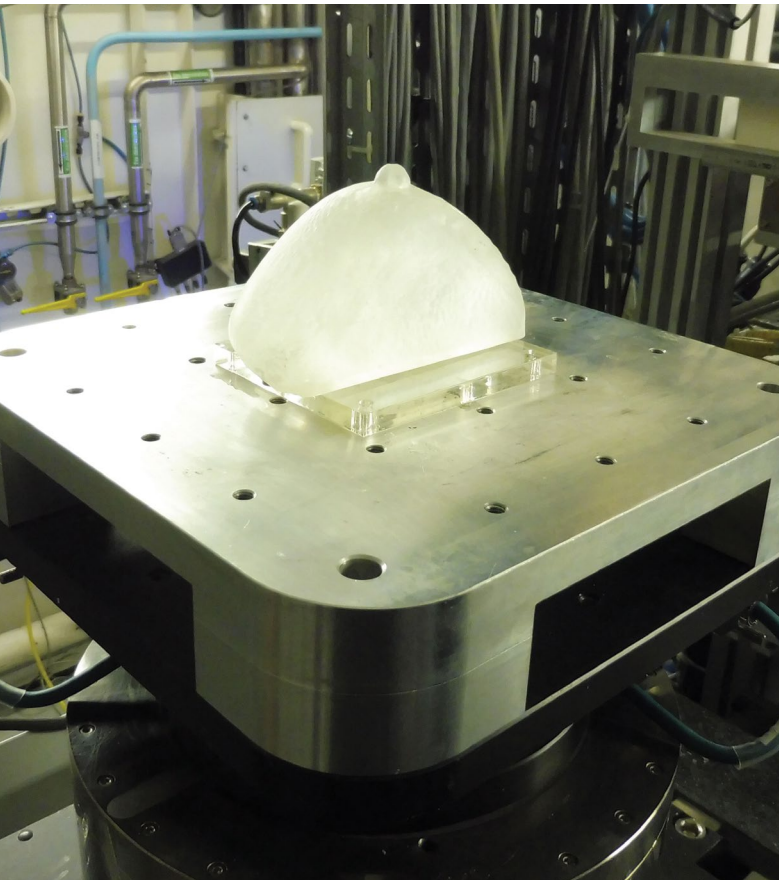
CORDIS FACTSHEET
cordis.europa.eu/project/rcn/200393

PROJECT WEBSITE
fowarim.eu/

Breast cancer detection boosted in Bulgaria via models

An EU-funded initiative helped the Technical University of Varna in Bulgaria establish excellence in 3D computer modelling of breast tumours. Improve detection of early-stage cancer would reduce the need for call-backs for additional testing.

Breast cancer is the scourge of our time. It affects one in eight women in Europe at some point in their lives. Approximately 20 % of breast cancers occur in women under the age of 50. Early diagnosis can greatly improve recovery and survival.



© Kristina Bliznakova

The EU-funded project MaXIMA focused on creating 3D computational models of malignant breast tumours. These can be used to develop new techniques for detecting more complex forms of breast cancer that are difficult to diagnose with standard examination methods. Formulated in partnership with the Catholic University of Leuven in Belgium and the University of Naples Federico II in Italy, MaXIMA's innovative research has the potential to save many lives.

Unmasking breast cancer in dense breasts

The research conducted by MaXIMA focused on enhancing techniques to detect small and irregular-shaped tumours in dense breast tissues. "Despite recent technological advances such as digital mammography, detecting cancers hidden in dense breast tissues is challenging," says project coordinator Kristina Bliznakova. "Unfortunately, contrary to expectations, breast cancer mortality continues to rise in many EU countries, and one of the most important reasons could be related to the limitations of current technology to screen dense breasts."

Breast tomosynthesis is a newer advanced technology that has been designed to overcome the limitations associated with conventional 2D mammography. The examination uses low-dose X-rays, and can be carried out at the same time as the 2D mammogram. Images are taken at varying angles and reconstructed using a computer into thin slices of 3D volume. These thin slices enable radiologists to detect small breast tumours that are masked by the overlying gland tissue.

