ISSN 2599-8293

European Commission

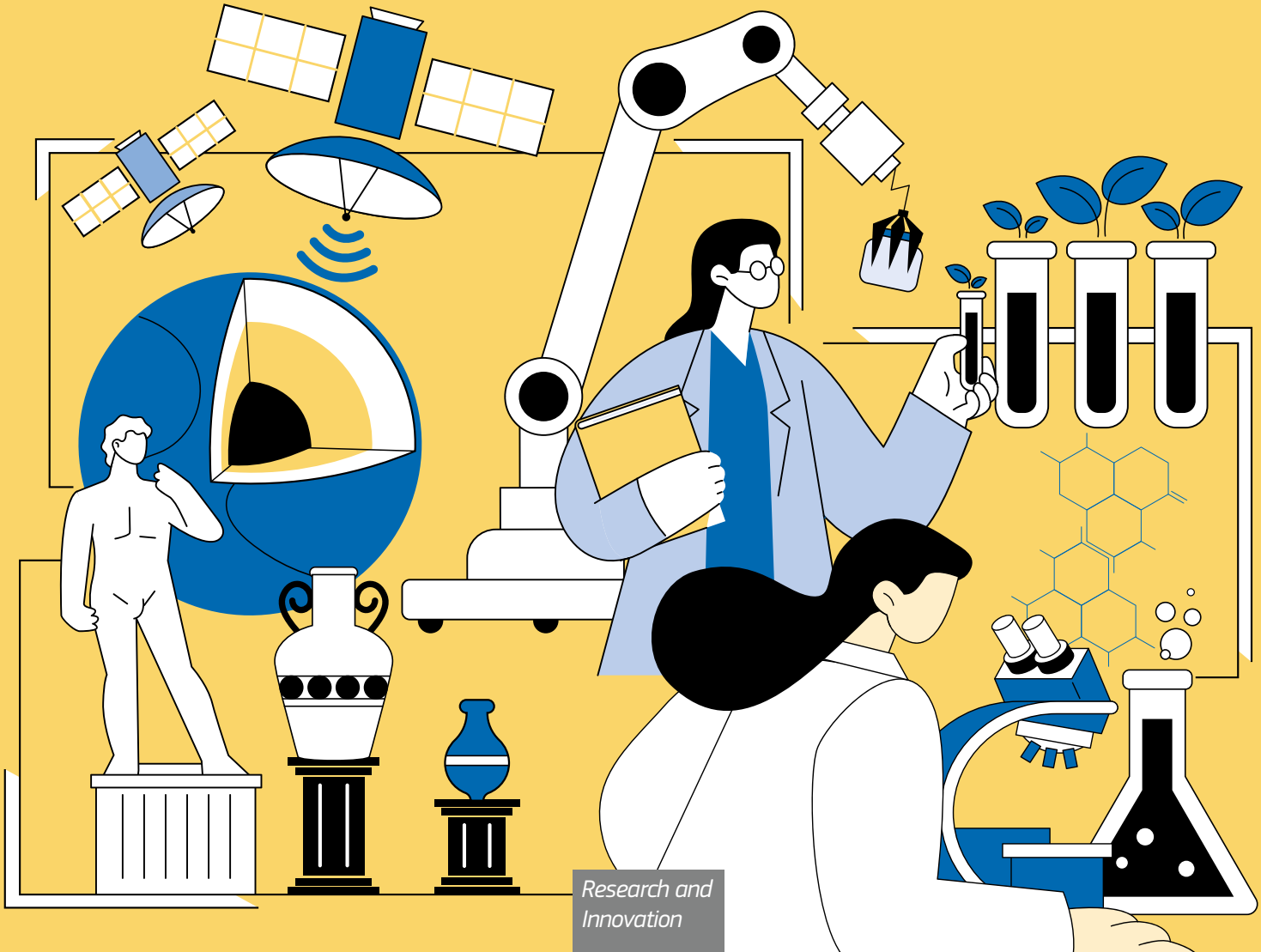
CORDIS Results Pack on

# research infrastructures in Europe

A thematic collection of innovative EU-funded research results

November 2023

# Fostering excellence, collaboration and innovation



Research and Innovation

# Contents



# Editorial

## Fostering excellence, collaboration and innovation

Pan-European research infrastructures and national research infrastructures of European interest are facilities that provide resources and services for scientific communities across the EU and beyond, to foster excellence and collaboration, attract talent and address societal challenges. This Results Pack highlights the work of 13 Horizon 2020- and Horizon Europe- funded projects that, through the support of research infrastructures, are helping to advance scientific knowledge and technological progress supporting European society in facing current and future challenges.

Research infrastructures are critical for science today. In order to tackle complex and global issues such as climate change, biodiversity changes, advanced medicine, energy production and the transition to carbon neutrality, researchers across Europe need access to world-leading resources.

Research infrastructures exist to provide scientists, researchers and innovators with the necessary equipment, services and facilities to conduct excellent research. They can be physical hardware such as synchrotrons and remote sensing satellites or offshore sensors, reference collections such as biobanks and sociocultural archives, computing systems and communications networks, or virtual services such as cloud data tools.

The European Commission, EU Member States and countries associated with the Horizon Europe programme aim to consolidate and develop the landscape of world-class sustainable research infrastructures in Europe.

The objectives include to open, integrate and interconnect research infrastructures, reducing fragmentation and avoiding duplication, exploiting the innovation potential of research infrastructures, and reinforcing international cooperation.

The concept of access to European research infrastructures emphasises open collaboration, interdisciplinary research and international engagement. These factors contribute to the advancement of knowledge and innovation, and the development of solutions to societal challenges.

By investing in research infrastructures, Europe is helping to attract and retain top researchers from around the world, providing them with the opportunity to pursue their work at an advanced level.

By encouraging better data management and sharing practices, research infrastructures also support evidence-based policymaking, putting Europe in a better position to address important societal challenges.

## Investing in research, innovation and economic growth

Investing in research infrastructures enables scientists in Europe and beyond to explore new ideas and promote interdisciplinary collaborations, helping to create growth and jobs, and tackle our societal challenges.

These activities are supported by the European Strategy Forum on Research Infrastructures (ESFRI), responsible for developing and updating a strategic European roadmap for research infrastructures, and the European Research Infrastructure Consortium (ERIC) Committee and Forum, to facilitate the establishment and overseeing of ERICs.

Within the Horizon Europe Research Infrastructures part, an objective relates to the development of the European Open Science Cloud (EOSC), aimed at ensuring that open science policies, practices and skills become the 'new normal' across the European Research Area, and enabling Europe's contribution to a web of findable, accessible, interoperable and reusable (FAIR) data and services.

All these efforts are contributing to placing the European Research Area in a leading position, curating an innovation-friendly ecosystem that promotes interdisciplinary science and attracts talent from all over the world as well as fostering European internal researchers mobility.

# Cloud-based infrastructure increases access to archaeological data

Free and open to everyone, the integration of archaeological data infrastructures streamlines research, aids networking and expands access to information.

© mrks/stock.adobe.com

Fundamental to our understanding of what it means to be human, archaeology is also the scaffolding of our discreet cultural identities. The EU-funded project ARIADNEplus builds on the work of the preceding ARIADNE project in order to integrate archaeological data sets and promote an engaged and connected community of researchers.

Archaeology was among the first fields to digitise content, but searching across multiple sites was problematic. Discrepancies in how data was organised and how terminology was applied had to be worked out. Collectively the two projects addressed these issues and developed the ARIADNE data infrastructure, a one-stop access point to archaeological data.

In addition to strengthening professional networks, consolidating archaeological information saves money. It avoids the duplication of work, as researchers and funders know what others are doing. It also promotes culturally relevant archaeological sites, giving a boost to cultural tourism.

## Iterations of ARIADNE

The first ARIADNE project indexed over 2 million items. The resulting catalogue was so well-received that ARIADNEplus was quickly funded to carry the project further. The number of data sets has nearly doubled, as the searchable catalogue continues to grow. The consortium for the second iteration of the project concentrated on Europe, but it also included four international partners: Argentina, Israel, Japan and the United States.

