WHITE PAPER

Recommendations towards cooperation between Latin American and European research infrastructures

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Executive summary

International cooperation in science and technology is an important part of addressing major global issues like climate change, infectious diseases, food security and natural disasters. Research infrastructures (RIs) are organizations that enable scientists to use specific facilities, resources and services in order to accelerate scientific achievements, break boundaries and promote sustainable research. Fostering RI partnerships across borders has the potential to improve the efficiency and quality of research to tackle the many challenges faced by society today.

RI-VIS is a Horizon 2020-funded project to increase the visibility and raise awareness of European RIs to new communities in Europe and beyond. This report, as part of RI-VIS, focuses on ways to increase collaboration between Latin American and European RIs. It collates the insights of experts from Latin American RIs, European RIs and policy makers into sections that cover examples of successful collaboration, lessons learned and possible challenges/bottlenecks.

The following key recommendations from experts (RI representatives and policy makers) to facilitate Latin American-European RI partnerships are categorized into actionable items for RI representatives, policy makers and funders:

Key recommendations for RI representatives

RATIONALE/GLOBAL CHALLENGES

- First and foremost, scientific priorities must align between the two parties for a collaboration to be successful.
- Getting involved with initiatives that promote bi-regional collaboration, such as EU-LAC ResInfra (EU-LAC ResInfra, 2019) or EULAC-PerMed (EULAC PerMed, 2019), have proven effective as a means to connect RIs.
- Build trust and relationships incrementally, as having a few initial connections usually opens the door to many more.

FRAMEWORK

- Take into account that legal, ethical and funding frameworks may differ significantly in the other region.

OUTREACH

- European RIs should place more emphasis on outreach activities in Latin America and make it clear that they want to collaborate.
- Understand that Latin American researchers are not as familiar with the concept of open-access RIs in the European sense.

ACCESS

- Think about ways to collaborate virtually, such as making RI tools available through remote access.

SUSTAINABILITY

- Look into signing official agreements that place a priority on long-term, sustainable collaboration with partners from the other region instead of only working together on informal, one-off projects.

Key recommendations for policy makers & funders:

FUNDING

- The concept and many benefits of research infrastructures (RIs) need to be clearly conveyed to policy makers and funders.
- The example of prominent RIs may be leveraged as a success story to show policy makers and funders the advantages of RIs and RI collaboration across borders.
- Core funding to ensure intrinsic stability over a period of several years is key to take the next step of international RI partnerships.
- Small grants or funding opportunities for bilateral collaborative research projects, practical workshops or staff exchanges are necessary.
- European policy makers and funders could reach out to Latin American governmental organizations to establish RI collaborations.
- Political engagement in RI collaborations is important, and science ministers or heads of funding agencies should get involved for maximum impact.

CO-CREATION BASED ON NEEDS

- Funding calls originating from Europe should promote projects that incorporate Latin American colleagues.
- Co-funding is another option which allows countries from different regions to put money in a common pot for ambitious transnational projects.

Contents

Background

In 2015, the United Nations General Assembly outlined a set of 17 Sustainable Development Goals to achieve a better and more sustainable future for all (Sustainable Development Goals, 2015). They aim to address major societal challenges faced by humankind related to disease, climate change, food security, environmental degradation and poverty. Scientific research is an essential part of tackling these issues. The process of gathering information and expanding our knowledge of the world has the power to improve overall health, safety and standard of living.

Research infrastructures (RIs) are crucial to the advancement of science in many fields. The availability of well-maintained RIs facilitates cutting-edge research and training of highly skilled specialists. They include major scientific equipment; resources such as collections, archives or scientific data; e-infrastructures such as data and computer systems; and networks of communication (Ministro de Ciencia, Tecnología e Innovación, 2020).

A key motivation of RIs is the sharing of knowledge and resources across institutions, countries and continents. Large-scale research facilities are incredibly expensive and challenging to build and maintain by one single nation on its own. Others require data collection from different parts of the world. Thus, a more effective and productive way to conduct research is to pool together resources and share costs. Both single-sited and distributed RIs allow for technological transfer to reduce costs, enable user access across borders, set common standards, help to avoid duplications of effort and strengthen regional integration. The European Strategy Forum for Research Infrastructures (ESFRI) was instrumental in setting up a pan-European ecosystem of research infrastructures, promoting not only integrated services from RIs across several disciplines but also providing a forum for dialogue and the promotion of consensus among countries for the future composition of the RI ecosystem and the adoption of common standards and best practices amongst its constituent RIs.

RI-VIS is a Horizon 2020-funded project to increase the visibility and raise awareness of European RIs to new communities in Europe and beyond (RI-VIS, 2020). Part of RI-VIS involves identifying routes to maximize the exchange of information and bases for new partnerships, in particular with RIs or communities outside of Europe. Mutually beneficial RI partnerships across borders can harness collective knowledge, assist in meeting global challenges and enhance global science capacity.

This report assembles the insights of several experts from both Europe and Latin America who have previous experience with such collaboration. Interviews were conducted from August to November 2020 with five representatives from RIs in Europe and Latin America, as well as three individuals from the policy side (see Appendix A). They highlighted examples of Latin American-European RI collaboration, best practices for successful collaboration, challenges/bottlenecks and recommendations to policy makers and funders. The preceding sections will outline the definition of an RI, the importance of RIs to society and the benefits of international research collaboration.

What is a research infrastructure?

The term “research infrastructure” comes with a certain degree of flexibility, since it lacks an established formal definition in scientific and policy literature. The European Commission defines research infrastructures (RIs) as “facilities that provide resources and services for research communities to conduct research and foster innovation” (European Research Infrastructures, 2020). The RI-VIS Communication Toolkit for European Research Infrastructures states that an RI is “an organization that

enables the research community to use specific facilities, resources and services in order to accelerate scientific achievements and promote sustainable research" (Abecasis & Pintar, 2020).

In Latin America as a whole, the concept of research infrastructure is not as well-established and still fairly new. While most European countries have regularly updated national RI roadmaps, only "frontrunner" countries in Latin America such as Argentina and Brazil have undertaken this process (EU-LAC ResInfra, 2020). While the European Strategy Forum on Research Infrastructures (ESFRI) establishes a European Roadmap for research infrastructures across the entire region, no equivalent body or document exists for the Latin American region.

In Argentina, the National Systems of Large Instruments, Facilities and Databases (Los Sistemas Nacionales de Grandes Instrumentos, Facilidades y Bases de Datos) was established in 2008 as an initiative of the Ministry of Science, Technology and Innovation and the Inter-institutional Council of Science and Technology. The programme promotes the efficient use of the country's large-scale equipment and facilities, as well as scientific databases, that exist across different science and technology organizations.

The latest report, published in July 2020, describes RIs as "diverse and heterogeneous" and may include "main scientific equipment, resources such as collections, archives or scientific data, e-infrastructures such as data and computer systems and networks of communication" (Ministro de Ciencia, Tecnología e Innovación, 2020). RIs can register with the National Systems of Large Instruments, Facilities, and Databases by providing information about the host institution and infrastructure, equipment or data. When registered, 20 percent of the available operating time of the infrastructure should be made available to the community.