Another X-ray imaging technique that can add more information on tissue structure is phase-contrast X-ray tomography. Traditional

mammography relies on the decrease of the X-ray beam's intensity when traversing the body tissues. However, phase-contrast X-ray imaging measures the difference in the way an X-ray beam oscillates through normal tissue compared with denser tumour tissues. The technique provides a sharper picture of subtle changes in tissue density as it increases the visibility of thin edges and border details in many specimens.

3D models to better outline the tumour

Despite their uptick in popularity, advanced X-ray breast imaging techniques need to be complemented by computer models and simulations to be entirely effective in practice. "In most cases, tumours form inhomogeneous masses with no distinct boundaries. This prevents us from clearly distinguishing the contours of the cancer formations," explains Bliznakova.

ESPAR antenna design demonstrates low cost, reduced complexity and compact size, making them excellent candidates for T2T and T2I links.

"Three-dimensional computational and physical models are powerful tools in the hands of engineers, physicians and physicists. Advanced models help scientists accurately define breast shapes, glandular tissue distribution and cancer mass shape and type," adds Bliznakova. In light of this, project researchers developed novel computational models of hard-to-diagnose breast tumours such as those surrounded by dense parenchyma. Furthermore, they created physical anthropomorphic models, known as phantoms, of breasts and tumours for testing and validating X-ray imaging techniques including breast tomosynthesis and phase-contrast imaging. Suitable 3D printing techniques and materials were investigated for producing physical breast phantoms.

Close cooperation between the partnering institutions helped to significantly increase the scientific and technological capacity of the Technical University of Varna in the X-ray breast imaging field. Innovative projects like MaXIMA should help establish Bulgaria as a hub for research and development in Europe.

PROJECT
MaXIMA – Three dimensional breast cancer models for X-ray Imaging research

COORDINATED BY
Technical University of Varna (TUV), Bulgaria

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/199020

PROJECT WEBSITE
maxima-tuv.eu/

Croatia expands its potential in particle and radiation detectors

EU funding is enabling the Ruđer Bošković Institute (RBI) in Croatia to develop, test and construct large research equipment for nuclear, particle and astroparticle physics experiments.

To analyse how the Universe works, modern experiments in astrophysics and nuclear and particle physics are crucial. This requires complex detector systems whose design and testing necessitate a deep understanding of physics, electronics and computing. Thanks to the EU-funded project PaRaDeSEC, RBI upgraded its existing research infrastructure for the research, development and testing of detectors, sensors and related electronics.

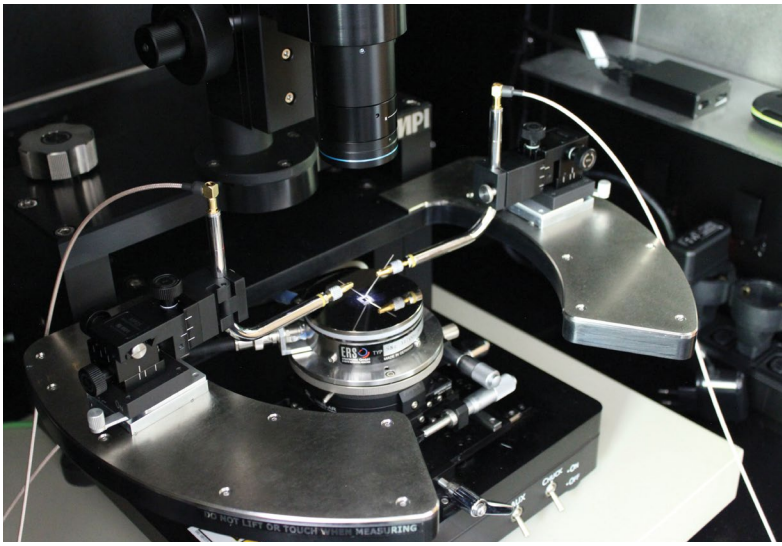
In 2018, midway through the project, the institute inaugurated the Centre for Detectors Sensors and Electronics (CDSE). The funding mechanism supported the transnational mobility of five international experts in RBI. Effective synergy between existing and newly recruited researchers and collaboration with several international leading institutions boosted the research capacity of RBI.

