

## PROPOSAL - SECOND CALL NATIONAL CALL FOR SHARED-USE MAJOR SCIENTIFIC AND TECHNOLOGICAL EQUIPMENT SERVICE CENTERS, 2021

<p><b>Proposal Title</b></p>	<p><b>SmartC-Bioren: Strengthening the scientific-technological platform in bioresources</b></p>
<p><b>Name and briefly description of the Center</b>  (describe the objective, the equipment available and operational, as well as the service to be provided)</p>	<p>The Scientific and Technological Bioresources Nucleus (BIOREN-UFRO) aims to strengthen multidisciplinary research and development in biological resources and bioprocesses associated with food production, environmental sustainability, and human health. The main objective is to gather and coordinate multidisciplinary research teams that include Chemists, Biochemists, Molecular Biologists, Cell Biologists, Microbiologists, Agronomic, Environmental, Forestry, and Medical Engineers to develop innovative biological products and bioprocesses. Currently, BIOREN-UFRO is a multidisciplinary platform organized into five units <b>I) Microscopy and Flow Cytometry, I) Genomics and Bioinformatics, II) Proteomics and Metabolomics, IV) Materials and Carbon Footprint Prospecting and V) Microbiome and Microbiology</b>. These units have a wide range of equipment available to users; eleven have been awarded through Fondecap projects: <b>1.</b> Sequencer NGS Illumina Miseq System; <b>2.</b> Sanger Sequencer Applied Biosystems 3500 Genetic Analyzer; <b>3.</b> Scanning Electron Microscope HITACHI SU3500; <b>4.</b> Ultramicrotome LEICA EM UC7; <b>5.</b> Cell Sorter Becton Dickinson FACSAria Fusion; <b>6.</b> MALDI-TOF/TOF Bruker Autoflex Speed; <b>7.</b> Preparative ultracentrifuge Beckman Coulter Optima XPN 100K; <b>8.</b> Nano spray dryer Buchi Nano spray dryer B90; <b>9.</b> Gas chromatograph/mass spectrometer (GC/MS) Perkin Elmer Clarus 680 GC Clarus SQ8T MS and TL8500 interfase; <b>10.</b> The Simultaneous Thermal Analyzer TGA-DSC Perkin Elmer STA 6000 and, <b>11.</b> Z-SIZER MALVERN Nano ZS ZEN 3500. These units provide many academic and scientific public services in diverse research areas, including <b>1.</b> Preparation and processing of samples for Optical Microscopy, Electron Microscopy, and Flow cytometry; <b>2.</b> Obtaining fine and ultrathin sections of tissues and cells; <b>3.</b> Image acquisition and analysis; <b>4.</b> sample processing, including complex samples, for genomic research and construction of genomic libraries; <b>5.</b></p>