ARIADNEplus expanded the project in many ways. It included new areas of specialisation, notably palaeoanthropology, bioarchaeology and environmental archaeology. The portal relays content ranging from a single discovery to material from known archaeological sites that have been the subject of research for many decades. The project expanded the time frame for archaeological exploration too, incorporating information about the earliest hominids and continuing through to the present times.

## High tech enables a principled approach

A major goal of the project was creating an open access portal that encourages networking and collaboration. The infrastructure built by the team incorporates many features that promote this, including a virtual research environment. Other enhancements provided by technology include linked data, visualisation, annotation, text mining and geo-temporal data management.

Fundamental to achieving the sort of connected and informed community envisioned by the project is the importance of free and open access to archaeological data. ARIADNEplus explicitly applied the FAIR principles to the site. Training and workshops to help build community and foster networking are also available.

## A new era for archaeological infrastructure

The ARIADNE portal is rapidly becoming essential to archaeological research. At the 2023 Computer Applications in Archaeology Conference, many direct and indirect references were made to it, both in formal contributions and in conversation. Quantitatively, the site saw a 350 % increase in visitors between 2021 and 2022.

The project has designed an infrastructure to meet the needs of researchers. Content in the catalogue is cross-indexed, so investigators can start by searching for when, where or what, creating multiple points of access. According to project coordinator Franco Niccolucci: “ARIADNE has overcome the fragmentation of digital archaeological information and made it findable, accessible, interoperable and reusable. It is a unique-in-the-world research infrastructure.”

ARIADNEplus presents a compelling vision for the role archaeology can play in human society. Technological advances in cloud-based infrastructure have brought the realisation of that vision within reach.

**PROJECT**
**ARIADNEplus – Advanced Research Infrastructure for Archaeological Data Networking in Europe - plus**

**COORDINATED BY**
PIN – University Centre City of Prato in Italy

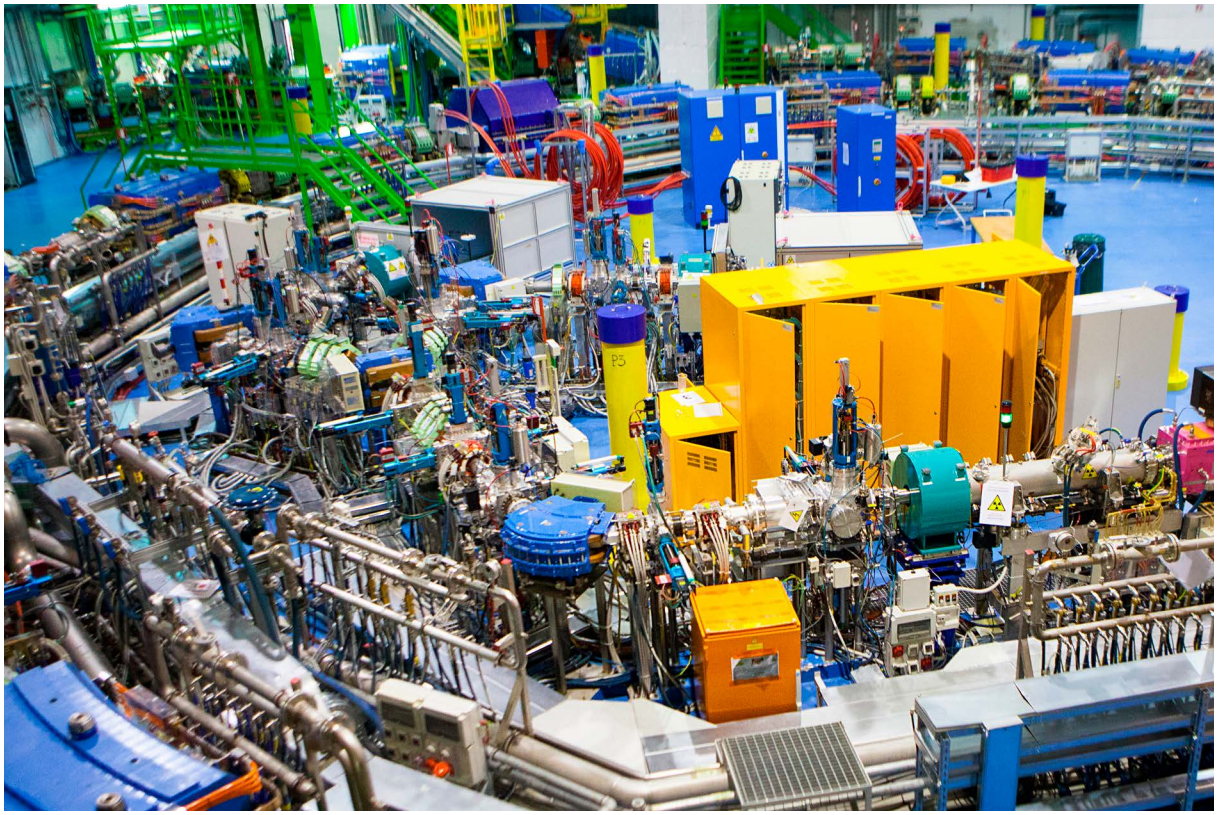
**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/823914

**PROJECT WEBSITE**
ariadne-infrastructure.eu

# Honey, I shrunk the particle accelerator: towards smaller, more efficient colliders

**Particle accelerators do much more than smash atoms together. To sustainably meet their wide-ranging potential, the EU-funded ARIES project is finding a way to make them more compact and energy-efficient.**



© RFBSIP/stock.adobe.com

The 27 km Large Hadron Collider at the CERN has made a string of discoveries since it powered up, most notably the discovery of the Higgs boson. But further advances will prove challenging with present accelerator technology.

"Larger and more powerful accelerators could certainly be built, but their cost, energy consumption and environmental impact raise concerns about their long-term sustainability," says Maurizio Vretenar, project coordinator of the EU-funded ARIES project. "Also,

only 5 % of all accelerators worldwide are used to scientifically analyse particles. Most are used by medicine and industry for activities such as cancer therapy, medical imaging or equipment and food sterilisation."

ARIES has explored a range of innovative technologies that could lead to next-generation accelerators able to meet growing demand for improved performance, reliability, cost and design. "These are very exciting developments because accelerators that deliver high energies with a small physical footprint could open up research and applications only currently possible at large-scale facilities," remarks Vretenar.

## Accelerating innovation

ARIES, a consortium of 42 members from academia and industry across 18 European countries, focused on innovations most likely to reduce the energy requirements, size and environmental impact of future accelerators.

"We researched a range of technologies including superconducting magnets, superconducting coatings, new materials, laser- and plasma-based acceleration," adds Vretenar, an accelerator physicist at CERN, the project host.

The team's research into high-temperature superconducting magnets led to sophisticated multilayer tapes which were used to make coils for large magnets. The result was more powerful magnetic fields carrying more current that can bend particles on a smaller radius, offering the prospect of smaller, more efficient accelerators.

*These are very exciting developments because accelerators that deliver high energies with a small physical footprint could open up research and applications only currently possible at large-scale facilities.*

"What we achieved was record-breaking. After producing 413 metres of tape, we tested a proportion at low temperatures and reached record electrical current densities," explains Vretenar. "Being able to deliver such high energies in a compact device really would open up exciting opportunities."

ARIES's results have already enabled the EuPRAXIA collaboration to launch the final design and construction plan for the first-ever operational particle accelerator based on plasma acceleration, at the National Laboratory of Frascati near Rome, Italy.

Plasma will be modulated by a drive beam that generates extremely high electric fields. Inside, electrons can be accelerated to high energies over 1 000th the distance required by conventional radio frequency accelerators.

## Novel environmental benefits

The team also identified, developed and tested new accelerator applications that could benefit the environment, such as cleaning municipal waste water.

The team developed a new accelerator-based system for removing sulphur, nitrogen and particulates from the exhaust of diesel ship engines. With maritime traffic one of the main contributors to pollution worldwide, the system could be retrofitted in old container ships and tankers.

"I'll never forget the look on the face of a ship's captain at Riga shipyard when we connected the ship's funnel to our particle accelerator. He was proud that his old rusty tugboat was part of a high-tech experiment," notes Vretenar.