In 2016, the Brazilian Institute of Applied Economic Research (IPEA) published the first systemized study on the location, quantity and situation of RIs in Brazil (De Negri & de Holanda Schmidt Squeff, 2016). A book that encompassed the methodology and results of the study states that RI is "the set of physical facilities and material support conditions (equipment and resources) used by researchers to carry out R&D activities." It adopted this definition from the Mapping of the European Research Infrastructure Landscape (MERIL), a Horizon 2020-funded project coordinated by the European Science Foundation (ESF) (ESF Member Organisation Forum on Research Infrastructures, 2013).

Despite it being used in different contexts both internationally and even within Europe, the term maintains some common threads across definitions (International Research Infrastructure Landscape 2019: A European Perspective, 2019; Florio, Forte, Pancotti, Sirtori, & Vignetti, 2016):

- RIs are motivated first and foremost by **scientific objectives**. The main purpose of RIs is to generate new knowledge in a scientific field, allow research and innovation to break barriers and push the frontiers of science. They may be **curiosity-driven** without immediate application or application-driven, leading to products or services that directly **benefit humanity.**
- All RIs at their heart contain **valuable and unique assets**, whether they be major facilities, instrumentation, knowledge-based collections or collaborative networks. These networks may be cross-sectoral, multidisciplinary, international or any combination of the above.
- RIs often require **substantial capital investment** that typically goes beyond the capacity of an individual faculty, institution or funding program.

- Access to RIs expands **beyond an institutional level** to a national or international reach. The uniqueness and steep cost of the assets mean that the RI's capabilities will be in demand by external researchers in the field who are based outside the site.

RIs are often placed into three broad categories: single-sited, distributed or virtual. Single-sited RIs are centralized facilities at a single physical location. These include large telescopes, particle accelerators, synchrotrons, nuclear reactor sources or extreme laser sources. Distributed RIs usually integrate research facilities scattered in different regions or countries. They consist of a network of distributed instruments, collections or capacities that, taken as a whole, constitute an RI in order to achieve common goals. An interferometrically linked array of radio telescopes, large genome sequencing facilities or a network of clinical research units are examples of distributed RI. Lastly, virtual RIs are internet/cloud-based systems for scientific research, such as an archive of historical texts or virtual research environments (virtual labs) for data processing and analysis. RIs often offer a mixed category that combines physical and virtual aspects.

High-profile examples of RIs include CERN's Large Hadron Collider, the world's largest and most powerful particle accelerator; INSTRUCT, a collection of distributed facilities that promote structural biology research; Sirius, a Brazilian synchrotron light source that is the largest and most complex research infrastructure ever built in Brazil; and the National Consortium for Scientific and Technological Information Resources (CONRICYT), a digital RI that brings together several Mexican institutions to expand and streamline access to scientific databases and other specialized information. The Mercosur Centre of Structural Biology (CeBEM) is yet another example. While not formally constituted into a distributed RI, CeBEM has been successful in coordinating an array of medium and large facilities located in prestigious research institutions from South America and open to users working in protein science. Further examples from Europe and Latin America are provided in Table 1.

Societal impact of research infrastructures

The development, operation and maintenance of RIs require large investments from countries, sometimes encompassing tens or hundreds of millions of Euro per year. Decisions about investment in RIs at a national level often include an assessment of any direct societal benefits in addition to their future scientific impact (Horlings, Gurney, Somers, & van den Besselaar, 2013). However, such benefits tend to be difficult to predict, particularly for curiosity-driven projects.

For example, the overarching goal of CERN's Large Hadron Collider (LHC) was to better understand the fundamental structure of matter. The total cost of the accelerator, detectors and computing was 4.332 billion Swiss francs, making it one of the most complex and expensive scientific research facilities ever constructed. Beyond its obvious contributions to physics, CERN has been responsible for innovations that have improved medical and biomedical technology, space missions, art restoration and energy efficiency (Our Contribution to Society, 2020). The building of LHC has resulted in highly advanced superconducting magnets, exceedingly accurate measurement equipment and breakthroughs in data communication and storage. CERN also sparked the invention of the World Wide Web in 1989 (The birth of the Web, 2020) and the capacitive touch screen in 1972 (Stumpe & Sutton, 2010).

Other RIs provide direct outputs. For instance, the European Plate Observing System (EPOS) and the European Multidisciplinary Seafloor and water-column Observatory (EMSO) are both distributed RIs that inform society about environmental hazards and allow for more advanced preparation. The Oswaldo Cruz Foundation (FIOCRUZ) in Brazil, a large, distributed organisation composed of 16 scientific and

technical units, works on all aspects of the therapeutic development pipeline, from drug discovery to validation and development.

In addition, RIs have the power to mobilize a global network to consider and refine important ideas that affect humanity as a whole. Global issues include environmental protection, energy security, natural disaster mitigation, preventing/curing infectious diseases and food security. In the area of food security, for example, researchers from academia and industry across the globe often have similar goals, such an increase in crop productivity and resilience, and RIs are pivotal in this respect (Pieruschka & Schurr, 2019).

On the economic side, jobs are created during the RI development process and for long-term maintenance. Gemini South is a large telescope in Chile that employs about 200 people, of which just 30 are astronomers and 80 are Chilean (Barandiaran, 2015). The staff who work there develop skills and knowledge that set them apart from their peers and their substantially-higher-than-average wages reflect their unique proficiencies. In addition, parts of the instrumentation are built by local engineering firms. In Chile overall, the number of faculty positions in astronomy almost doubled between 2006 to 2010 (Catanzaro, 2014).

RIs can also be hubs for innovation, as measured by records on the number of patents filed. The Brazilian RI roadmap included an analysis of patent activity during the period from 2007 to 2011 (De Negri & de Holanda Schmidt Squeff, 2016). A total of 548 infrastructures were associated with 591 patent applications during this time. In particular, patents were more concentrated within RIs who cooperate with other institutions, allow access to external researchers or provide services to companies and other organizations.

Aside from jobs and spillover technologies, RIs impact the economy and society in several other ways. RIs serve as key learning environments and hubs where knowledge is exchanged (Horlings, Gurney, Somers, & van den Besselaar, 2013). Researchers, students, industry and government all interact throughout the RI's development, construction and use. In addition, many RIs participate in public outreach to stimulate interest of students and other members of the community. The aim is to inspire curiosity and encourage a new generation of scientists to enter the field.

Taking all of the above points into consideration, the general consensus tends to be that RIs provide a positive return on investment and a substantial net benefit to society, economic development and scientific progress.

Scientific collaboration across borders

The collaborative nature of scientific research is inherent to its success. By sharing skills and data, researchers improve the efficiency and quality of their work while supporting the process of scientific production, knowledge creation and breakthroughs. The whole of a scientific collaboration is undoubtedly greater than the sum of its parts. But what are the benefits of collaborating with researchers based in other countries?

Different motivations exist, depending on the scientific field and country at hand. However, one thing is clear: The number of scientists participating in international collaborations is growing. An analysis of scientific publications and co-authorships found that international scientific collaboration is increasing in

volume in all research fields over time (Coccia & Wang, 2016). Research is more global, cross-national and cross-cultural than ever before.

A 2019 study of interregional scientific collaboration from the 28 EU countries and Latin American and Caribbean countries demonstrates a steady rise in scientific publications with at least one author from each region (Belli & Baltà, 2019). From 2005 to 2016, the number of co-authored publications increased roughly 9.9 percent per year, with a total increase of 68.3 percent over the entire time period. The leading countries for bi-regional collaboration were found to be Brazil, Spain, France and Germany. However, small and emerging countries like Ecuador, Peru and Uruguay have more recently taken advantage of international collaborations to enhance their visibility in scientific scenarios.