	<p>Amplification of regions or genes of interest; <b>6.</b> Sequencing of first and second-generation (massive or NGS); <b>7.</b> Determination of molecular masses; <b>8.</b> Protein Identification by Peptide Fingerprint; <b>9.</b> Analysis of small and large organic molecules; <b>10.</b> Fast and reliable identification of microorganisms; <b>11.</b> Bioinformatic analysis and support; <b>12.</b> Simultaneous quantification of elements by combustion; <b>13.</b> Determination of the composition and quality of organic matter associated with materials; <b>14.</b> Morphological analysis of materials; <b>15.</b> Zeta potential measurement of colloids and nanoparticles; <b>16.</b> Service of microbial collection in the Chilean Culture Collection of Type Strains-CCCT (<a href="http://ccct.ufro.cl/">http://ccct.ufro.cl/</a>); <b>17.</b> Many other complex services and analyzes.</p> <p>The BIOREN-UFRO has been a successful platform as reflected in the formation of human capital, research development, publications, awarded projects, and national and international cooperation networks (see section indicators). However, a qualitative and quantitative leap is required to connect this platform with the outside, enabling and facilitating our research equipment to the public and private sectors. Moreover, BIOREN-UFRO still has to deal with some difficulties derived mainly from the lack of budget for its operation, which are detailed: 1. Centralized management system focused on internal scientific growth (Research groups, Ph.D. programs, and students); 2. Budgetary limitations that influence maintaining equipment (specially obtained from Fondecap projects), the number of hiring trained personnel, the timeliness of the analysis carried out, and underutilization of several types of equipment. 3. Low visibility and outreach outside the scientific community. Therefore, we propose an administrative and functional restructuring of BIOREN-UFRO, named <b>Service Management Analytical Research and Training Center (SmartC-Bioren)</b>. In this context, the main objectives of our proposal are "To strengthen and consolidate the service platform <b>SmartC-Bioren</b> proposed as a Service Management Analytical Research and Training Center through structural reorganization, diversification, and optimization of new services provided and actively searching for new users". The <b>Specific objectives involved in the proposal are</b> 1) To strengthen management by restructuring BIOREN-UFRO and to create the Service Management Analytical Research and Training Center (SmartC-Bioren). 2) To reinforce the quality, improve opportunity, and diversify the services provided to the stakeholder from private and public organizations. 3) To increase the outreach activities and visibility of SmartC-Bioren and attract users from the productive sector and other scientific and public institutions. 4) To consolidate and increase national and international collaborative networks with similar technologies. 5) To consolidate the SmartC-Bioren as a regional, national, and international reference center in areas of scientific knowledge that address the main challenges of Chile and the world, including climate change, food security, biomedicine, emerging infectious diseases (i.e., COVID-19), and sustainable management of natural resources.</p> <p>Finally, we expect that through the technical proposal and business model that the SmartC-bioren will be operationally and financially sustainable. Consequently, consolidating the SmartC-Bioren as a reference in scientific</p>
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and technological services at the regional, national, and international level, promoting innovation and technological transfer.



**Figure 1. Conceptual diagram**

## Instructions:

1. Describe each of the requested items in this formulary, considering the **evaluation criteria** of the Contest Guidelines.
2. Respect the format and maximum length of each section.
3. It is not allowed to alter the established format regarding sentences, margins, spacing and font size.

# 1. Scientific and technical justification of the proposal.

## 1.1 Quantity, quality and relevance of the unit (s) of equipment (s) with the service to be provided and considered in the project. Include the achievements or progress already made with the equipment included in the proposal.

Refer to the operational equipment(s) available in the "Service Center", whether or not there is a link between them, scope and/or productivity and/or results obtained derived from their use.

Relationship and relevance with the service or services that you want to offer to the scientific community. (Maximum length 3 pages, including this one. You must use Calibri letter 11 and line spacing 1.0).