ARIES has already helped spotlight new technologies, such as the plasma-based EuPRAXIA initiative, for the European Strategy Forum on Research Infrastructures, which includes several accelerator-based projects. The team has also started a new EU-funded project, I.FAST, to speed up the transfer of accelerator technologies to industry.

**PROJECT**
**ARIES – Accelerator Research and Innovation for European Science and Society**

**COORDINATED BY**
European Organisation for Nuclear Research in Switzerland

**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/730871

**PROJECT WEBSITE**
aries.web.cern.ch/

# Integrating open data to tackle infectious diseases

By ensuring timely, quality and integrated data on COVID-19 and other infectious diseases, the multidisciplinary BY-COVID project is helping decision makers better prepare for future threats.

© Wesley JvR/stock.adobe.com

As the SARS-CoV-2 virus spread around the world in 2020, governments faced questions about their preparedness. Despite pandemics regularly appearing on risk registers, many countries appeared to have been caught unprepared.

Launched in October 2021, the EU-funded BY-COVID project is addressing one of the biggest challenges to effectively preparing for and responding to infectious disease outbreaks – the availability of timely, accurate and integrated data.

Drawing on the expertise of over 50 partners from around 20 European countries, the interdisciplinary project is helping to mobilise, connect, standardise and analyse critical data.

## Integrated data systems

As the COVID-19 pandemic unfolded, a variety of methods were quickly developed to monitor the spread and evolution of the virus, alongside the adoption of different measures to suppress its health, social and economic impacts. These efforts relied on establishing various infrastructures around the world, which still generate vast amounts of valuable data.

By leveraging this data to share knowledge, coordinate efforts and allocate resources effectively, the BY-COVID project helps authorities better anticipate and so prepare for future outbreaks.

An example of the initiative in action is the Infectious Diseases Toolkit, a repository of national strategies and best practice responses. So far, resources have been added for Belgium, the Netherlands, Norway, Sweden and Switzerland.

Showcase pages also highlight particularly exciting innovations, such as an automated and modular SARS-CoV-2 genome surveillance system, created around the open-source platform Galaxy.

BY-COVID will also collaborate with the Korea Research Institute of Standards and Science, helping establish a national COVID-19 Data Portal to standardise data (including viral whole genome) and so enhance its compatibility with international databases.

In turn, the sharing of SARS-CoV-2 sequence variations from Korean institutes will extend the comprehensiveness of the European COVID-19 Data Portal, a key component of the COVID-19 Data Platform set up early in the pandemic.

## Better preparedness

BY-COVID has also developed a policy brief to support decision makers develop pandemic preparedness plans. Recommendations include: prioritising open data; encouraging researchers to deposit data; assuring investment in the necessary national, local and research community-driven infrastructures; and ensuring training for the effective use of the tools available.

BY-COVID aligns with the global One Health initiative to more effectively coordinate the practices and resources of multiple sectors and stakeholders for better public health outcomes. As such, it is designed to integrate into established national and European infrastructures, including ELIXIR, BBMRI, ECRIN, PHIRI and CESSDA, as well as work with partners such as the Versatile Emerging infectious disease Observatory (VEO).

The project is also part of the European Commission's biodefence preparedness plan – the HERA Incubator – to anticipate the threat of coronavirus variants and bring together science, industry and public authorities in developing effective responses.

**PROJECT**
**BY-COVID – Beyond COVID**

**COORDINATED BY**
European Molecular Biology Laboratory, Heidelberg in Germany

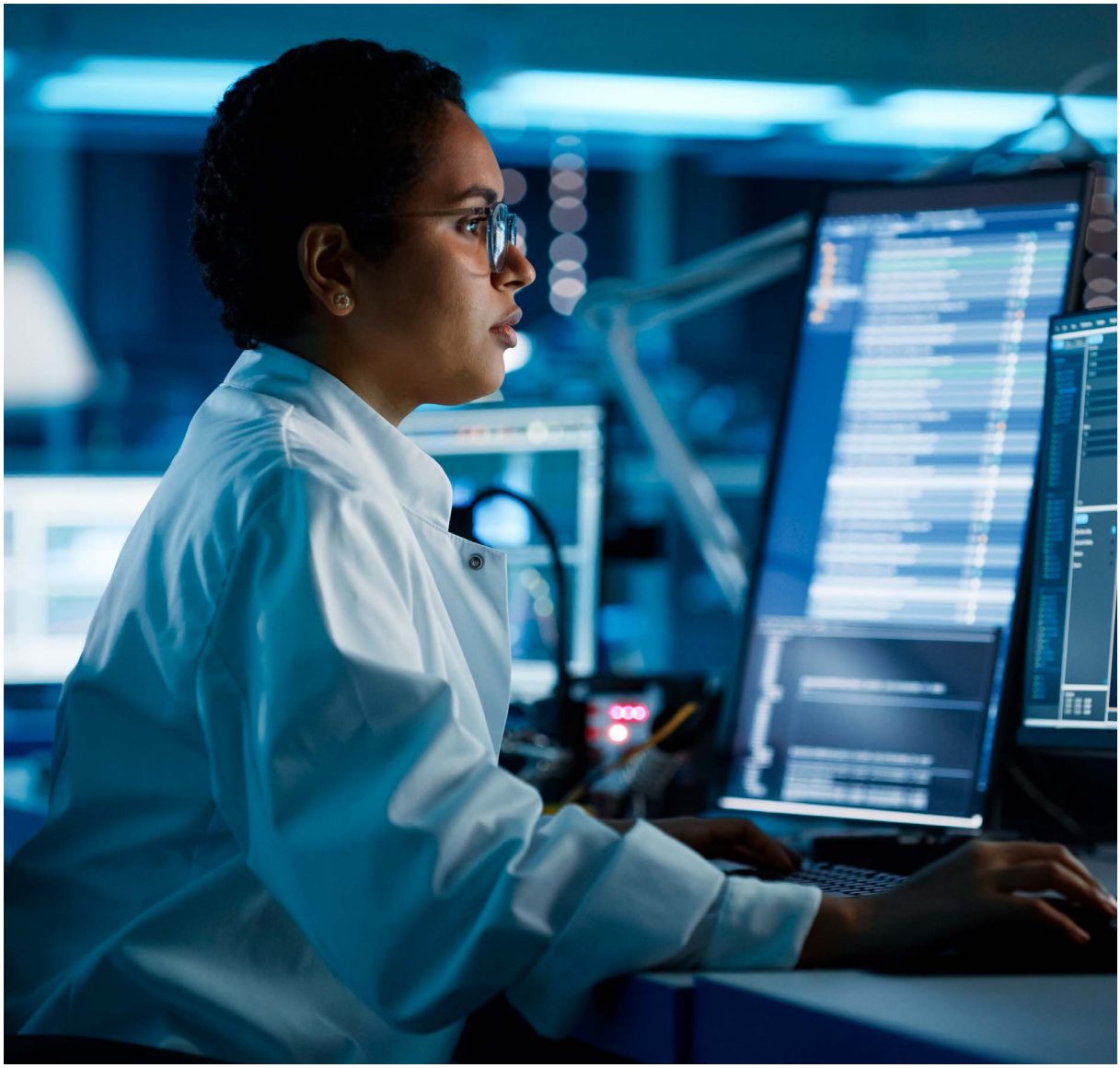
**FUNDED UNDER**
Horizon Europe-Research Infrastructures

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/101046203

**PROJECT WEBSITE**
by-covid.org/

# Facilitating cross-border, data-driven cancer research

Ensuring that cancer data is machine-readable and accessible across borders could lead to more productive research collaboration, and bring innovative new therapies to patients more quickly.



© Goradenkoff/stock.adobe.com

Across a number of sectors, including healthcare, we are increasingly reliant on computational support to handle sharp increases in the volume and complexity of data. To ensure that Europe can fully benefit from such innovations though, this data needs to be harmonised, and researchers and clinical staff need ways of accessing and sharing information across borders.

To achieve this, the EU-funded EOSC4Cancer project was launched. Running until March 2025, it brings together cancer research centres, research infrastructures, hospitals and supercomputing centres across 14 European countries.