A metaphor used to describe the importance of international collaborations is a frog deep inside a well, who has an excellent view of a small patch of sky (National Research Council, 2008). If most of the research in a field is done predominantly stuck in one well, such as North America or Europe, it can prove detrimental to scientific discovery. Getting out of the well can provide new research topics and collaborators, which help question underlying assumptions and spark fresh insights.

As an example, a 2010 study of scientific research in Colombia found that partners located overseas collaborate with local scientists and engineers to work mostly on Colombian issues or issues where Colombia is of scientific interest (Ordóñez-Matamoros, Cozzens, & García-Luque, 2010). The knowledge, experience and tools brought about by overseas researchers complement those of Colombian researchers. It also found that co-authoring publications with partners located overseas increased Colombian researcher output by nearly 40 percent.

Healthcare (34 percent) and biology (29 percent) are the biggest and most contributive areas of collaborative research between European and Latin American/Caribbean countries, according to the 2019 scientific publication analysis (Belli & Baltà, 2019). Astronomy, physics and environmental sciences are also productive areas of scientific cooperation between the two regions.

Beyond the scientific benefits, international collaboration in large science projects can also save money and support foreign policy (U.S. Congress, Office of Technology Assessment, 1995). The cost of "big science" has gone up, which makes it more difficult for a single nation to undertake such projects alone. Of course, reducing net costs for individual countries also motivates the creation of RIs. Collaboration makes it possible to share both the financial and technical risks of ambitious projects.

Lastly, research can also be a form of diplomacy, leading to alliances and memoranda that support foreign policy objectives. Joint scientific research can strengthen bonds with other countries and establish levels of trust.

Latin American-European research infrastructure collaboration

The European Union and Latin America (along with the Caribbean) "enjoy privileged relations and are natural partners, linked by strong historical, cultural and economic ties," according to the European Union External Action Service (European Union External Action Service, 2018). They share a strategic bi-regional partnership, launched in 1999, and co-operate closely at an international level across a broad range of issues. The EU is the second largest trading partner for the Latin American and Caribbean region (European Commission, 2018).

In terms of scientific collaboration, the asymmetry of relations seen in the 1970s and 1980s has given way to a more equal partnership between the two regions (Gaillard & Arvanitis, 2013). Latin America went through an accelerated process of institutionalization and professionalization of research after the 1940s, and for several decades, scientific collaboration with Europe mostly involved European researchers lending technical assistance to Latin American researchers.

Over time, interactions became mutually beneficial to both parties instead of Europe merely supporting Latin America. A bibliometric analysis of co-authorship for the period 1984 to 2007 found that more Latin American and Caribbean papers were co-authored with European partners (98,155) than with the US and Canada (87,540) (Gaillard & Arvanitis, 2013). Under the seventh Framework Programme, Latin American and Caribbean researchers participated 1,143 times in joint projects with European partners (European Commission, 2018).

Regular summits have been held between the EU and the Community of Latin American and Caribbean States (CELAC) since 1999. CELAC, consisting of all 33 Latin American and Caribbean countries in the region, represents a regional political coordination mechanism. The last EU-CELAC Summit took place in June 2015 and highlighted science and research as a priority area for bi-regional cooperation (European Commission, 2018). Leaders suggested moving towards an EU-CELAC Common Research Area based on increased research cooperation, enhanced mobility of researchers, and exchange of knowledge and best practices.

Established in 2010, the Joint Initiative for Research and Innovation (JIRI) aims to enhance EU-CELAC cooperation on science and research by facilitating bi-regional dialogue on common priorities. Senior Officials Meetings are held regularly to discuss progress and future plans for the JIRI. The eighth meeting convened virtually on 30 October 2020, where the senior officials discussed cooperation on COVID-19 to ensure global access to medicines, vaccines and medical equipment. They also created a 2021-2023 Strategic Roadmap that outlines developments in the EU-CELAC Common Research Area (Senior Officials Meeting, October 2020).

The EU-CELAC Common Research Area has four pillars: mobility of researchers, cooperation of research infrastructures, global challenges and innovation. The roadmap states that the participants of the Senior Officials Meeting “acknowledged the multidisciplinary and strategic role of the Research Infrastructures to promote collaboration across borders of scientific domains, contributing to EU-CELAC strategic priorities in response to Global challenges” (Senior Officials Meeting, October 2020).

So clearly, both Latin America and Europe recognize RIs as an essential part of international scientific collaboration. Bringing together RIs from both regions with the common goal of scientific advancement and innovation has the potential to breathe fresh life into research topics, bring new perspectives and spur on novel developments. In fact, because RIs are already focal points of collaboration within themselves, the mutual advantages of Latin American-European RI partnership are expected to be even greater.

Broadly, RI partnerships at a global or intercontinental scale are worth developing for the following reasons:

- To harness collective global knowledge and experience
- To support leveraging of new international funding for RIs
- To promote access to and exchanges between RIs

- To facilitate the mobility of researchers
- To assist in meeting global challenges
- To compensate each other's shortcomings with regard to available infrastructures

Latin American-European RI collaboration can take many forms, and the examples that follow represent only a small sampling of partnerships. However, our objective is to learn from these real-world cases for the benefit of future collaborations and to better recognize opportunities for the two regions to work together.

Examples

LNMA & Global BioImaging

In 2006, Mexico's National Council of Science and Technology (Consejo Nacional de Ciencia y Tecnología - CONACYT) put out a call for institutions to apply for status as one of several "National Laboratories of Scientific Infrastructure or Technological Development" (CONACYT, 2006). The purpose was to achieve full national scientific development through the consolidation of physical, analytical, and experimental infrastructure that would allow researchers to produce high quality work. Eleven years and 1.6 million pesos (= about 65 thousand Euros) later, Mexico has established 77 National Laboratories that operate across the country in all areas of knowledge.

The National Laboratory for Advanced Microscopy (Laboratorio Nacional de Microscopía Avanzada – LNMA) provides highly specialized optical microscopy services to academic, industrial, and educational institutions. The RI grew out of a scientific collaboration between two researchers, one originally from Mexico and the other from the United Kingdom.

"Originally, I'm from the UK. I did my doctorate and first postdoc there, and then in 2002, I had the opportunity to come to Mexico and continue some work I'd started in the UK with a Mexican researcher," said Chris Wood, Academic Manager of the LNMA. "After a few years, it was obvious that we really needed to improve the availability of infrastructure."

At that time, the concept of RIs as core facilities and open access centers for researchers from any institution simply wasn't part of the landscape in Mexico. Wood and his colleagues had already put together an application for the Wellcome Trust, which had a fund for establishing infrastructure projects in developing countries, when they saw the call for National Laboratories from CONACYT. They rapidly translated the original application back into Spanish, sent it in, and won National Laboratory status along with financial support.

The LNMA facility opened its doors to offer services to scientific researchers in any discipline or Institution in January 2013. In 2015 a second site for the LNMA opened in the Mexican Health Service's main teaching hospital in Mexico City.

Wood spent the first four years spreading the concept of shared, free RI access to Mexican researchers who had never heard of such a thing.