The Scientific and Technological Bioresources Nucleus (BIOREN-UFRO; [www.bioren.ufro.cl](http://www.bioren.ufro.cl)) was created with the mission "To strengthen multidisciplinary I+D in biological resources and bioprocesses associated with food production, environmental sustainability, and human health; and also, to strengthen the education, dissemination, and scope of bio-resources in the University, the Region and the Country." This platform is open for research services both to the Nucleus and to external institutions and companies. The BIOREN-UFRO is supported by researchers from the Faculties of Engineering and Sciences, Medicine and Agricultural, and Forestry Sciences, through ten associate centers 1. Center of Excellence in Biotechnology Research Applied to the Environment (CIBAMA-UFRO) associated with CRHIAM FONDAF Center, 2. Center of Excellence in Translational Medicine (CETM-UFRO), 3. Center of Excellence for Biotechnology in Reproduction (CEBIOR-UFRO), 4. Center of Waste Management and Bioenergy, 5. Center for Soil-Plant Interaction and Natural Resources Biotechnology, 6. Center for Molecular Biology and Pharmacogenetics, 7. Center for the Improvement and Sustainability of Volcanic Soils (AMESUVOS), 8. Center for Food Biotechnology and Bioseparations, 9. Center for Research in Dental Sciences (CICO) and 10. Center for Research in Forensic and Legal Dentistry (CIO). Nowadays, BIOREN-UFRO is adding more than two hundred scientists, graduate, and undergraduate students. The research Groups Associated with BIOREN-UFRO are focused on developing frontier knowledge in smart (bio)technologies that have the potential to revolutionize science, technology, and innovation. In BIOREN-UFRO, we are concerned with the more important global research challenges contributing to the knowledge and possible solutions in Biomedicine, Climate Change and Extreme Environment, Food Security, and Food Bioprocesses. We are also focused on strengthening education and disseminating research about biological resources in the University, the Region, and the Country. Throughout the history of BIOREN-UFRO, it has contributed enormously to promoting the postgraduate programs of UFRO, as well as the quality and number of manuscripts published in high-impact journals (average rate of 131 articles per year) and the awarded projects (average rate of 61 per year) by its associated researchers. The BIOREN-UFRO has also promoted the strengthening of multidisciplinary research collaboration (please see 1.2) between inter-Universities members and their national and international network. In this context, BIOREN-UFRO also has been a platform to integrate other initiatives like Network for Extreme Environment Research (NEXER [www.nexerchile.cl](http://www.nexerchile.cl)), PROMUEVE (scientific dissemination), the international "Journal of Soil Science and Plant Nutrition" (<https://www.springer.com/journal/42729>), MACH-SATREPS (<https://www.mach-satreps.org/es/>), and EURAXESS. Therefore, BIOREN-UFRO is a multidisciplinary platform that gathers and makes available a wide range of equipment and services, and currently consists of five scientific-technologic units, which have top quality modern equipment, where eleven equipments were obtained through the award of FONDEQUIP projects: Sequencer NGS Illumina Miseq System (EQM150126), Sanger Sequencer Applied Biosystems 3500 Genetic Analyzer (EQM170171), Scanning Electron Microscope HITACHI SU3500 (EQM130014), Ultramicrotome LEICA EM UC7 (EQM140169), Cell Sorter Becton Dickinson FACSAria Fusion (EQM160059), MALDI-TOF/TOF Bruker Autoflex Speed



(EQM160054), preparative ultracentrifuge Beckman Coulter Optima XPN 100K (EQM120186), Nano spray dryer Buchi Nano spray dryer B90 (EQM130045), gas chromatography/mass spectrometer (GC/MS) Perkin Elmer Clarus 680 GC Clarus SQ8T MS and TL8500 interfase (EQM 150128), Simultaneous Thermal Analyzer TGA-DSC Perkin Elmer STA 6000 (EQM 130156) and, Z-SIZER MALVERN Nano ZS ZEN 3500 (EQM120155). These units provide services mainly to the academic and scientific public in diverse research areas. The units are:

**Microscopy and Flow Cytometry Unit** is focused on the study and microstructural characterization of materials, nanomaterials, and biomaterials, in addition to the morpho-functional analysis of biological samples. The main available equipment includes Microtome RM2235-LEICA, Ultramicrotome EM UC7-LEICA, Epifluorescence Microscope Axio Scope A1-Zeiss, Confocal Laser Microscope FV1000- Olympus, Scanning Electron Microscope (SEM, STEM) detectors SE, BSE and coupled to EDS, SU3500-HITACHI, Flow Cytometer FACS CANTO II Becton Dickinson, Cell Sorter FACS ARIA FUSION Becton Dickinson. This unit contributes to research through projects, advanced human capital training, managing scientific activities, courses, and outreach to the community.