## From cancer prevention to diagnosis and treatment

The EOSC4Cancer project consortium is applying these principles to a number of use cases that cover the patient journey. A key element is ensuring that such data sets are harmonised, machine-actionable and amenable to artificial intelligence approaches.

One use case focuses on cancer screening programmes, which are critical for improving survival rates through early detection. Screening programmes typically produce data sets that can be used for further data-driven research.

The project team correlated a subset of data, extracted from screening programmes in three countries, to evaluate the risk/benefit of colorectal cancer screening and to help optimise screening strategies. A key aim is to achieve better data flow, and facilitate collaborative research by making this information accessible through federated data spaces.

A second use case is looking at multi-omics for the effective diagnosis and treatment of colorectal cancer. Data sets covering medical images, genomics and other factors have been collected, with a focus on ensuring that such data is harmonised. The project team plans to deliver standardised templates that researchers and clinical staff can use for sharing multiomic data such as this.

Another use case is exploring how tumour molecular data can be optimised, in the context of precision cancer medicine. The aim is to build a clinical decision support system (CDSS) to help clinicians make biomarker-driven precision medicine interventions.

The project team is currently investigating the data infrastructures and format specifications required for the CDSS to fulfil this task. This element of the project builds on the work being carried out by the Molecular Tumor Board Portal, which uses bioinformatic tools to identify treatment opportunities.

## Effective evidence-based medical research

The data sets being collected from these and other specific use cases, as well as the project work being done to ensure that such data is accessible, sharable and reusable, will help lay the foundations for further collaborative cancer research. The complex nature of cancer means that broad cooperation is critical in order to bring effective new therapies to patients.

The EOSC4Cancer project's key contribution here is ensuring that diverse types of cancer data – genomics, imaging, medical, clinical, environmental and socio-economic – can be securely processed and reused across borders, using federated and interoperable systems. Investment in such research infrastructure will ultimately pay dividends, through fostering effective evidence-based medical research that leads to better health outcomes.

**PROJECT**
**EOSC4Cancer – A European-wide foundation to accelerate Data-driven Cancer Research**

**COORDINATED BY**
Barcelona Supercomputing Center in Spain

**FUNDED UNDER**
Horizon Europe-Research Infrastructures

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/101058427

**PROJECT WEBSITE**
eosc4cancer.eu/

# Exploring Venus' surface from planet Earth

To prepare for an upcoming extraterrestrial mission, several EU scientists spent their summer conducting research in Europe's frozen north. Their findings will help position the EU at the forefront of space exploration.

© jenyateua/stock.adobe.com

The wild and desolate landscapes of Iceland are often described as otherworldly – and that's exactly what is drawing participants of the EU-funded EPN-2024-RI project.

The volcanic terrain of Iceland provides an ideal analogue for Venus, offering researchers the chance to test out instrumentation and better understand the processes that shape the Venusian surface.

The EPN-2024-RI project coordinated field trips to the Matis Transnational Access Field Site, one of seven such sites located around the world. These free-to-access field sites provide the most realistic terrestrial geological-geomorphological analogues for volcanic and other climatic and geological conditions, aiding studies in support of planetary exploration – including the European Space Agency's forthcoming EnVision mission to Venus.

EPN-2024-RI assists visiting scientists, planning their field research, choosing appropriate sites and organising the logistics of assessing them, along with providing access to biological laboratories and other research facilities.

## Studying Venus' surface from planet Earth

At the Iceland field site, researchers have access to a multitude of different environments, including glacial and subglacial environments, lava fields of different ages, volcanic areas, and active hydrothermal systems – all of which can be used for astrobiological and planetary research.

This summer, the German Aerospace Center's (DLR) Institute of Planetary Research was at the site to study the composition and origin of the major geologic terrains found on Venus' surface. To do so, the team used a prototype instrument to characterise lava flows found on the Reykjanes Peninsula.

Not only is this an opportunity to test and calibrate the instrument before it takes off for use on Venus, but the research also increases scientists' understanding of the spectral emissivity data that will be obtained during the EnVision mission.

## Positioning Europe at the vanguard of space exploration

In addition to its field sites, the EPN-2024-RI project provides researchers with the infrastructure they need to address the major scientific and technological challenges facing modern planetary science. This includes the world's largest collection of planetary simulation and analysis facilities, data services and tools linked to the European Open Science Cloud (EOSC), a ground-based observational network, and a range of community support activities and networking opportunities.

Led by the University of Kent, the project currently has over 50 beneficiary institutions from 24 countries in Europe and around the world, with an additional 44 affiliated partners. The project draws on the resources of the Europlanet Society to disseminate activities and outcomes, develop a more diverse community of users, and – most importantly – ensure Europe's position at the vanguard of space exploration.

**PROJECT**
**EPN-2024-RI – Europlanet 2024 Research Infrastructure**

**COORDINATED BY**
University of Kent in the United Kingdom

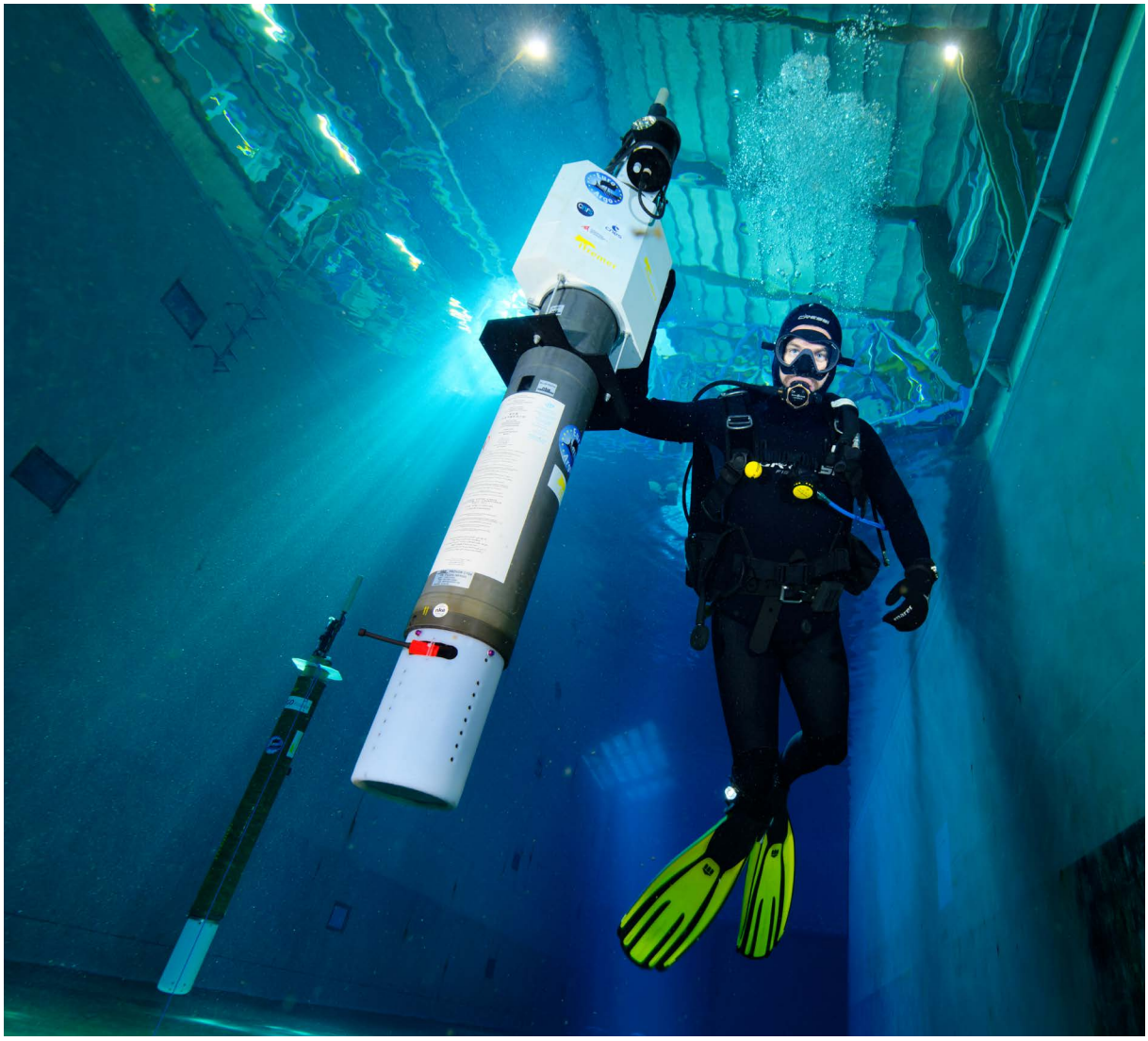
**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/871149

**PROJECT WEBSITE**
europlanet-society.org/europlanet-2024-ri

# Boosting Europe's ocean monitoring capabilities

By upgrading a network of marine sensors, the EU-funded Euro-Argo RISE project is helping scientists to build more accurate weather models and better understand long-term climate trends.