Key achievements

In collaboration with the Helsinki Institute of Physics and the Xiangtan University in China, the RBI project team worked on the development of a new generation of semiconductor detectors that uses cadmium telluride crystals as the sensor material for direct conversion of X-ray and gamma-ray radiation. "This semiconductor material effectively attenuates radiation, resulting in superior detection efficiency even at high energies. Its high sensitivity in the detection of single photons makes it ideal for medical imaging and quantum information security applications," notes project manager Dr Neven Soić.

Work on specialised silicon detector types (e.g. silicon drift detectors and silicon detectors) coupled with scintillator counters is currently in progress. In collaboration with partners from Australia, Japan, Slovenia and Portugal, researchers are also testing a silicon-carbide-based detector for fast neutron response, which is intended for security screening applications.

Significant emphasis was laid on researching particle tracking detectors. "Silicon pixel detectors allow to track the paths of particles emerging from collisions with extreme accuracy. They are also cost-effective because they are produced with the same tools used to create integrated circuits," explains Dr Soić. In particular, the RBI team was responsible for building and calibrating 150 pixel modules that are central to the Compact Muon Solenoid experiment at CERN. This was carried out in collaboration with the Paul Scherrer Institute in Switzerland. "The RBI is one of the few hubs in the production of next-generation silicon pixel detectors," adds Dr Soić.



© RBI Probe station

Other activities focused on the development of improved electronics for detector readout. "Single event upsets (SEU) are caused by ionising particles or high-energy photons that strike electronic circuits and change their state. Although SEU themselves are not permanently damaging to the circuit functionality, they are found in massive amounts close to powerful particle accelerator environments such as the Large Hadron Collider," Dr Soić points out.

Powerful impact

PaRaDeSEC made it possible for RBI to procure a large number of instruments important for research and remodelling laboratories. This includes creating controlled conditions of cleanliness, temperature and air humidity, improving electric system stability, and reducing the electronic noise level. These enable the characterisation and testing of a new generation of detectors with significantly improved characteristics compared to those currently used for research in CERN.

Project advances do not only benefit particle and nuclear physics but also basic and applied research in material science, engineering, medicine and environmental science. The activities of the recently established CDSE in RBI will also help the upcoming project O-ZIP, which is linked to PaRaDeSEC. PaRaDeSEC will significantly enhance RBI's reputation in the international scientific community and increase RBI participation in international projects.

The RBI is one of the few hubs in the production of next-generation silicon pixel detectors.

PROJECT
PaRaDeSEC - Expanding Potential in Particle and Radiation Detectors, Sensors and Electronics in Croatia