"I did a lot of miles within Mexico, basically putting a lot of shoe leather into giving seminars explaining the concept. I would still have people at the end of a talk raise their hands and say, 'Would you be so

kind as to receive my samples?'" he recalls. "I would reply, 'Absolutely. This is your laboratory, and I am just the custodian.' And they would be amazed."

Once Wood successfully established the LNMA's national reputation, he moved on to increasing the RI's visibility on an international stage. In February 2018, he attended a conference in the US on strategies for bioimaging centres co-organized by Antje Keppler, Head of Imaging Infrastructure Strategy Development at the European Molecular Biology Laboratory (EMBL) and Coordinator of Global BioImaging (HHMI Janelia Research Campus, 2017).

The event was Wood's first introduction to Global BioImaging, a Horizon 2020 project that created an international network of imaging infrastructures and communities in 2015. It brings together imaging facility operators and technical staff, scientists, managers, and science policy officers from around the globe. The network organizes an annual international workshop called Exchange of Experience to discuss common goals, trends, and challenges in running open access imaging facilities.

Keppler, who is also the Interim Section Director of Euro-BioImaging, later reached out to Wood to say that she would love to have more representation from Latin America within Global BioImaging. LNMA is now an active member of Global BioImaging, bringing the unique perspective of a developing country from a different part of the world.

"Even if you work in the best funded science system in the world, you're going to find that there are barriers to development and progress at some point," said Wood. "But the ones that we face in Latin America are not necessarily the same as you would find in Europe, Japan, or the US."

After six years, the LNMA has over 400 registered users from 14 Mexican states, and has delivered over 20,000 hours of services (an average of 14 hours daily). It has received 4.5 million USD in grant awards, and its staff have authorships on 32 – and received over 70 acknowledgements – in published papers. Six students have graduated from the LNMA at undergraduate and postgraduate level.

INSTRUCT

INSTRUCT is a distributed RI in structural biology that makes cutting-edge technologies and methods available to researchers around Europe and increasingly outside of Europe (Daenke & Owens, 2017). It is composed of 14 European Member Countries, one member International Organisation (EMBL), and one Observer Country (Greece). In July 2017, INSTRUCT was awarded European Research Infrastructure Consortium (ERIC) status by the European Commission.

In 2014, the British Council gave INSTRUCT some funding as part of an initiative to create and strengthen links between researchers and institutions in Uruguay and the UK. The RI undertook a small pilot project that allowed for an exchange visit and a structural biology workshop in 2016 organised at the Institut Pasteur de Montevideo in Uruguay. Following the workshop, a memorandum of understanding (MoU) was signed between INSTRUCT and Pasteur Montevideo.

The newly formed relationships with Uruguayan colleagues soon expanded into other connections within Latin America. A key for success in this case nicely illustrates the importance of symmetric work and experiences. The Pasteur Institute in Uruguay had previously joined efforts with several other prestigious research centres in South America, creating CeBEM in 2008. CeBEM is a regional network of

RIs, engaged in consolidating and disseminating Structural Biology methods for Life Sciences, offering medium and large-sized research facilities to Latin American scientists.

Quite similar to INSTRUCT with regards to scientific/strategic aims and values, the fact that CeBEM was already established served to speed up a truly bi-regional association with INSTRUCT, as well as ensured long-term sustainability of such a cooperation. Over the last four years, INSTRUCT has signed eight MoUs with other institutes and networks in Argentina, Brazil, Uruguay, and Venezuela. Members of these institutes were invited to apply for an International Access Call, launched in March 2019, to access the structural biology facilities in INSTRUCT. Such research visits are already delivering concrete results and are leading to much stronger bi-regional collaborations among scientists.

“In the last year, we’ve had another call for research infrastructure access for researchers in Latin America to use our European infrastructure,” said Susan Daenke, Coordinator of INSTRUCT. “That’s been a very successful program over the last several years.”

In addition, INSTRUCT has worked closely with colleagues in Brazil – which already had very sophisticated structural biology infrastructure – to further develop its capability. For example, INSTRUCT RI helped advance the country’s cryogenic electron microscopy (cryo-EM) facility. Brazil is also making a significant upgrade to its synchrotron facility, called Sirius, which should help foster further collaborations with Europe. Sirius will be one of the first 4th-generation synchrotron light sources in the world and designed to be the brightest of all the equipment in its energy class.

“This is very good news for us because they’re very keen to work with us on training programmes but also to establish an exchange programme where they can access our infrastructure and vice versa,” said Daenke. “So we’ve seen a really good expansion on the first relationship with Latin America that we had.”

The INSTRUCT-CeBEM example, with their focus in life sciences, has experienced an unexpected boost with regards to its impact in 2020. Infectious diseases such as COVID-19, while extremely unfortunate for mankind, are utmost pertinent examples of how global research development is very much needed. Pathogens do not respect borders and turn quickly into truly global issues. These cannot be addressed appropriately by building excellent science only in the more developed countries. Only if excellent science becomes a reality everywhere will we be able to tackle the huge challenges that are affecting humanity as a whole.

EULAC PerMed

The term “personalised medicine” generally refers to a medical model that uses the characterisation of individuals’ phenotypes and genotypes (e.g. molecular profiling, medical imaging, lifestyle data) to tailor the right therapeutic strategy or targeted prevention. The field has grown considerably over the last decade with the emergence of new diagnostic and informatic approaches.

Launched in January 2019, the EULAC PerMed project aims to strengthen the cooperation of Europe with Latin America and the Caribbean on research topics within personalised medicine (EULAC PerMed, 2019). It consists of a bi-regional consortium of eleven organisations from ten countries: Spain, Germany, Brazil, Italy, Chile, Uruguay, Panama, Israel, and Argentina. Organisations include the European Clinical Research Infrastructure Network (ECRIN), a distributed RI that was awarded ERIC status in November 2013, and the Oswaldo Cruz Foundation (FIOCRUZ) in Brazil.

Funded by Horizon 2020, EULAC PerMed also aims to engage Latin American countries in the International Consortium on Personalised Medicine (IC PerMed), which supports communication and exchange on personalised medicine research, funding, and implementation. The project has organised major meetings in Madrid, Spain (February 2019) and Montevideo, Uruguay (December 2019) that involved both researchers and stakeholders like policy makers and funders.

“It was amazing how people reacted just to the organization of the meeting. Everybody really came to the meeting from all over Latin America, and this was really great,” said Esther Rodríguez, Head of the European Project Office for EULAC PerMed. “So the first thing you see is that they're really interested in establishing more networking and cooperation with Europe.”

The technical workshop in Montevideo covered innovative methodologies for data use and management in personalised medicine research, while the stakeholder workshop aimed to build bridges in personalised medicine between Latin America and Europe. Around 60 to 70 participants took part in the stakeholder workshop, while 50 participants were selected for the technical workshop through an application-based process. The meetings highlighted opportunities to work together as well as challenges or barriers to bi-regional cooperation.

“Our priority is to make personalized medicine a reality in Europe and beyond,” said Rodríguez. “For Latin America, we wanted to know if we share a common vision and understanding on what personalized medicine is, and what is being done on both sides.”

While the COVID-19 pandemic prevented face-to-face meetings among the consortium, the members of EULAC PerMed managed to organise its 3rd summer school (November 2020) as a virtual event on the ethical, legal, and societal aspects of personalised medicine. Also, as part of the project, ECRIN and the Gorgas Memorial Institute for Health Studies in Panama are working together to establish a clinical trial helpdesk to facilitate networking between experts from the two regions.