**Genomics and Bioinformatics Unit** has the necessary equipment for the processing of biological samples, which includes the extraction and purification of nucleic acids, electrophoresis and quantification of nucleic acids, amplification of regions or genes of interest, construction of genomic libraries, and sequencing of first (Sanger) and second-generation (massive or NGS). This Unit provides advice on the design and planning of studies and the exploration of massive sequencing data. The Unit's mission is to generate genomic data, help users extract all the relevant information, and guide the proper interpretation of the results. The main available equipment are qPCR StepOnePlus, NGS MiSeq-Illumina Sequencer, 3500 Genetic Analyzer Sequencer, and Capillary Electrophoresis Fragment Analyzer. It is also worth mentioning that for the computational management of data and bioinformatics analysis, BIOREN has access to High-performance computing through the SOROBAN server hosted at the Center for Modeling and Scientific Computing UFRO (<https://cemcc.ufro.cl/satreps/>). Moreover, the Genomics and Bioinformatics Unit has received approval from the Public Health Institute (ISP) of the capabilities of sequencing and analysis of SARS-CoV-2 genomes; with this, BIOREN-UFRO has joined the Genomic Surveillance network for SARS-CoV-2. This network has the collaboration of the regional health services (SEREMI de Salud - Araucanía) and the Ministry of Health, and its objective is the sequencing of SARS-CoV-2 genomes and the detection of variants of concern (VOC), variants of interest (VOI), or new variants. With this, BIOREN-UFRO also has a relevant role in controlling the pandemic and direct commitment to society.

**Proteomics and Metabolomics Unit** is equipped with the most sophisticated spectrometry instruments (MALDI-TOF/TOF and ESI-MS/MS), working closely with researchers from industry, academia, and government organizations to support multidisciplinary projects spanning the chemical and biological sciences, biomedicine, and health, food and agriculture, and microbiology. Main available equipment: HPLC Semipreparative, Shimadzu Prominence LC-20AT, HPLC Shimadzu LC-20 AD coupled to spectrometer, Mass Spectrometer SCIEX 3200 Q-TRAP LC/MS/MS, MALDI-TOF / TOF Autoflex Speed, and Ultracentrifuge XPN-100.

**Microbiome and Microbiology Unit.** In 2014 the Chilean Culture Collection of Type Strains-CCCT (<http://ccct.ufro.cl/>) was implemented. It is a public service culture collection hosted at BIOREN-UFRO. It preserves and distributes microbial strains, mainly those related to the Chilean biomes. CCCT-UFRO also offers services related to genomic identification, isolation of microbial strains from complexed and simple samples, phytopathological analyses from plant diseased, among others.

**Materials and Carbon Footprint Prospecting Unit** combine the materials' science attribution to promote the development of specific nano-bio-technological applications and the climate change concern. This unit is oriented to managing inventories guided towards neutrality and reducing the carbon footprint through research and measurement of field data on greenhouse gas emissions and carbon sequestration. This combination gives the unit the ability to address ambitious environmental



and technological challenges with different scientists associated with BIOREN specialized in the areas of study. The ability to manipulate matter at the nanoscale can lead to the development of smart nanomaterials and improve understanding of biological, physical, and chemical processes and the creation of improved materials, structures, devices, and systems that can be used from human health to climate change. Thus being able to generate a differentiation in companies focused on research and development to create value in their products and processes. Main available equipment: Thermo-Gravimetric Analyzer with Differential Scanning Calorimetry STA 6000, TG-GC / MS, and the equipment is a TGA/DSCSTA6000 coupled to GC/MS, Zetasizer Nano ZS, Elemental Analyzer Eurovector EA 3000, Nano Spray Dryer B90I, and Spectrometer Tensor 27 FT-IR.

It is important to note that all units work in a coordinated form (Fig 1), and studies involving different units are common within BIOREN-UFRO. Likewise, associate researchers and qualified technical personnel of the BIOREN-UFRO periodically discuss resolving difficulties for the users and provide technical support from preparing the samples to the analysis of the results.