COORDINATED BY
Ruđer Bošković Institute, Croatia

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/197321

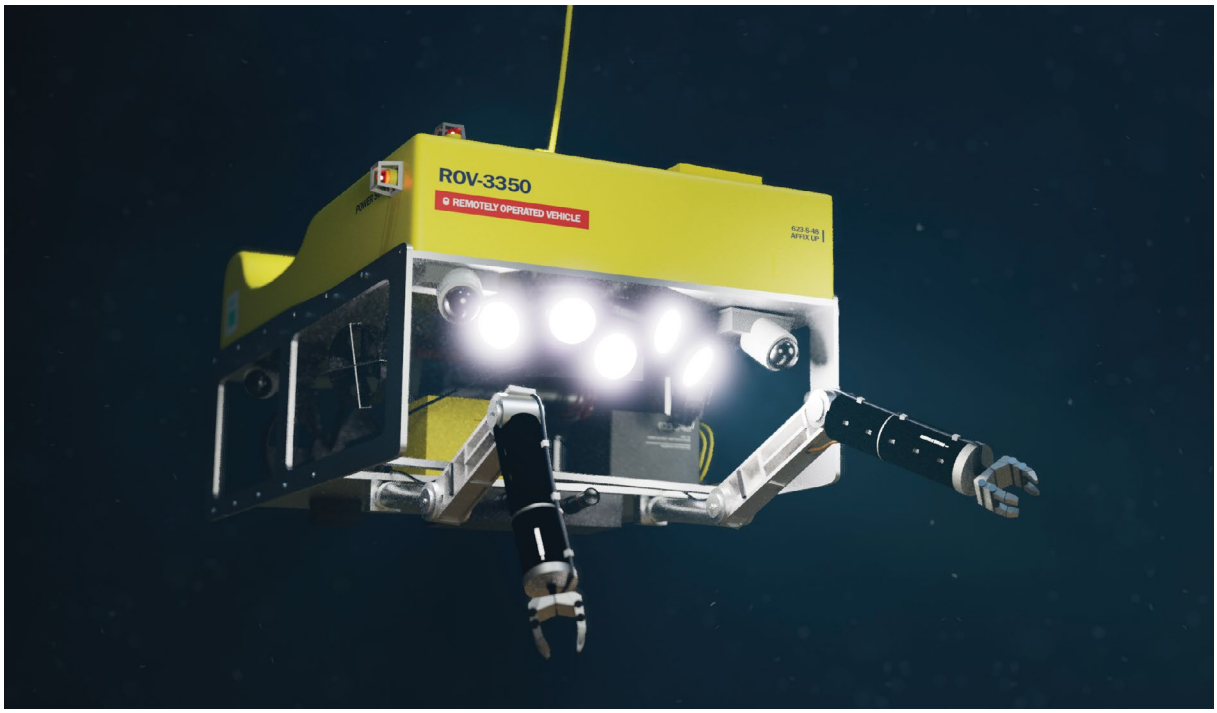
PROJECT WEBSITE
lnr.irb.hr/PaRaDeSEC/

Portugal fulfilling its potential in maritime and deep-sea technologies

Portugal's Institute for Systems and Computer Engineering, Technology and Science (INESC TEC) envisioned becoming a centre of excellence in maritime and deep sea technologies, but lacked the skills and an integral network in the field. Thanks to an EU initiative, INESC TEC is now a recognised European maritime research asset.

INESC TEC is a private non-profit research institution that tackles two main challenges involving the Portuguese maritime region. The first is the coverage of a vast area of water and soil, where the sole use of manned vehicles isn't feasible if physical presence is required on site. The second is the exploration and exploitation of deep and ultra-deep sea, where the physical presence of humans isn't an option. Addressing these challenges requires building multiple competences, improving knowledge in the domain, and acquiring new knowledge to collaborate with multidisciplinary teams in Europe and beyond.

The EU-funded STRONGMAR project "boosted the scientific knowledge of INESC TEC's researchers in key marine science and technology areas while enhancing their European and international standing," says coordinator Prof. Eduardo Silva. Specifically, personnel "lacked fundamental skills and experience



in underwater robotics and a strong network in this field." To achieve its goals, STRONGMAR supported transnational access to European partners in Italy, Spain and the UK – the worldwide leaders in deep sea technology.

Raising researcher profiles

Summer and winter schools and thematic workshops reinforced INESC TEC staff's scientific and technological potential. These week-long meetings enabled the exchange of know-how, experience and best practices among partners. This helped to provide INESC TEC research staff with the skills necessary to work at different technology readiness levels.

Networking meetings, short-term meetings and conferences fostered dialogue and promoted new joint research activities. Employees networked with top researchers and experts to discuss advanced topics related to sea technologies and cross-disciplines. Such events also offered opportunities to explore potential project proposals and research contracts, and to establish connections with leading experts.

Scientific expertise and research and innovation capacity will help develop innovative low-cost sensors. They will increase the capabilities for resilient long-distance and long-term deployment of autonomous and semi-autonomous platforms, as well as long-distance and underwater control of robotic platforms. They will also play a role in developing, producing, deploying and operating off-shore and deep sea platforms.

European maritime research centre of excellence

Extensive exploitation and outreach efforts increased INESC TEC's visibility in marine robotics. Dissemination and communication activities mainly included presentations at international scientific events, participation in global trade fairs and organisation of technology transfer workshops with stakeholders. "INESC TEC is now a recognised institution in this field alongside prestigious research institutions," notes Prof. Silva.