LifeWatch & LNVCS

In March 2016, the EU-CELAC Senior Officials Meeting on science and technology confirmed “access to research infrastructures” as one of the three pillars for the implementation of the Common Research Area (EU-LAC WORKING GROUP ON RESEARCH INFRASTRUCTURES, 2017). One year later, a bi-regional Working Group on Research Infrastructures was established to support policy making and coordination in the RI dimension. The objectives of the Working Group include the exchange of information on EU-LAC RI policies and the identification of RIs that are priorities for bi-regional cooperation.

Andrés Eduardo Triana Moreno, Director of Research Infrastructures and Research Networks at Mexico’s National Council of Science and Technology (CONACYT), serves as a liaison between Mexican and European RIs as a member of this Working Group. At a meeting in Costa Rica, he met representatives from LifeWatch, a European distributed RI that supplies e-Science research facilities for the study of biodiversity and ecosystem which achieved ERIC status in March 2017.

“When we were talking to LifeWatch, we were exploring the possibilities to include different kinds of collaborations with them because they are working on very interesting topics about climate change and environment,” said Moreno. “In Mexico, we are very interested in that agenda. So when I came back to

Mexico, I was talking with my partners in my office about the possibilities to explore some collaboration with them."

At the same time, a Horizon 2020 project called EU-LAC ResInfra began in January 2019 as a way to support the dialogue within the Working Group. EU-LAC ResInfra will create a map of national and regional RI policies, with the objective of identifying eligible RIs for European-Latin American collaboration (EU-LAC ResInfra, 2019). It also aims to develop four pilot projects that build on existing European RIs – LifeWatch being one of them – in an area of knowledge identified as a priority for scientific cooperation between the EU and LAC.

Moreno put LifeWatch in touch with the National Laboratory of Housing and Sustainable Communities (Laboratorio Nacional de Vivienda y Comunidades Sustentables - LNVCS), an inter-institutional body with technical and scientific competencies that focuses on the development of sustainable housing and communities. He facilitated meetings between the two RIs that explored areas of interest and potential partnerships.

So far, LifeWatch and LNVCS plan to explore two topics together. The first is studying traditional techniques of making houses in the south of Mexico and the north of Guatemala, where they use natural materials and tools. LifeWatch is interested in learning more about these methods for building European houses. The second topic revolves around urban planning and creating more sustainable smart or green cities, which fits with both LifeWatch's agenda and the European Green Deal.

"The idea of ResInfra, more than the specific issues that the RIs can work on together, is to explore a more sustainable collaboration agenda for the next three, four, or five years," said Moreno. "The goal is really the formalizing of relationships between Mexican and European partners. In this moment, we are interested in another level of this relationship to involve the policy makers, funders, and managers."

MIRRI & Brazil

Biological Resources Centres (BRCs) act as service providers and repositories of living cells, genomes of organisms, and information relating to heredity and functions of biological systems. They ensure the proper maintenance and exchange of biological resources that are necessary parts of scientific investigations in biotechnology.

Since 1998, the Organisation for Economic Co-operation and Development (OECD) has been building international cooperation among BRCs. It aims to establish a global BRC network that will enhance access to biological resources and foster international collaboration. The project was first coordinated in 2008 by two leading European institutions in culture collections, the UK's Commonwealth Agricultural Bureaux International (CABI) and Germany's Deutsche Sammlung von Mikroorganismen und Zellkulturen (DSMZ).

"They started this demonstrative project for the global BRC network, which involved different countries including Brazil," said Manuela da Silva, Director of Biological Collections at FIOCRUZ in Brazil. "So the people from Europe involved with this project were also the people involved with MIRRI, and that's why they invited Brazil to become an observer country."

Launched in 2012, the Microbial Resource Research Infrastructure (MIRRI) spans more than 40 public biorepositories and research institutes from 19 European countries. It facilitates access to a broad range

of high quality bioresources and data to support research and development in the field of biotechnology. MIRRI includes both Member States and Observer States, and Brazil was invited to be an Observer State.

First, da Silva and her colleagues wish to organise a stable BRC network within their own country. Eventually, the Brazilian BRC network will link together multiple institutions including FIOCRUZ, the state-owned Brazilian Agricultural Research Corporation (EMBRAPA), the University of Campinas, and a large cell bank in Rio de Janeiro.

Once the network is officially recognised by Brazil's Ministry of Science, Technology and Innovation, da Silva hopes to reconnect with her European colleagues. She also has a more ambitious goal of creating a Latin American or South American BRC network that will become part of a global BRC network made up of several regional BRC networks such as MIRRI.

Despite not joining MIRRI yet, the initial steps to membership and overall discussions between MIRRI and Brazilian BRCs have already produced some fruitful results. Representatives from DSMZ and CABI came to Brazil to evaluate the collections and, in doing so, shared useful information about quality management systems.

"They brought their experience, which was very important because the DSMZ and CABI are two institutions which have their quality systems in place and are accredited. So, we had a lot of discussion about this," said da Silva. "Even today, because of all these exchanges, we have a very good relationship with some European collections."

They also spoke about the complexities of access and benefit-sharing legislation, which aims to share the benefits arising from the utilisation of genetic resources among countries in a fair and equitable way. Currently, DSMZ is helping Brazilian BRCs with some issues related to national legislation. Da Silva has a close relationship with the Belgian culture collection network as well, known as the Belgian Co-ordinated Collections of Micro-organisms (BCCM), and she recently did an exchange visit to evaluate their collections and learn from the other's experiences.

Recommendations and best practices

The successful Latin American-European partnerships outlined above have several similarities that point to recommendations for future RI collaboration.

RATIONALE/GLOBAL CHALLENGES
Getting involved in large, multinational initiatives like ResInfra, the EULAC Working Group on Research Infrastructures, and EULAC PerMed has proven effective as a means to connect RIs from both regions. EULAC PerMed has an overarching global challenge in mind – to better the health of the world populations through personalised medicine – that serves as a common motivator. The EULAC Working Group, on the other hand, explores collaboration within five topics that both regions have expressed interest in, which comprise energy; biodiversity and climate change; food security, health and emerging technologies.

"International collaboration works best by incrementally building trust and relationships, as well as identifying where the needs and interests are of both parties," said Daenke.

INSTRUCT's involvement with ResInfra and other projects focused on European-Latin American cooperation have opened the doors to other countries within the region that the RI previously had no contact with. But Daenke emphasizes that scientific priorities between the two parties much align to produce a successful partnership.

"They're not really interested in working on our problems. They want to solve their own problems," she said. "We as a research infrastructure need to make sure that what we're offering is relevant to the topics that they want to address."

FRAMEWORK

Rodríguez suggests that European RIs take into account the very different frameworks – legal, ethical, funding etc. – present in different Latin American countries. For instance, something like the General Data Protection Regulation in the EU that gives individuals control over their personal data doesn't always exist in other places.

"If you really want to implement something for real, you have to deal with these issues, and they're very different from country to country," she said. "So, you have to deal with these different realities."