The BIOREN-UFRO has played a leading role in the research development of UFRO, of its associated centers, researchers, and networks. In fact, the technical and professional capacities of the BIOREN-UFRO have allowed the development of complex researchers and projects that implicate and integrate modern imaging, chemical, biochemical, molecular, and bioinformatic analysis. Despite the promising indicators and results, BIOREN-UFRO still has the potential to continue growing in quality, quantity, and diversity of services provided. In this context, we propose some strategies to strengthen the BIOREN-UFRO and, in the medium term, consolidate it as a reference center from the "southern macrozone" for Chile. These strategies are **(1)** institutional strengthening through the implementation of the "Service Management Analytical Research and Training Center (SmartC-Bioren)" that involves a restructuring of the organization and management of the Nucleus (as described in detail in section 2.1.); **(2)** Improvement in the offer and timeliness of services, which involves hiring additional technical personnel, training and qualification of trained personnel, implementation of new methodologies and the number of services offered (please see the 3.2 section) and timeliness and frequency of maintenance and quality controls; **(3)** Active search for new users and strategic alliances, including local (southern macrozone) and national entrepreneurs and consolidated companies, other research and educational institutions (both public and private) and the public sector. This search will be led by the Executive Director (Please see 2.1.) and will include marketing campaigns, seminars, webinars, and other outreach activities. These activities will be complemented with the new methodologies and services offered by SmartC-Bioren. We will also focus on increasing and consolidating our current alliances and scientific cooperation networks, both national and international, in order to promote the development of complementary studies between institutions. It is important to note that BIOREN-UFRO already has experience providing technical and methodological support to technology-based companies. Such is the case of the Startup born at the University of La Frontera, Myconativa (<https://myconativa.com/>) led by Dr. Paula Aguilera, to which we provide comprehensive advice and services. Likewise, BIOREN-UFRO has been working together with Watt's S.A. company to calculate the carbon footprint, focusing on generating new strategies to contribute to carbon neutrality for 2050. This contribution science-company has allowed us to identify the urgent necessity to implement new techniques, in the available equipment such as Isotope Abundance analysis, to contribute with the monitoring of GHGs as well as to build C footprint, through the isotopes relative abundances which can be measured in GC/MS analysis. Therefore, the new analyzes and consultations implemented will contribute considerably to the study of Carbon neutrality in line with the country-level challenges and Intergovernmental Panel on Climate Change (IPCC) considerations. Finally, the implementation of the SmartC-Bioren will strengthen and consolidate the platform's services, becoming a reference center from the southern macrozone through structural reorganization, diversification, and optimization of new services provided and actively searching for new users.

## 1.2 Linkage and articulation with similar national and international centers and networks.

Mention the current connection(s)/relationship(s) with other centers and/or national and/or international networks of similar activities. In addition, indicate any future articulations.

(Maximum length 3 pages, including this one. You must use Calibri letter 11 and line spacing 1.0).

The BIOREN-UFRO is an analytic platform open to researchers, academics, students, the public sector, and private companies for research and research support services. The BIOREN-UFRO has a large number of major equipment and facilities available to users that can be used to find answers and generate technology focused on facing some of the main challenges of Chile and Humanity. As we mentioned, more than two hundred researchers are associated with BIOREN, belonging to ten centers directed by researchers with an outstanding experience. All these centers have high productivity and are directly linked to the activities carried out at BIOREN.

At an international level, BIOREN-UFRO keeps the contact point in Chile for the European Infrastructure "MIRRI-Microbial Resource Research Infrastructure". This partnership has allowed the award of two international projects and the publication of more than 20 scientific ISI articles. The Nucleus also cooperates with global centers located in Asia, Europa, Latin America, North America, and Oceania, as can be observed by the international agreements proposed by the Nucleus, currently available in the Universidad de La Frontera (<https://app.powerbi.com/view?r=eyJrljoiNjZmOTE3MDgtOGIwNC00NDY5LWFhN2EtMmE3NmY2N2Q5N2VliwidCI6ImZjZDIhYmQ4LWRmY2Q0tNGExYS1iNzE5LThhMTNhY2ZkNWVvK0SiImMiOjR9>).