INESC TEC is now a recognised institution in this field alongside prestigious research institutions.

Enhanced visibility and credibility led to collaborations with the Portuguese Navy and prominent national organisations such as the Portuguese Institute for Sea and Atmosphere and the Interdisciplinary Centre of Marine and Environmental Research. International institutions have also contacted INESC TEC for future partnerships.

STRONGMAR has contributed to the long-term sustainability and viability of the TEC4SEA research infrastructure, a unique and pioneering European platform for research, development and testing of marine robotics, telecommunications and sensing technologies in support of a sustainable blue economy. It's also helping to overcome technological barriers that limited the full implementation of the Portuguese National Ocean Strategy 2013-2020 and the National Research and Innovation Strategy for Smart Specialisation 2014-2020.

Lastly, the INESC TEC team successfully participated in a proposal submission to co-organise OCEANS Europe, an influential conference in marine robotics. The event will be held in 2021 in Porto.

PROJECT
STRONGMAR - STRengthening MARitime Technology Research Center

COORDINATED BY
Institute for Systems and Computer Engineering, Technology and Science (INESC TEC), Portugal

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/199452

PROJECT WEBSITE
strongmar.eu/site/home-1

Poland set on successful course for renewable and sustainable energy

Poland is one of the EU's biggest polluters and home to its dirtiest power plant. To help Poland convert to renewables, an EU initiative connected a renowned Polish energy research centre with prominent European energy institutions.

The transition from fossil fuels to renewable and sustainable energy sources (RES) has become the EU's top developmental priority, with low-performing Central European countries like Poland facing the most urgent need. The roll-out of intermediate renewable energy technologies has typically lagged well behind the rest of Europe, and the historical legacy of coal dependency makes the region one of the worst polluters in Europe. Many technological, economic, social, political and practical barriers remain in rolling out advanced RES.

Knowledge transfer to benefit Poland's energy sector

Poland is directing efforts to address its unique challenges and develop a nationwide system for responsible energy production, use and management. "While Polish research has made tremendous advances and now has expertise in many of the RES technologies needed for energy transition, it lacks knowledge in modelling, planning, integrating and managing large-scale RES systems in a flexible and effective manner," says Ewa Domke, coordinator of the EU-funded SuPREME project.

SuPREME created long-lasting and effective partnerships that will have a very significant impact on Poland's energy systems infrastructure and climate footprint.

Focusing on needed knowledge transfer in integrating energy technologies, the Institute of Fluid-Flow Machinery Polish Academy of Sciences (IMP PAN), one of Poland's most promising energy research centres, teamed up with Austria's European Sustainable Energy Innovation Alliance (ESEIA), Denmark's Aalborg University (AAU) and the Netherlands' University of Twente (UT).

IMP PAN researchers lacked sufficient know-how to advise or be part of energy transition in Poland. Thanks to short- and long-term staff exchanges, technical site visits, training sessions, workshops and summer schools involving AAU, ESEIA and UT, IMP PAN researchers have been able to model, design and test smart energy systems.

Boosting IMP PAN research capacity and personnel expertise

IMP PAN staff and leading international experts at AAU, ESEIA and UT made strides in developing a technical transition plan in line with EU and national guidelines and targets. This strategic document envisions how Poland could produce and consume different forms of sustainable energy in both local and regional systems. "Knowledge shared through the project has equipped IMP PAN in becoming an influential voice in Poland's transition from fossil fuels to renewables," explains Domke.

Before SuPREME, IMP PAN wasn't collaborating with any government agencies. "Researchers are invited to expert group meetings, so IMP PAN's voice is heard. Not only is this voice now heard in government, but in industry, too." The strengthened networks have resulted in 4 cooperation agreements, 10 new project proposals and 21 international conference papers.

IMP PAN staff also helped set up a micro-energy cluster – a community that produces energy locally from renewable sources. IMP PAN acts as the community's expert advisor, helping to design the local grid and testing how new technologies will impact the national grid.