This issue can be acutely observed when it comes to the exchange of biological samples from one country to another. The Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization to the Convention on Biological Diversity, as well as national laws and regulations (especially in Brazil (Dutra, Campos, Santos, & Calixto, 2016)), make it very difficult for scientists to freely exchange samples. For instance, if a chemist wants to make compounds available through EU-OPENSCREEN, there is a risk that the required paperwork would prevent this sort of collaboration.

OUTREACH

RIs in both regions should also place emphasis on outreach activities. In particular, European RIs could initiate communication, since many researchers in Latin America may not be familiar with the concept of research infrastructures.

In order to establish his lab's reputation nationally, Wood spent several years giving seminars around Mexico, explaining what RIs do and how they exist for the purpose of aiding researchers. Having Latin American scientists understand the benefits of their own local RIs may also help them become more receptive to collaboration with European RIs.

"What was probably our biggest hurdle in the early stages, was actually to change the culture and way of thinking," said Wood. "Once that was established, and I could feel that we were accepted as part of the community as a reference point for microscopy, I took the strategic decision to make contact with our international peers."

In addition, Moreno believes that European RIs – even those with legal ERIC status – are not sufficiently visible in Latin America. Initiatives like RI-VIS and ResInfra serve as excellent opportunities to show Latin American researchers that European RIs are eager to work together on collaborative projects.

"When you are inside this world of research infrastructures, you know about ERICs, but when you are just a researcher in your institution, you don't always know. And you don't know that the ERICs are

interested to explore other networks outside of Europe," said Moreno. "I think it's very important to have ERICs show what they are doing outside of Europe."

ACCESS
The COVID-19 pandemic has certainly slowed down some bi-regional partnerships, but it has also facilitated the creation of innovative tools that allow for increased virtual collaboration. For instance, INSTRUCT has transformed many of their tools from physical access, where people actually visit their centres to do the work, into remote access. Nearly all their infrastructure now is available from remote access, where researchers can monitor and gather data from their own computers.

"That means that the work can still be done, but you don't have to travel. And that has been a revelation," said Daenke. "It has pushed the development of technologies so that remote access becomes available to more people."

However, virtual access for many RIs is not a permanent solution and does not replace other forms of access. It can serve as a compromise or add-on, but having users present on-site will always be more valuable.

SUSTAINABILITY
One major aim of the ResInfra project is to develop a Sustainability Plan for a long-term bi-regional collaboration rather than short-term, one-off projects. Moreno believes that the key to sustainability lies in the signing of official agreements such as MoUs that involve policy makers and funding agencies. Without a formal partnership that involves other parties, scientific collaboration across borders can become short-lived or fall by the wayside.

"All of us know that we have a lot of years working together but not officially. The researchers and institutions usually have a relationship with partners on other side, they have friends at the other institution, they travel, and they build these relationships in that way," Moreno said. "We have to concrete the agreements and other instruments to the policymakers and the managers of the infrastructures here in Latin America to establish the relationship more formally."

Challenges and bottlenecks

In terms of factors that hinder Latin American-European RI collaboration, most experts mentioned funding as a challenge.

Rodríguez mentioned that RIs must cope with the fact that there are no such funding instruments akin to Europe's framework programmes in Latin America. Many Latin American RIs receive funding as an institution and not for specific collaborations, so they must look for additional funding when it comes to collaborative projects. Even national funding for scientific research in general is not always stable, as Daenke describes, and that usually comes from political volatility.

"These national fluctuations have a big effect on not only funding but also the research environment and the stability of academic salaries and tenure ship in academic posts, and so on," said Daenke. "It's sometimes difficult to navigate through that and to maintain relationships even in spite of the instabilities that might be operating nationally."

Da Silva talked about the difficulties with the change in Brazilian government that has significantly delayed the creation of a Brazilian BRC network – and subsequently, the joining of Brazil as an Observer State within MIRRI. In 2016, an ordinance published by the Ministry of Science, Technology and Innovation outlined all the steps needed for the recognition of the network. But the new government changed everything, and the ordinance lost its purpose. Now, da Silva and her colleagues have to start from scratch.

“We don’t know when we are able to get back on track. That’s why, in Brazil, we still don’t have a recognized BRC,” said da Silva. “We have several candidates, and some of them are already accredited by our accreditation body, but we don’t have a BRC network yet as we planned it.”

Moreno agreed that bureaucracy in Latin America can easily frustrate researchers who are eager to work together. Even when two parties are ready to formalize a scientific collaboration with a written agreement and dedicated funding, extreme delays introduced by legal reviews and other issues can get in the way.

“As a very specific example, when the lawyers review the documents to sign agreements on both sides, they have very different ways to make the assessment. It can take months and months,” said Moreno. “The researchers may feel confused and sad because they say, ‘I'm ready to start to work with my partner in the other region, but you, the bureaucracy, you never help us.’ This is the principal problem.”

In addition, the fragmentation of the regulatory framework in Latin America – with no overarching guidelines like in the EU – can serve as an obstacle to successful research collaboration. This can prove challenging from both sides, as some EU policy makers and investigators are less knowledgeable about this fact and believe that Latin America operates as a multi-country block. On the other hand, Latin American policy makers and investigators sometimes have a simplistic vision of what it takes to navigate the EU system, assuming that there are single policies and frameworks for every aspect.

Another challenge is the language barrier that can arise between certain countries from Europe and Latin America. Natalie Haley, Project Manager at INSTRUCT, notes that language is a key point when engaging with different regions. It can be far more productive and meaningful to have someone on the RI side who speaks the local language fluently when engaging with representatives from Latin American governments.

“Particularly, the funders speak in their local language and feel more comfortable interacting in that language,” said Haley. “Although the scientists may speak English, the policy makers and funders may not, so it makes things difficult sometimes.”

Advice for policy makers and funders

The expert interviews revealed recommendations for policy makers and funders coming from the government side, both in Latin America and Europe, that would increase RI partnerships between the two regions.

FUNDING
First and foremost, more policy makers and funders in Latin America need to understand the concept and many benefits of RIs. Wood’s colleagues based in other Latin American developing countries have asked him to talk to their science ministers about the importance of establishing and funding RIs. Once

RIs are built up at a national level, they can then raise their profile to the international level and begin to collaborate more widely with regions like Europe.

“The argument has to be made for the benefits of organizing facilities or infrastructures into networks and centralizing them,” said Wood. “That argument doesn’t have to be made to scientists, but I do think that argument has to be promoted still to the funders.”

While policy makers and funders in the EU seem to intrinsically recognise the advantages of RIs, their Latin American counterparts need to be introduced to the idea first, perhaps by presenting European RIs as a success story. Many European RIs receive a degree of core funding to give them sufficient continuity and stability over a window of five to ten years – enough time to initiate and foster a long-term international scientific partnership.

“That kind of core funding just releases your shackles and enables you to think big. That is something I would dream about having in this region,” he said.

While larger, more complex projects like EU-LAC ResInfra have been successful, one should not ignore the importance of small grants and other funding opportunities for bilateral collaborative research projects, practical workshops, and staff exchanges. They can complement higher-impact projects while serving to bring scientists together and initiating collaborative research projects. For instance, Latin American funders can start small by providing funds to their own scientists to access European RIs.

European policy makers and funders could also reach out to Latin American governmental organisations to establish concrete collaborations with the region through RIs. Wood recommends having some kind of political engagement included in those initiatives by inviting science ministers or heads of funding agencies.