The Flow Microscopy and Cytometry Unit-BIOREN, from its beginning, has maintained a link with the Advanced Microscopy Center (CMA) of the University of Concepción through an agreement between them. Currently, the Unit holds a collaboration with HITACHI and Becton Dickinson Companies in Chile dedicated to promoting the training of students through symposiums, seminars, and summer schools (Student Chapter - UFRO). This Unit has also been in charge of generating links with different application specialists in Scanning Electron Microscopy operated by HITACHI equipment, such as PhD. Alberto Riveros from LAMARX, FAMAF, UNC-Argentina, MSc. Carla Campos from CIMAV-México, Specialist Maryuri Conde de Cubillan from HLATAM; PhD. Isabel Niño from SENA-Colombia and in Chile with Dr. Maria Soledad Romero from the Universidad Católica del Norte and Specialist Maria Villarroel from the PUC-Valparaíso Electron Microscopy Laboratory. These links have allowed international and national training involving the exchange of technical knowledge and professional experiences. Moreover, this year we joined the Society of Advanced Equipment Specialists (SEECA), presenting the BIOREN Platform in the Facilities Tour in Chile.

The Proteomics and Metabolomics Unit through the Latin American Network of Young Scientists Working in Chemistry (LANYSC: <https://latyoungchem.wixsite.com/lanysc>) has established alliances between several laboratories in Latin America that working with mass spectrometry techniques, proteomics, metabolomics, among others, through events held in partnership with BIOREN-UFRO (e.g. the "I Encuentro LANYSC – Espectrometría de Masas y Redes Internacionales de Colaboración"). The laboratories that are involved in the network are: Centro de Estudos de Insetos Sociais (CEIS); Laboratório de Biologia Estrutural e Zooquímica -São Paulo State University (UNESP); Centro de Investigaciones en Bionanociencias (CIBION) – CONICET, Argentina; Centro de Cromatografía y Espectrometría de Masas -CROM-MASS, Universidad Industrial de Santander – Colombia; Universidade Federal do Mato grosso (UFMT) – Brasil; Universidad de la República – Uruguay; Universidad de Talca - Chile; Empresa Embrapa tropical agroindustrial – Brazil. These alliances have made it possible to achieve two international projects and to optimize the processing and analysis of samples, adapt or develop new protocols, as well as to evaluate the implementation of new services.



Additionally, we maintain collaboration networks with researchers from other foreign universities, where we have been trained and shared experiences in using this molecular tool. An example of international collaboration networks is three projects focused on proteomics funded by ANID (REDI170334 and Fondecyt N° 11200377 by Dr. Patricio Barra and Fondecyt N° 1210684 by Dr Mabel Delgado), which have the support and collaboration of Dr. Stéphane Claverol from the Plateforme Protéome, Université de Bordeaux (France). Other international partners are the Department of Plant Biophysics and Biochemistry, Institute of Plant Molecular Biology, BC CAS, České Budějovice, Czech Republic ([http://webserver.umbr.cas.cz/~kupper/AG\\_Kuepper\\_Homepage.html](http://webserver.umbr.cas.cz/~kupper/AG_Kuepper_Homepage.html)) and Department of Soil Amelioration, University of Zagreb (<https://www.agr.unizg.hr/en/group/356/Department+of+Soil+Amelioration>) who have worked closely with BIOREN-UFRO. As a result of this alliance, one project and four publications have been generated.