IMP PAN is currently assisting several leading car manufacturers to prepare for electric cars in Poland in the future. It's doing so by testing charging points and brainstorming how they could be connected to the main power grid.

"SuPREME created long-lasting and effective partnerships that will have a very significant impact on Poland's energy systems infrastructure and climate footprint," concludes Domke. "It has greatly improved the overall scientific and innovation potential of the IMP PAN team in energy systems integration and management and raised the profile of both researchers and the Institute." Europe is now closer to realising its goal of becoming a green economy with lower carbon emissions.

PROJECT
SuPREME - Twinning for a Sustainable, Proactive Research partnership in distributed Energy systems planning, Modelling and managEment

COORDINATED BY
The Institute of Fluid-Flow Machinery Polish Academy of Sciences (IMP PAN), Poland

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/200260

PROJECT WEBSITE
h2020-supreme.eu/

University of Cyprus strategically placed in photovoltaics research

The FOSS Research Centre for Sustainable Energy at the University of Cyprus (UCY) has conducted promising research in photovoltaics (PV). An EU initiative has stimulated FOSS's research excellence and innovation (R&I) capacity by fostering long-term collaboration with world class institutions.

By teaming up with the Austrian Institute of Technology (AIT) and the Technical University of Denmark (DTU), the EU-funded TwinPV project set out to "bring UCY up to par with renowned PV research institutions while reversing Cyprus' R&I performance," says coordinator Prof. George Georghiou. "We enhanced the quality of UCY's R&I outcomes, and strengthened its networking, participation and success rates in research funding bids." The project also helped bridge the gap between academia and industry, and reinforced research links between the EU and Middle East and North Africa (MENA) countries.

TwinPV performed a scientific audit to develop a long-term strategy for FOSS that covers personnel, research, education and service. This input allowed AIT and DTU to refine the strategy.

TwinPV has raised the profile of UCY, and it's in a position to attract more competitive research funding at national, EU and international levels.

Putting Cyprus on the R&I map in Europe and beyond

Collaboration with AIT and DTU, together with capacity building mainly through young researcher hires, increased publications by more than 100 %. Papers published in high-impact journals increased significantly, too. The number of successful proposals and the amount of funding UCY attracted rose by over 150 %.

AIT and DTU facilitated cooperation between Cyprus and the European industry. Various activities and events introduced FOSS's actions to these industry contacts. Consequently, the funding received from proposals involving key industry connections grew considerably. The two partner institutions also boosted FOSS's visibility at influential networking forums.

Researchers, doctoral students and industry stakeholders from across Europe and MENA participated in extensive training, PhD summer schools and thematic workshops. The training was the catalyst for further research, with results presented at international conferences. The intensive thematic workshops and networking with Cypriot industry took place regularly. Workshop topics ranged from fundamentals, emerging technologies, smart grids and network integration to funding and investment opportunities. The workshops explored how new developments apply to and influence the Cypriot PV industry.

A workshop in Cyprus and visits to MENA countries strengthened research links between the two. The MENA region serves as a strategic location for FOSS expansion. These events provided an opportunity to tap into this unexplored market.

PhD students and researchers received training and gained access to previously unavailable equipment and infrastructure. Scientific outputs include fundamentals such as mechanical integrity and degradation of PV modules, system integration and high penetration of PV energy in the grid. "TwinPV is helping to increase the renewable energy share in the electrical grid

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in Cyprus and Europe overall," adds Prof. Georghiou. "It's also helping Europe to transfer its knowledge and expertise to the surrounding region."

Austria, Cyprus and Denmark synergy: a win-win scenario

The fruitful cooperation between AIT, DTU and UCY continues. They are partners in two ongoing national projects and a European initiative. Several new proposals have also been submitted. Their combined resources are helping to realise UCY's vision of a PV park. When complete, "it will be one of the largest in Cyprus, completely transforming UCY's financial standing," he adds.