European programmes that are open to the world or emphasize non-EU partners have worked well to foster collaboration between the two regions. Horizon 2020 was the biggest EU Research and Innovation programme to date, with nearly 80 billion Euro worth of funding available over seven years (2014 to 2020). It was “Open to the World,” meaning that participants from anywhere could apply for most of the calls. In addition, several topics strongly encouraged or required cooperation with non-EU partners.

Up to October 2018, CELAC entities participated 524 times in 265 signed grants of collaborative, Marie Skłodowska-Curie, and European Research Council (ERC) actions of Horizon 2020, receiving a total of 26.3 million euros from the EU. The successor to Horizon 2020, Horizon Europe, will allocate an even more ambitious 95.5 billion Euro and cover the period of 2021 to 2027.

CO-CREATION BASED ON NEEDS

In addition, experts support having more funding calls originating from both European and Latin American sides that promote bi-regional projects. For example, Horizon 2020 had a call that funded several research projects in collaboration with Latin America including EULAC PerMed. Rodríguez also recommends more opportunities for “common pot”-style funding where countries collectively put money together for research.

“You each put a little bit of money, decide on the topics you want to fund, and then each party saves money on the management,” said Rodríguez. “Also, you can fund wider and more impactful projects

because they're transnational. So if you believe you really can share some priorities, I think it's worth it for the funders to go for these transnational programs."

She describes the success of ERA PerMed, a funding instrument under Horizon 2020 to support collaborative research projects in personalised medicine. The co-fund is supported by 32 partners from 23 countries and co-funded by the European Commission. EULAC PerMed aims to bring Latin American countries into the ERA PerMed funding scheme so they can work on transnational projects together. Panama already joined the 2020 funding call, and Brazil and Chile are due to join the 2021 funding call.

Future opportunities and areas for growth

Overall, experts believed that Latin American-European RI collaboration would only increase in the future and highlighted several potential avenues for cooperation.

Daenke remarks that INSTRUCT's various collaborations with Latin America have been very rewarding, and the RIs participation in projects like ResInfra continue to open up contacts with more countries. Countries like Brazil already have sophisticated structural biology technology, but even the smaller countries have great science and new areas of knowledge to offer.

"It's important for them to not only be in receipt of some of the work and infrastructure access that we can provide for them, but they also want to provide something themselves as well," she said. "So the collaboration goes both ways. We can provide some of the technology and infrastructure, but they provide great science and the support for doing that."

For instance, experts at INSTRUCT have worked with Latin American colleagues on pathogenic diseases that are endemic to the region but not in Europe. These are areas of interest that European researchers wouldn't otherwise have an opportunity to be involved in.

The European Green Deal, an action plan to make the EU's economy sustainable, could also provide incentive for collaboration with Latin America. The EU aims to become climate neutral by 2050, and it plans to work with international partners to improve global environmental standards.

Every country in Latin America represents a different set of opportunities for scientific collaboration with Europe. Ana Vasquez and Nancy Ghan, representatives from the National Research and Innovation Agency of Uruguay (ANII), describe the country as small but very capable in terms of scientific research. Their strengths include agriculture, information technology, biomedical research, and clean energy. Andres Lopez Lara, a representative from the National Research and Development Agency in Chile (ANID), mentions that Chile is abundant in "natural laboratories" like the Atacama Desert, the Pacific Ocean, and access to Antarctica.

"We have a really strange geography in Chile. We have the driest desert in the north, and we have Antarctica in the south," said Lara. "For example, the rovers that went to Mars came here first to know how they can work. We also have a lot of volcanoes."

Lara hopes that Chilean researchers will increase collaboration with Europe in the future for access to better technology, as well as the chance to tackle problems of a global scale. To face looming issues like climate change, the regions of the world need to work together. Chile, in particular, has several research institutes dedicated to studying Antarctica. Of course, the COVID-19 pandemic has also highlighted the

advantages of sharing information and working together to get results more quickly. Latin America has the strength of a huge population and incredible diversity, which are optimal when studying genomic medicine.

"One strength that is very clear, apart from their own capabilities in research at different places in Latin America, is the size of population," said Rodríguez. "Diversity is a key strength when dealing with personalized medicine because then you have rich information."

Conclusion

Latin American-European RI collaboration has the potential to advance scientific progress in several areas, including genomics, agriculture, arts and humanities, and medicine. Challenges and bottlenecks do exist – for instance, large time differences and the lack of European funding available to Latin America – but the case studies outlined in this report demonstrate that these can be successfully overcome.

Key recommendations from experts to facilitate Latin American-European RI partnerships can be categorized into actionable items for RI representatives, policy makers and funders.

Key recommendations for RI representatives

RATIONALE/GLOBAL CHALLENGES

- First and foremost, scientific priorities must align between the two parties for a collaboration to be successful.
- Getting involved with initiatives that promote bi-regional collaboration, such as EU-LAC ResInfra (EU-LAC ResInfra, 2019) or EULAC-PerMed (EULAC PerMed, 2019), have proven effective as a means to connect RIs.
- Build trust and relationships incrementally, as having a few initial connections usually opens the door to many more.

FRAMEWORK

- Take into account that legal, ethical and funding frameworks may differ significantly in the other region.

OUTREACH

- European RIs should place more emphasis on outreach activities in Latin America and make it clear that they want to collaborate.
- Understand that Latin American researchers are not as familiar with the concept of open-access RIs in the European sense.

ACCESS

- Think about ways to collaborate virtually, such as making RI tools available through remote access.

SUSTAINABILITY

- Look into signing official agreements that place a priority on long-term, sustainable collaboration with partners from the other region instead of only working together on informal, one-off projects.

Key recommendations for policy makers & funders:

FUNDING

- Policy makers and funders should understand the concept and many benefits of RIs.
- The example of prominent RIs may be leveraged as a success story to show policy makers and funders the advantages of RIs and RI collaboration across borders.
- Core funding to ensure intrinsic stability over a period of several years is key to take the next step of international RI partnerships.
- Small grants or funding opportunities for bilateral collaborative research projects, practical workshops or staff exchanges are necessary.
- European policy makers and funders could reach out to Latin American governmental organizations to establish RI collaborations.
- Political engagement in RI collaborations is important, and science ministers or heads of funding agencies should get involved for maximum impact.

CO-CREATION BASED ON NEEDS

- Funding calls originating from Europe should promote projects that incorporate Latin American colleagues.
- Co-funding is another option which allows countries from different regions to put money in a common pot for ambitious transnational projects.

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Table 1: Examples of Research Infrastructures in Europe and Latin America

Energy	• European Carbon Dioxide Capture and Storage Laboratory Infrastructure (ECCSEL) • Brazilian Centre for Research in Energy and Materials (CNPEM)
Environment	• European Multidisciplinary Seafloor and water column Observatory (EMSO) • Centro de Referência em Informação Ambiental (CRIA)
Biomedical Sciences	• European Clinical Research Infrastructure Network (ECRIN) • The Oswaldo Cruz Foundation (FIOCRUZ) • The Mercosur Centre for Structural Biology (Centro de Biologia Estructural del Mercosur – CeBEM)
Physics & Engineering	• European X-Ray Free-Electron Laser Facility (European XFEL) • Labratorio Argentino de Haces de Neutrones (LAHN)
Social Sciences & Culture	• Survey of Health, Ageing and Retirement in Europe (SHARE) • Instituto Nacional de Estadística y Censos (INDEC)
Big Data & Computing	• European High-Performance Computing Joint Undertaking (EuroHPC JU) • High-Performance Computing Latin America Community (HPCLatAm)

Many more examples of research infrastructures can be found in the RISCAPE International Research Infrastructure Landscape 2019, which can be found online at https://riscape.eu/riscape-report/.