© Olivier Dugornay/Ifremer

Accurate ocean data is critical to understanding the Earth's climate, and to making estimates of how it will change in the future. To this end, the international Argo programme, launched in 1999, established a network of floats, deployed across the world's oceans.

The network consists of thousands of autonomous instruments that spend almost all their life below the surface, at depths of up to 2 000 metres. Data on temperature, salinity and the chemical make-up of the sea is relayed to satellites, and then sent on to receiving stations onshore.

"This data, which is freely and openly accessible, is delivered in real time for operational users, such as meteorological offices, and for climate change research and monitoring," explains Euro-Argo RISE project manager Estérine Evrard, from Euro-Argo ERIC in France.

## Better coverage and more precision

Euro-Argo ERIC coordinates Europe's contribution to the programme and is responsible for operating around a quarter of the global Argo floats array. Around 2019, it was recognised that ocean coverage needed to be extended further into partially ice-covered polar regions and shallower waters, along with more biogeochemical sensors deployed and data management systems updated.

These were some of the key objectives of the Euro-Argo RISE project, which also sought to bring Europe's contribution into line with the programme's long-term vision, called OneArgo. "To monitor climate change, we need long-term data," says project coordinator Sylvie Pouliquen, also part of Euro-Argo ERIC. "This is why ensuring the sustainability of the Argo network is essential."

To achieve this goal, Euro-Argo RISE tested new sensors to assess their accuracy and performance, as well as floats' capacity to survive in ice-covered areas. Ice-sensing software was used to ensure that instruments did not attempt to surface until they drifted into open sea.

Similarly, float configurations were tuned for shallower waters and tested in selected sites of the Baltic, Mediterranean and Black Seas. The result is that the Euro-Argo RISE project has expanded the programme's ocean coverage, in terms of both deployed devices and monitored range of parameters.

## Data for informing climate policy

The project has also made it easier to access Argo data. A new data selection tool has been designed to help users select, visualise and download data in different formats through a user-friendly interface.

"This data is used by the Copernicus Marine Service for analysing and forecasting the state of the ocean," says Evrard. "It can also be used by intergovernmental organisations such as the European Centre for Medium-Range Weather Forecasts."

The advances will also benefit researchers and oceanographers interested in better understanding the long-term processes under way within our oceans, such as how interactions between the ocean and atmosphere work, and how ocean acidification evolves.

"This information is critical for informing climate policy," notes Pouliquen. "It is currently being used by bodies such as the IPCC."

## Sustainability of ocean monitoring network

The project has been an important step forward in ensuring the success of this research infrastructure over the long term and helped to expand its reach.

For example, a series of regional workshops led to Denmark's application as a candidate Member of Euro-Argo ERIC, which includes 28 institutes (19 of which were partners in Euro-Argo RISE) across 12 countries.

"The huge amounts of data and knowledge being created can only be achieved through the sustainability of the network," adds Pouliquen. "We are currently working with national ministries to identify any gaps in coverage and the different scenarios to sustain the European contribution to OneArgo over the long term."

*The huge amounts of data and knowledge being created can only be achieved through the sustainability of the network.*

**PROJECT**
**Euro-Argo RISE – Euro-Argo Research Infrastructure Sustainability and Enhancement**

**COORDINATED BY**
Euro-Argo ERIC in France

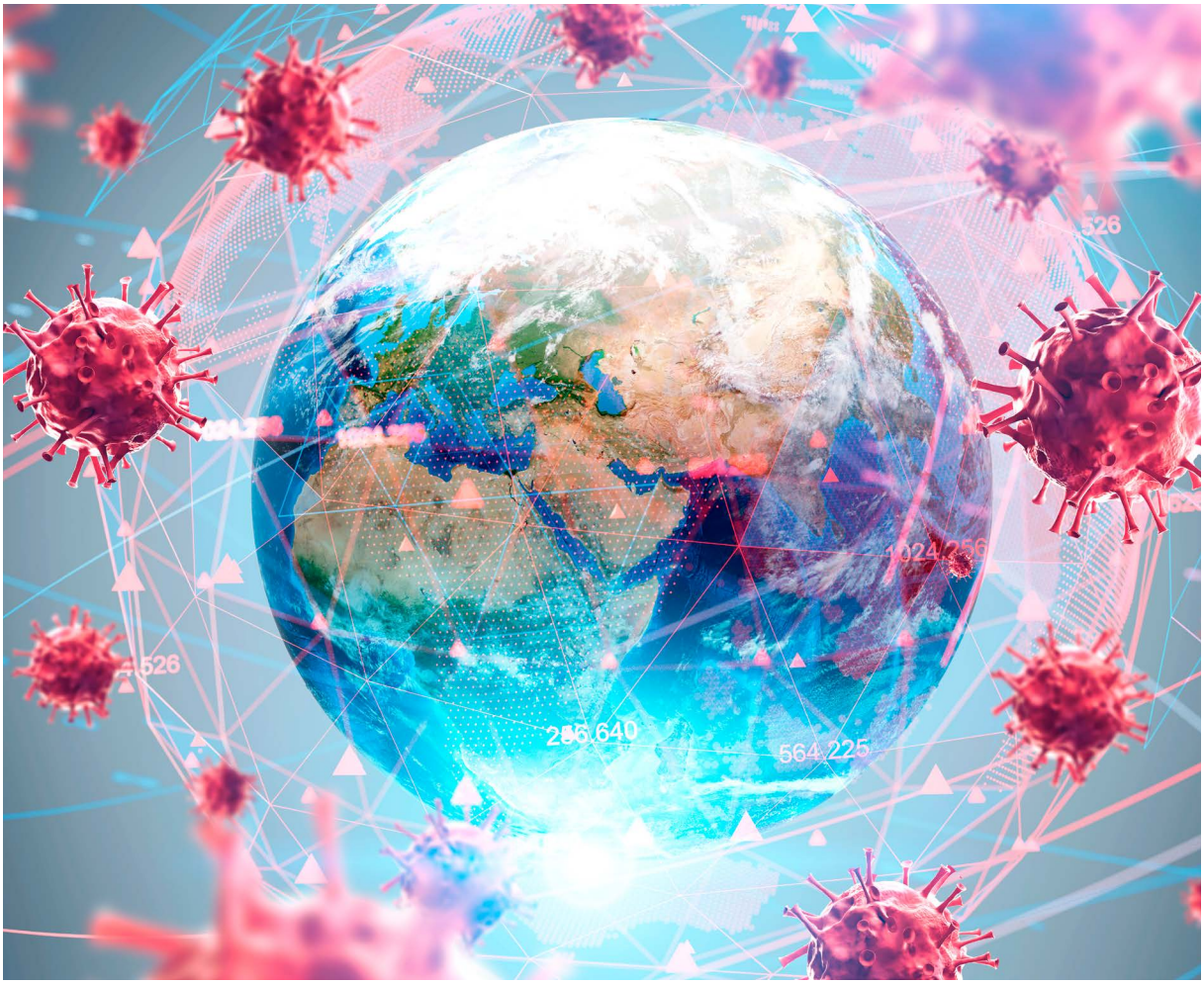
**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/824131

**PROJECT WEBSITE**
euro-argo.eu/EU-Projects/Euro-Argo-RISE-2019-2022

# Going viral: the European biobank at the centre of a global anti-pandemic network

The European Virus Archive has been built up over the last decade to become an indispensable collection of virus research materials, supporting the fight against COVID-19. Now, the EU-funded EVA-GLOBAL project has expanded this research infrastructure to a global network, supporting the scientific response to future outbreaks.