"TwinPV has raised the profile of UCY, and it's in a position to attract more competitive research funding at national, EU and international levels," concludes Prof. Georghiou. UCY has more than doubled its PV team. "This means that we can offer joint services to European industry and MENA countries while playing a role in maintaining Europe's competitiveness."

PROJECT
TwinPV – Stimulating scientific excellence through twinning in the quest for sustainable energy (TwinPV)

COORDINATED BY
University of Cyprus, Cyprus

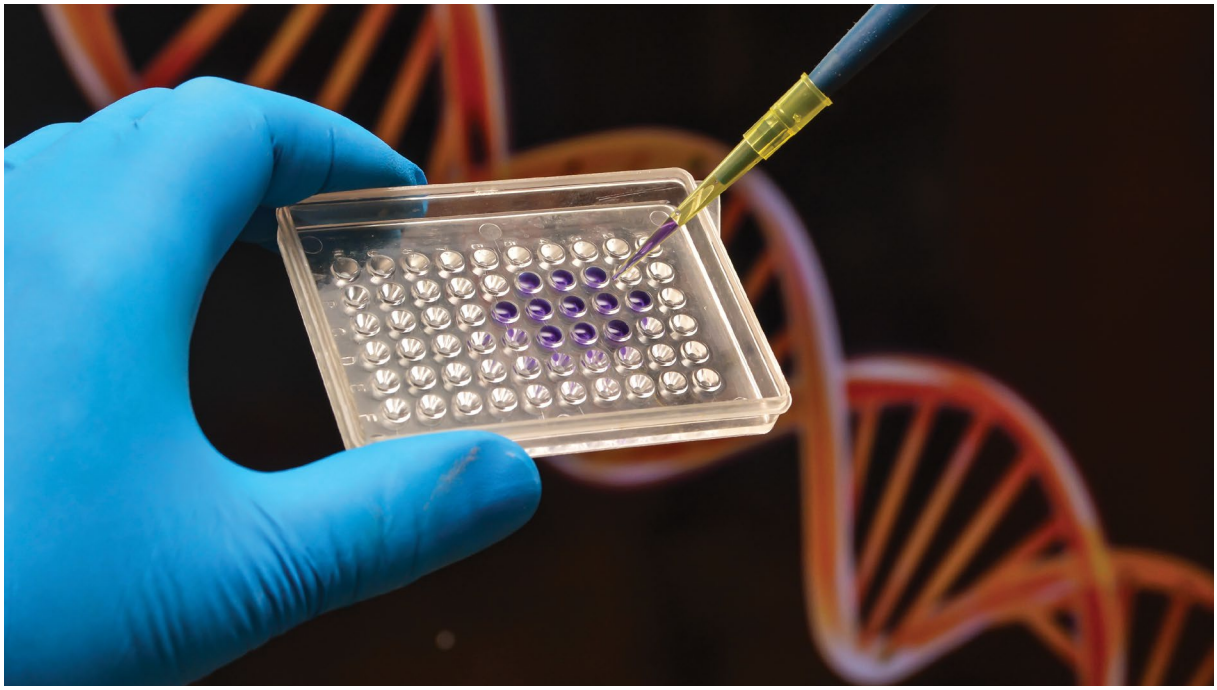
FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/199595

PROJECT WEBSITE
twinpv.eu/

A major boost for metagenomics research in Europe

An EU initiative is transforming the Research Network in Biodiversity and Evolutionary Biology (InBIO) in Portugal into a hub for top-level research in metagenomics.



The advent of more powerful and cost-effective DNA sequencing technologies has expanded gene discovery and characterisation studies from single organisms, through microbiomes, to complex invertebrate and vertebrate communities. Insights gained from metagenomes increase knowledge on species richness and their relative abundance (biodiversity assessment), how species sort into different habitats (species sorting) and their role in food webs. What's more, several organisms are used to monitor environmental changes and serve as excellent models for understanding biological interactions and evolutionary changes.

The EU-funded project EnvMetaGen has been established to upgrade the research and technological capacity of InBIO, thereby increasing research quality and output in metagenomics. The funding mechanism has enabled the institute to build a team comprising a number of international researchers in addition to researchers of Portuguese origin who have left the country. So far, InBIO has successfully sustained collaboration with more than 12 organisations and institutes across Europe.