APPENDIX A: List of experts interviewed

Dr. Susan Daenke, Coordinator of the Instruct-ERIC Hub

Daenke is the Coordinator of the Instruct-ERIC Hub, a pan-European distributed research infrastructure making high-end technologies and methods in structural biology available to users. She is responsible for the delivery of all access, training, internship, and networking offered through Instruct. She has more than ten years of experience in managing and coordinating large European projects in structural biology. Daenke is a former scientist and group leader who oversaw the implementation of the first European Commission access program to be run at the structural biology facilities through the I3 project P-CUBE and subsequently through the Biostruct-X project.

Dr. Manuela da Silva, Director of Biological Collections at FIOCRUZ

Since August 2002, da Silva has worked as a Federal Government Specialist at the Instituto Nacional de Controle de Qualidade em Saúde of Fundação Oswaldo Cruz (INCQS/FIOCRUZ) in Rio de Janeiro, Brazil. She focuses on the identification and preservation of fungi from environmental and clinical samples. Her work also consists of research on fungal degradation of pollutants, fungal diversity, fungal deterioration, and their elimination by gamma radiation. da Silva graduated in Biological Science from the São Paulo State University (UNESP) in 1991 and then started her career at the International Mycological Institute (now CABI) from 1992 to 1993, compiling the list of fungi from Brazil.

Andrés Eduardo Triana Moreno, Director of Networks and Scientific Infrastructure at the National Council for Science and Technology (CONACYT) in Mexico

Triana is the Director of Networks and Scientific Infrastructure and Deputy Directorate for Scientific Development at the National Council for Science and Technology (CONACYT) in Mexico. He participates in the EU-CELAC Working Group on Research Infrastructures (WG RI), which was officially created in March 2017, highlighting the importance of research infrastructures as one of three strategic pillars of the EU-CELAC Common Research Area (CRA). Triana also has a role as a coordinator of Work Package 4 for the Horizon 2020-funded ResInfra project, which pursues the construction of a bi-regional collaboration between the EU and LAC countries.

Nancy Ghan, Cooperation Officer at the National Research and Innovation Agency of Uruguay (ANII)

Ghan is a professional with a scientific background and experience in molecular biology applied to diagnosis in human health. At present, she is working in the field of Science, Technology, and Innovation Management as a Cooperation Officer at the National Research and Innovation Agency of Uruguay (ANII). Ghan also has a role as a teacher and mentor for biotechnology entrepreneurs. She is trained in Quality Management, Intellectual Property, and Marketing. She received her degree in biochemistry and molecular biology from Universidad de la República in 2005.

Andrés López Lara, National Contact Point for Research Infrastructures at the National Research and Development Agency of Chile (ANID)

López currently works as the Fondequip Program Officer in the Scientific and Technological Equipment Program and the National Contact Point for Research Infrastructures at the National Research and Development Agency (ANID) in Chile. He also serves as a representative of Chile in the CELAC-EU

initiative of research infrastructures. He received his degree in Industrial Civil Engineering from the Pontificia Universidad Católica de Valparaíso in 2006 and his Diploma in Management Skills from the Universidad Adolfo Ibáñez in 2013. In total, López has more than 11 years of experience and more than 7 years in management and leadership positions in various organizational areas.

Dr. Esther Rodríguez, Head of European Project Office at the Instituto de Salud Carlos III

Rodríguez is the European Project Office Director at the Instituto de Salud Carlos III based in Madrid, Spain. She has a role as the National Contact Point and expert for the European Research Council and Research Infrastructures. In terms of science policy, she has experience in reporting for policy makers such as performing follow-up of Competitive Councils and Horizon 2020 preparation. Rodríguez received her doctoral degree in physics from the Université Denis Diderot (Paris VII) in 2005 and a postgraduate degree in International Management of RTD projects from the Universidad Politécnica de Madrid in 2007.

Ana Vasquez Herrera, Cooperation Officer at the National Research and Innovation Agency of Uruguay (ANII)

Vasquez is a Cooperation Officer at the National Research and Innovation Agency of Uruguay (ANII). Her professional interest is focused on the design and management of projects that aim to bring together the fields of science, technology and innovation, and society. From this axis, Vasquez has participated in scientific communication projects, public participation in science and technology, and promotion of science and scientific careers. More recently, she has expanded her experience and training in the field of organizational communication. Vasquez received her degree in biology and life sciences from Universidad de la República in 2013.

Christopher Wood, Director of the National Laboratory for Advanced Microscopy (LNMA)

Wood is an optical microscopist and cell biologist, and Director of the Laboratorio Nacional de Microscopía Avanzada (National Laboratory for Advanced Microscopy or LNMA), incorporated into the Instituto de Biotecnología, UNAM. He graduated with Honours from the University of Oxford with a Bachelor's degree in Biochemistry and gained his Ph. D in 2000. Wood arrived in Mexico in 2002 to continue studies with Dr Alberto Darszon of the Instituto de Biotecnología, UNAM. He subsequently became an Associate Researcher in the laboratory of Dr Luis Covarrubias. Since 2008 he has worked to establish Mexico's first open-access microscopy core facility, and after receiving funding from Conacyt and UNAM in 2011, the Laboratorio Nacional de Microscopía Avanzada opened its doors to offer services to scientific researchers in any discipline or Institution in January 2013. In 2015 a second site for the LNMA opened in the Mexican Health Service's main teaching hospital in Mexico City. After six years the LNMA has over 400 registered users from 14 Mexican states, and has delivered over 20,000 hours of services (an average of 14 hours daily). It has received 4.5 million USD in grant awards and its staff have authorships on 32, and received >70 acknowledgements, in published papers, and six students have graduated from the LNMA at undergraduate and postgraduate level.

APPENDIX B: Further reading

ESFRI Roadmap 2018: Strategy Report on Research Infrastructures:
http://roadmap2018.esfri.eu/media/1066/esfri-roadmap-2018.pdf

RISCAPE International Research Infrastructure Landscape 2019:
https://riscape.eu/wp-content/uploads/2019/12/Riscape_report_digi_19122019.pdf

Grandes instalaciones científicas en Iberoamérica:
http://tux.iar.unlp.edu.ar/boletin/bol-mar10/2010-01revistacts.pdf

INFORME SOBRE INFRAESTRUCTURAS DE INVESTIGACIÓN EN ARGENTINA (Argentina RI Roadmap):
https://www.argentina.gob.ar/sites/default/files/catalogo_-_sistemas_nacionales_2707.pdf

SISTEMAS SETORIAIS DE INOVAÇÃO E INFRAESTRUTURA DE PESQUISA NO BRASIL (Brazil RI Roadmap):
https://ipea.gov.br/portal/index.php?option=com_content&id=27203:sistemas-setoriais-de-inovacao-e-infraestrutura-de-pesquisa-no-brasil

EU-LAC ResInfra D2.1 Report on the criteria, scientific areas and methodology to develop the LAC RI landscape: https://resinfra-eulac.eu/resinfra-deliverables/