© ImageFlow/stock.adobe.com

With the human population expanding further around the world, ecosystem changes and increased contact between humans and novel pathogens, future outbreaks – particularly viral diseases – are more likely. In the wake of the COVID-19 pandemic, a European Partnership on Pandemic Preparedness is being readied under Horizon Europe.

The EVA-GLOBAL project is building the first global collection of viral biological material to support scientific research, education and the control of old and emerging diseases. As well as building an international research infrastructure, the project is establishing ethical, safety and security standards relating to viral material.

Launched in 2020, EVA-GLOBAL is already the world's largest archive of viral pathogens and ensures that scientists around the world can collaborate effectively on future outbreaks. The project is a collaborative effort between 46 laboratories around the world, including 27 EU research centres, which offer a broad range of expertise in animal and plant virology.

The project is fostering an exchange of knowledge between partner organisations and creating new tools to access, study and respond to viral diseases. These tools incorporate advances in the sequencing of viral genomes, molecular diagnostics, virus classification and discovery, and methods for long-term conservation of viral material, as well as agreed safety and quality standards between the participating institutions.

## Responding to SARS-CoV-2

As a responsive global network confronting emerging viral disease outbreaks, EVA-GLOBAL worked during the COVID-19 pandemic in cooperation with international entities such as the World Health Organization and the European Centre for Disease Prevention and Control, to ensure that rapidly developed diagnostic materials and protocols were distributed across Europe and around the world.

EVA-GLOBAL has already been at the forefront of pandemic response. Project partners were among the first institutions to receive information about the new SARS-CoV-2 virus from authorities in China, where the outbreak began. Partner institutions quickly developed reagents needed to detect the virus and made these immediately and widely available.

EVA-GLOBAL partners added SARS-CoV-2 research materials such as reference strains and diagnostic materials into their online materials and services catalogue within one month of the discovery of the virus. In record time, more than 3 000 SARS-CoV-2 diagnostic reference and PCR assay materials were distributed to academic organisations and biomedical industries in over 100 countries, enabling a rapid research response to COVID-19.

## Establishing viral standards and a research portal

A longer-term goal of the EVA-GLOBAL project is to establish guidelines for viral storage and distribution to meet international standards. This includes proficiency testing in individual laboratories and engagement with science policymakers to discuss the importance of biobanked material such as viruses.

The project is the continuation of predecessors the European Virus Archive and EVA goes global (EVAg). During this third project phase, EVA-GLOBAL delivers more systematic geographic coverage around the world, including more institutions in South America, Asia and Africa. Funding was specifically increased during the COVID-19 crisis to support SARS-CoV-2 research in Europe and beyond.

**PROJECT**
**EVA-GLOBAL – European Virus Archive GLOBAL**

**COORDINATED BY**
Aix-Marseille University in France

**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/871029

**PROJECT WEBSITE**
european-virus-archive.com/

# Putting Earth under the microscope through community science

**By providing Earth science researchers with access to technology and data, the EU-funded EXCITE project is helping to address fundamental questions relating to our planet, from evolution to energy storage.**

© EdNurg/stock.adobe.com

Cutting-edge research into the materials that make up our planet is critical to ensuring a safe and sustainable future for all. This work can help us to better understand phenomena such as earthquakes, identify potential threats posed by mineral extraction, and lead to possible solutions to storing carbon dioxide safely below the surface.

"We only have one Earth, which is why we need to understand the materials we stand on every day," says EXCITE co-coordinator Oliver Plümper, an associate professor of Geosciences at Utrecht University in the Netherlands.

## Connecting researchers across Europe

The EXCITE project sought to support excellence in Earth materials research, through providing scientists with easy and open access to the equipment and data they need. To achieve this, the project brought together 15 European institutions, all with high-end electron or X-ray microscopy facilities.

Many scientists don't have the technology they need at their own institution, or access to funding to make use of existing facilities. The EXCITE research infrastructure is designed to make equipment more accessible to early-career Earth sciences researchers, as well as to more experienced researchers.

*We only have one Earth, which is why we need to understand the materials we stand on every day.*

"The idea is that this network will help researchers to answer any question related to Earth materials," explains Plümper. "This might be a fundamental question, such as: 'Why is this rock the way it is?' to more practical questions such as: 'Is this rock a good storage medium for hydrogen?'"

An important element of the network is that each partner institution brings specific competences and strengths, which, when pooled together, will improve the quality of research. Awareness-raising workshops focused on the potential of the network have also been held.

"Some researchers are focused on microscopy at the nanoscale, while others are interested in using 3D microscopy for larger things," adds Plümper. "This research infrastructure makes correlative imaging possible, through using different techniques."

## Enabling access to technology

The EXCITE project, which is due for completion in April 2024, has already helped scores of researchers to access the technology and data they need. "This work has been multifaceted, from research on the evolution of mammals on Earth to topics focusing on the energy transition and climate change," explains Plümper.

The project team also developed a number of new tools, one of which is a publicly available machine learning model for data analysis.

"The network also provides a platform for new users to discuss results and find the help they need," says project coordinator Veerle Cnudde, affiliated to both Utrecht University, the Netherlands and Ghent University, Belgium. "For those who might not have used this microscopy technology before, it opens up the world, and shows what is possible."

## Sustaining an Earth sciences ecosystem

The project has sparked a great deal of interest within the Earth sciences community. "The EXCITE community has been extremely busy over the past two and a half years, which shows there was a real need for this research space," remarks Plümper.

Funding for a follow-up project has already been secured. This will continue the infrastructure-building work, and the EXCITE consortium will also put a key focus on data analysis. "While collecting data can be quick, researchers often find they don't have the computational infrastructure they need," Plümper notes.

Overall, the EXCITE project team is delighted with the results achieved to date. "Everyone involved sees the benefits of this research infrastructure to the community," adds Cnudde. "We are convinced that this is the only way to move forward – by joining forces, and seeing how we can help each other out."

**PROJECT**
**EXCITE – Electron and X-ray microscopy Community for structural and chemical Imaging Techniques for Earth materials**

**COORDINATED BY**
Utrecht University in the Netherlands

**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/101005611

**PROJECT WEBSITE**
excite-network.eu/

# Advancing proton beam therapy through collaborative research

By facilitating collaboration between companies and research centres, the EU-funded INSPIRE network is helping Europe maintain its competitive edge within the rapidly developing field of proton beam therapy.

© RFBSIP/stock.adobe.com

Proton beam therapy (PBT) has the potential to revolutionise the way we treat cancer. By delivering a targeted dose of radiation directly to the tumour, drastically reducing damage to the surrounding healthy tissue, PBT can minimise the side effects that many patients experience.

Europe has positioned itself as a global leader in PBT research and innovation. Eleven Member States are either using or are about to start using PBT in a clinical setting. Furthermore, Europe is home to two of the world's largest PBT equipment manufacturers, not to mention countless related SMEs.

To maintain Europe's competitive edge within this rapidly developing field, the EU-funded INSPIRE project was launched to encourage collaboration and knowledge transfer.

"The project built a proton therapy infrastructure that gives researchers direct access to PBT resources, and facilitates joint research activities," explains Karen Kirkby, professor of Proton Therapy Physics at the University of Manchester, the project's coordinating institution.

## A flash of inspiration

A perfect example of the INSPIRE network in action can be seen in its work on FLASH, the name given to ultra-high dose rate radiotherapy. "When FLASH first came onto the scene, we quickly reacted to ensure our network developed the technology to deliver the beams needed to drive this exciting field of research," adds Kirkby.

*When FLASH first came onto the scene, we quickly reacted to ensure our network developed the technology to deliver the beams needed to drive this exciting field of research.*

As a result of the project's proactive response, Varian, one of the leading proton therapy vendors, was able to develop cutting-edge detector technology for use with ultra-high dose rate proton therapy. The full beam monitor system has since been tested on a clinical gantry and is now being used in the world's first FLASH PBT clinical trial.

"Being able to rapidly take a research idea to clinical prototype is a game changer for companies such as Varian," notes Kirkby. "The INSPIRE network made this possible."