A reference collection for insects

A major project output was the launch of the InBIO Barcoding Initiative – a campaign to collect DNA barcodes of Portuguese invertebrate taxa. So far, researchers have barcoded thousands of invertebrate species, especially insects, including agricultural and forest pests, novel exotic species in Europe and species new to science.

Retrieving species DNA from water samples offers an effective and low-cost method of monitoring degradation of the aquatic environment.

This initiative is particularly important given the lack of comprehensive reference collections in the Mediterranean Basin Biodiversity Hotspot, especially for invertebrate taxa, which hinders the application of metagenomics approaches in biodiversity research. For instance, through this initiative it was possible to barcode a number of highly diverse aquatic insects such as mayflies, stoneflies, caddisflies, and dragonflies and damselflies, for which barcodes were missing. "These insects found in freshwater habitats spend their larval stage under the water. Their high sensitivity to changes in the environment makes them excellent indicators of aquatic ecosystem health," says project coordinator Dr Pedro Beja.

Metagenomics benefits

Environmental DNA analysed by metagenomics offers a simple method of studying organisms that are elusive or endangered without introducing anthropogenic stress onto them. Furthermore, it is useful for detecting species at the early stage of invasion when they are found at low population densities.

Metagenomics also offers a powerful tool for assessing biodiversity within a habitat. With this in mind, researchers focused on improved methods of isolating and extracting DNA for metabarcoding analysis of small bodies of turbid waters that occur in arid areas. Results are highly relevant for biodiversity assessment as these waters are typically home to a large number of different species of vertebrates.

Another study focused on how use of water sample preservatives such as ethanol can improve DNA metabarcoding of macroinvertebrates. "Retrieving species DNA from water samples offers an effective and low-cost method of monitoring degradation of the aquatic environment," explains Dr Beja.

EnvMetaGen has also harnessed the power of metagenomics to further understanding on species' dietary habits through analysis of DNA fragments isolated from faeces of bats, birds and other vertebrates. "Identifying and quantifying trophic links amongst species can help build more detailed and complex food webs than ever," Dr Beja concludes. "For example, a better insight into the interactions between predators and agricultural pests may help reduce pesticide use in European farming systems."

Project results have been communicated through numerous papers published in peer-reviewed journals. Participation in several conferences and organisation of workshops also help ensure that valuable results are disseminated.

PROJECT
EnvMetaGen - Capacity Building at InBIO for Research and Innovation Using Environmental Metagenomics

COORDINATED BY
Institute of Agriculture and Agro-Food Sciences and Technologies (ICETA), Portugal

FUNDED UNDER
H2020

CORDIS FACTSHEET
cordis.europa.eu/project/rcn/197318

PROJECT WEBSITE
inbio-envmetagen.pt/

CORDIS Results Pack

Available online in six language versions: cordis.europa.eu/article/id/401448

Published
on behalf of the European Commission by CORDIS at the
Publications Office of the European Union
2, rue Mercier
2985 Luxembourg
LUXEMBOURG

cordis@publications.europa.eu

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This Results Pack is a collaboration between CORDIS and the Directorate-General for Research and Innovation (DG RTD)

PRINT	ISBN 978-92-78-41970-7	ISSN 2599-8285	doi:10.2830/38635	ZZ-AK-19-009-EN-C
HTML	ISBN 978-92-78-41767-3	ISSN 2599-8293	doi:10.2830/962215	ZZ-AK-19-009-EN-Q
PDF	ISBN 978-92-78-41971-4	ISSN 2599-8293	doi:10.2830/879446	ZZ-AK-19-009-EN-N

Luxembourg: Publications Office of the European Union, 2019

RESEARCH*EU MAGAZINE ISSUE 81:
Nuclear power, the underdog of Europe's energy mix

In this issue of Research*eu magazine, we explore whether nuclear energy has a future as a part of Europe's future energy mix, as the EU strives to become more energy independent and reduce its carbon emissions.

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