Other projects and companies have also leveraged the INSPIRE network to gain access to its FLASH proton beams, including ADVACAM and UHDpulse.

## Benefits to patients

INSPIRE facilitated several other important developments in PBT research. Among its accomplishments is an international benchmarking study that harmonises the way proton therapy's biological effect is calculated with respect to X-ray radiotherapy. "This study paves the way towards an EU-wide consensus on PBT dose prescription," says Kirkby.

Through the INSPIRE project's network, the Ion Beam Applications firm and the University Medical Centre Groningen (website in Dutch) in the Netherlands were able to collaborate on building a database containing tissue complication models. These models can be used to help select which patients are most likely to benefit from proton therapy.

To ensure that the project's many results have as far-reaching impact as possible, the project established a conference series on FLASH radiotherapy and particle therapy. The first two events attracted over 700 participants from over 40 countries each. A third conference will take place in Toronto at the end of the year.

The project has also made all its research and resources available via the EU-funded canSERV project.

**PROJECT**
**INSPIRE – INfraStructure in Proton International REsearch**

**COORDINATED BY**
University of Manchester in the United Kingdom

**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/730983

**PROJECT WEBSITE**
protonsinspire.eu/

# Facilitating cooperative research across the Arctic

Climate change in the Arctic has global implications and requires a coordinated, global response. The EU-funded INTERACT project is supporting international cooperation in the polar region.

© IzzetNoyan/stock.adobe.com

While the impact of climate change is felt the world over, it is most pronounced in the Arctic. Here, the climate is warming three times faster than the global average.

This accelerated change is having unprecedented and unpredictable consequences – consequences that, due to interconnected atmospheric and ocean circulations, are being felt across the globe.

"The Arctic is a uniquely transnational region where changes have a global impact and solutions require international cooperation," says Margareta Johansson, an associate professor of Physical Geography and Ecosystem Science at Lund University in Sweden.

With the support of the INTERACT project, Johansson is leading an effort to facilitate such international cooperation.

## Pooling resources

The project seeks to build capacity for research and monitoring across the Arctic, as well as in adjacent high alpine and boreal areas. It offers access to a network of 74 terrestrial research stations located in most Arctic countries, northern Europe and northern alpine areas, as well as in subarctic boreal areas.

"A vast and sparsely populated region, observing the environmental changes happening in the Arctic remains a challenge," explains Johansson. "We intend to overcome this challenge by providing researchers with the state-of-the-art facilities they need to work together in identifying, understanding, predicting and responding to these changes."

To date, more than 1 000 scientists from around the world have conducted collaborative research through the INTERACT network. Among the outcomes of this research is the discovery of a new bumblebee species.

*The Arctic is a uniquely transnational region where changes have a global impact and solutions require international cooperation.*

Other initiatives funded through the project have focused on evaluating the use of radar and remote sensing, studying greenhouse gas dynamics in the subarctic, seeing how snow cover insulates permafrost soils, and looking at the impact climate change has on indigenous peoples.

One unique feature of the network is its transnational access pool, where station managers can return unused funds that can then be used by another station with higher demand. "This is a good example of how all our partners help each other and are focused not on individual benefits, but rather on the greater good," notes Johansson.

## Shared results

A central goal of the INTERACT project is to ensure this type of research doesn't happen in silos. That's why, in addition to networking the research centres themselves, the project facilitates the sharing of data and results through its data portal.

INTERACT also regularly publishes informative articles on such urgent societal challenges in the Arctic as extreme weather events, Arctic tourism and reducing plastic consumption and pollution.

Through its Station Manager Forum, the project can build cooperation among research stations in an advanced infrastructure community, resulting in the sharing of best practices. It also creates bridges between these advanced infrastructure and scientific communities and industries, local communities and infrastructures in other regions.

To ensure that this spirit of international collaboration continues even when the project itself is finished, the project partners have established a non-profit association to ensure the long-term sustainability of the network.

"INTERACT's role as the basic building block for future research and monitoring of the terrestrial Arctic and adjacent high alpine and boreal areas has been internationally recognised, and we hope that future opportunities will be made available through the non-profit association," concludes Johansson.

**PROJECT**
**INTERACT – International Network for Terrestrial Research and Monitoring in the Arctic**

**COORDINATED BY**
Lund University in Sweden

**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/871120

**PROJECT WEBSITE**
eu-interact.org/

# Taking down barriers to open research in Europe

National research initiatives spearheaded by the EU-funded NI4OS-Europe project aim to unify Europe's open science landscape and boost open cooperation among scientists and researchers, especially those working in regional areas.

© Malik E/stock.adobe.com

The European Open Science Cloud (EOSC) is a trustworthy digital platform that provides scientists with continuous access to the entire research data cycle at the European level. Here they can access and share data, and collaborate on research.

While the EOSC framework offers great potential to advance European research, the overall open science landscape suffers from fragmentation in terms of services, policies and open science practices.

*One of the most critical aspects of the NI4OS-Europe project was the removal of barriers.*

The NI4OS-Europe project established National Open Science Cloud Initiatives (NOSCIs) in 15 countries to promote greater cohesion.

"One of the most critical aspects of the NI4OS-Europe project was the removal of barriers related to the delivery of cross-border and cross-sectoral interoperable services, tools and policies, especially within the EOSC framework," explains Ognjen Prnjat, NI4OS-Europe project coordinator and director of European Infrastructures and Projects at National Infrastructures for Research and Technology (GRNET) in Greece.

By recognising regional disparities in digital infrastructure and open science practices, the project played a crucial role in bridging the digital divide in southeast Europe.

"NI4OS-Europe, as a continuation of two decades of collaboration in south-east Europe, aimed to empower regional scientists and contribute to development of the area by improving access to research resources and adoption of open science practices in this specific region," says Prnjat.

## Building on existing EOSC practices

The NI4OS-Europe project built on a number of complementary initiatives over the last two decades, pooling existing electronic infrastructures, thematic services, open data and publications repositories, to reduce fragmentation of these services.

The project provided training and capacity building, offered policy guidance, promoted technical integration with the EOSC and supported findability, accessibility, interoperability and reusability (FAIR) data principles.

The NI4OS-Europe team developed specific recommendations on EOSC usage, and curated a series of legal, technical and procedural tools to support open data production and sharing. NI4OS-Europe ran a large number of training events, on national and regional levels, along with a range of dissemination activities.

## National Open Science Cloud Initiatives

The NOSCIs are initiatives formed by a coalition of prominent national organisations, who all have an interest in the EOSC. They ensure an alignment of technical and policy priorities on national levels, bringing together stakeholders and spreading awareness of EOSC developments. The NOSCIs also link to other national innovation-supporting initiatives in each country.

"To achieve this goal, we launched stakeholder analysis and mapping, which provided an insight into local capacities and needs and produced a set of guidelines to complement the establishment and operation of NOSCIs," adds Prnjat.

The NI4OS-Europe project facilitated collaboration and cooperation among researchers from different countries through the promotion of best practices and resource sharing.

The project assisted with the onboarding of a range of open services into the EOSC. These facilitate knowledge sharing across borders and aim to bring research capacities in south-east Europe in line with the rest of the continent.

"By connecting national initiatives and e-infrastructures, NI4OS-Europe enables researchers to access a broader range of services and collaborate more effectively, thereby advancing the goals of open science and research excellence in Europe and beyond," says Prnjat.

**PROJECT**
**NI4OS-Europe – National Initiatives for Open Science in Europe**

**COORDINATED BY**
National Infrastructures for Research and Technology in Greece

**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/857645

**PROJECT WEBSITE**
ni4os.eu/

# Improving access to digital services for European researchers

The EU-funded OCRE project facilitated adoption of cloud services and access to Earth Observation data, supporting a wide range of research projects, from flood risk to heart disease.

© lavizzara/stock.adobe.com

Commercial digital services such as Earth Observation (EO) platforms and the cloud are critical to many fields of scientific research. The EU-funded OCRE project established a pan-European framework for researchers to access these valuable tools, by setting up a range of commercial service agreements.

By establishing framework agreements with cloud service providers that meet the specific requirements of the research community, OCRE relieves institutions of this time-consuming and complex process, making cloud resources more widely available to research institutions and driving European research innovation.

"The ultimate aim of OCRE is to provide the European research community safe and secure access to commercial digital services and Earth Observation services," says David Heyns, director of OCRE at GÉANT.

## Improved access, better research

Through OCRE, European research institutes can procure commercial digital services by identifying a local supplier. This can be done through the OCRE list of cloud service vendors and EO catalogues, the GÉANT cloud catalogue or the European Open Science Cloud (EOSC) Marketplace.

*The ultimate aim of OCRE is to provide the European research community safe and secure access to commercial digital services and Earth Observation services.*

OCRE provides a wide and varied service portfolio, including Infrastructure as a Service (IaaS) and Platform as a Service (PaaS), which comprise computation, storage and network services, as well as platforms that allow customers to develop and run cloud-based applications.

The OCRE catalogue also offers Software as a Service (SaaS), a software licencing model providing on-demand programmes by subscription. Operated as a public cloud service, this includes file storage and tools for collaboration, simulation and visualisation.

Additionally, OCRE lets users tap into the EO services based on data collected by Copernicus, the EO component of the EU's space programme.

"Registered suppliers provide or develop bespoke thematic or regional EO platform services for the European science community," Heyns explains.

## Service building with the scientific community

The OCRE project gathered substantial community and market engagement, to tender a cloud-service framework of unprecedented scope and scale. Response to the framework exceeded 1 100 proposals from the market, representing 40 European countries. As a result, more than 430 national contracts were then created to support the framework.

"Over EUR 7.5 million of cloud-based digital services were distributed across the European science community to drive the adoption of OCRE services. This resulted in a significant number of compelling case studies from innovative research projects, using a range of state-of-the-art cloud-based services," adds Heyns.

OCRE success stories are wide-ranging in their scope and scale. In one example, Ukrainian researchers used satellite data to quantify crop losses, fire and bomb damage resulting from the war. Other projects include: an innovative blood-flow model used to diagnose aortic disease in real time; an assessment of the shifting British coastline over the last 38 years, which drew on EO technology to assess efforts to mitigate coastal flooding and coastal erosion; and new AI algorithms designed to optimise machine learning control of drone swarms.

These case studies have been used by various EOSC initiatives and national research and education networks (NRENs) across

Europe to demonstrate the enhanced agility and scalability with which research activities are able to be performed.

"Looking ahead, GÉANT will procure the next iteration of the framework, OCRE 2024, to ensure continuity on behalf of over 10 000 institutes in Europe, interconnected by GÉANT and the European NRENs," concludes Heyns.

**PROJECT**
**OCRE – Access to Commercial Services Through the EOSC-hub**

**COORDINATED BY**
GÉANT Association in the Netherlands

**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/824079

**PROJECT WEBSITE**
ocre-project.eu/

# Putting Europe at the centre of radiopharmaceutical excellence

A sustainable medical radionuclide programme is currently being established through the PRISMAP project. This will put Europe at the forefront of research into new methods of diagnosing and treating cancer.


© Werner/stock.adobe.com

The EU-funded PRISMAP project, which runs until April 2025, was launched to ensure that Europe is well placed to capitalise on this emerging field of medicine, and to bring research breakthroughs quicker to patients.

Drugs containing radioactive molecules, also called radiopharmaceuticals, are increasingly used in the medical field to provide accurate diagnostic information to clinical staff.

Radiopharmaceuticals can be injected into the body and used to target specific organs, tissues or cells in a non-invasive manner. Positrons, beta and gamma rays emitted by the radionuclides can be captured, generating images that reflect the function of the tissue under investigation.

In addition to enabling highly accurate diagnoses, radiopharmaceuticals can be used to treat many types of cancer. Once a radiopharmaceutical has stuck to a cancer cell, the radioactive compound naturally breaks down, releasing energy that damages the DNA of neighbouring cancer cells.

## High-purity radionuclides for medical use

The project team aims to address a key barrier to the effective development of this area of research: the difficulties that many labs face in accessing radionuclides. PRISMAP will establish a sustainable source of high-purity radionuclides for medical use, and provide experts in the field with a single point of access to these resources.

For this, a consortium of key neutron sources, isotope mass separation facilities and high-power accelerators and cyclotrons has been brought together, along with leading biomedical research institutes and hospitals. The project team also wants to establish harmonised research standards across Europe, and clarify current regulations.

PRISMAP has already taken steps to provide researchers with easy access to this research infrastructure. The project has established a web-based entry platform, which includes public information alongside a private consortium section for data sharing and communication.

The web platform covers a range of different radionuclides, all of which can be used as ingredients in diagnostics and treatment. For each radionuclide, general data, together with the mode of production and general application, is provided.

New terminologies and standards have also been introduced to account for novel methods of radionuclide production, such as combining isotope mass separation and more established accelerator (cyclotron) and reactor methods.

## Powering innovative radionuclide research

Interactions with other European infrastructure projects, such as Euro-BioImaging, have been forged in order to maximise future synergistic actions in the medical field. The project team plans to continue developing new production methods, generating new opportunities for cooperation and advancing medical radionuclide research in Europe.

**PROJECT**
**PRISMAP – The European medical isotope programme: Production of high purity isotopes by mass separation**

**COORDINATED BY**
European Organisation for Nuclear Research in Switzerland

**FUNDED UNDER**
Horizon 2020-INFRA

**CORDIS FACTSHEET**
cordis.europa.eu/project/id/101008571

**PROJECT WEBSITE**
prismap.eu/

# CORDIS Results Pack

**Available online in 6 language versions:** cordis.europa.eu/article/id/447652

**Published**
on behalf of the European Commission by CORDIS at the
Publications Office of the European Union
L-2985 Luxembourg
LUXEMBOURG

cordis@publications.europa.eu

**Disclaimer**
Online project information and links published in the current issue of the CORDIS Results Pack are correct when the publication goes to press. The Publications Office cannot be held responsible for information which is out of date or websites that are no longer live. Neither the Publications Office nor any person acting on its behalf is responsible for the use that may be made of the information contained in this publication or for any errors that may remain in the texts, despite the care taken in preparing them.

The technologies presented in this publication may be covered by intellectual property rights.

**This Results Pack is a collaboration between CORDIS and the European Research Executive Agency.**

@REA_research @Research-Executive-Agency @European-Research-Executive-Agency-(REA)

*Printed by*

| | | | | |
|---|---|---|---|---|
| Print | ISBN 978-92-78-43748-0 | ISSN 2599-8285 | doi:10.2830/206095 | ZZ-AK-23-017-EN-C |
| HTML | ISBN 978-92-78-43747-3 | ISSN 2599-8293 | doi:10.2830/738272 | ZZ-AK-23-017-EN-Q |
| PDF | ISBN 978-92-78-43749-7 | ISSN 2599-8293 | doi:10.2830/78126 | ZZ-AK-23-017-EN-N |

Luxembourg: Publications Office of the European Union, 2023
© European Union, 2023

The reuse policy of European Commission documents is implemented by Commission Decision 2011/833/EU of 12 December 2011 on the reuse of Commission documents (OJ L 330, 14.12.2011, p. 39).
Unless otherwise noted, the reuse of this document is authorised under a Creative Commons Attribution 4.0 International (CC BY 4.0) licence (https://creativecommons.org/licenses/by/4.0/).
This means that reuse is allowed provided appropriate credit is given and any changes are indicated.
Cover photo: © European Union, 2023
For any use or reproduction of elements that are not owned by the European Union, permission may need to be sought directly from the respective rightholders.

# RESULTS PACK ON OPEN INNOVATION TEST BEDS

Europe's tech industries face high capital costs and complex regulation. Knowledge sharing hubs can lower these barriers and bring products to market faster. This updated Results Pack on Open Innovation Test Beds showcases 10 EU-funded projects that are helping to bring new innovations to the market faster.


**Check out the Pack here:**
cordis.europa.eu/article/id/436434

Follow us on social media too!
facebook.com/EUresearchResults
x.com/CORDIS_EU
youtube.com/CORDISdotEU
instagram.com/eu_science

Publications Office
of the European Union

EN