We also have generated networks with the Institute of Bio- and Geosciences of Germany through Dr. Roland Bol. This institute has technological platforms to provide research concerning the sustainable bio-economy and climate and environment protection. It was generated two publications and promoted the training of advanced human capital. Another international network is with Dr. Siobhan Staunton from the INRAE, the French National Research Institute for Agriculture, Food and Environment. They have laboratories and equipment in different research areas to respond mainly to agroecosystems' global changes such as demographic pressure, climate change, mitigation of greenhouse gas emissions, and food security (generating three publications). Thus, for example, this scenario will allow the establishment of new SmartC-Bioren services related to the measurement of CO<sub>2</sub> capture, which has not been offered in Chile, opening a new service niche. Another active French collaboration has been with Dr. Rumpel since 2007, who belongs to the Institute of Ecology and Environmental Sciences. She has vast experience with the characterization and management of soil organic matter in many different environments. She has a direct collaboration with the Materials and Carbon Footprint Prospecting Unit. Her group focuses on agricultural practices and innovative organic amendments to increase soil C sequestration to increase food security and mitigate climate change. This collaboration has generated three international projects, 19 publications, and professional training. Combined with our research related to the generation of different nano(bio)technological applications in the field of sustainable agriculture and intelligent fertilization will allow us to establish as leaders in this exciting new field of research and to increase the publication records of scientists from both groups in world-renowned journals as well as we expect to obtain innovative research R&D able to allow us to generate at least one patent in the fertilizer field.

In addition, the genomics and Bioinformatics Unit (high-throughput sequencing), along with the Laboratory of Applied Microbiology Ecology (EMALAB), directed by Dr. Milko Jorquera and co-directed by Dr. Jacqueline Acuña, performs multiple international cooperation projects. Related to microbial-plants interactions, Dr. Acuña, Dr. Jorquera, and Dr. Campos perform the MEC80180048 project with Dr. Lukas Wick, head of Working Group Bioavailability from Helmholtz-Centre for Environmental Research, Germany. Regarding microbial-microbial interactions in lentic and lotic aquatic systems, Dr. Jorquera, Dr. Acuña, and Dr. Campos are performing the international cooperation projects NSFC190012 and REDES190079 with Dr. Jack Bai, head of the School of Environment, Beijing Normal University (China), Dr. Andrew Ogram Center for Stress Resilient Agriculture (CSRA), University of Florida (USA), and Dr. Deb Jaisi from Environmental Isotope System (EIS) Center, University of Delaware (USA). Additionally, framed in elucidating the role of microorganisms in algae blooms in Chilean coastal areas, Dr. Jorquera and Dr. Acuña are currently performing the international project supported by Science and Technology Research Partnership for Sustainable Development (SATREPS JICA/JST) code JPMJSA1705 with Dr. Fumito Maruyama, head of Microbial Genomics and Ecology Laboratory, Hiroshima University (Japan).



At the national level, we have an alliance with the Agricultural Research Institute (INIA) institution linked to the Chilean Ministry of Agriculture. They are the leader in sustainable agrifood development, creating value and proposing technological solutions for farmers, strategic partners, and society. The INIA has a national presence through ten Regional Research Centers and participates actively as a founding partner in at least eight specialized technology centers. The Institute has contributed to the conservation of genetic and microbial resources as patrimony of humanity, to the development of techniques for the control and management of pests, the extension of technologies that favor the productivity of the agrifood sector, and the adaptation of the agricultural systems to the new climate change scenarios.

Moreover, we have a connection with the Network for Extreme Environment Research (NEXER) that brings together researchers from the Universidad of Antofagasta, the Universidad of Magallanes, and the Universidad of La Frontera. Nowadays, NEXER is integrated for more than thirty principal investigators and their respective working groups spread across the three universities. NEXER has increased inter- and intra-University collaborations between the members and its national and international networks. This network financed four projects, which seek to improve associative development and the construction of knowledge in areas relevant to extreme environments and climate change. The awarding of projects (FONDECYT, INACH, ECOS, MAX PLANCK, other funds), the development of human capital, and publications have been significantly increased due to networking. This association has benefited researchers from different universities with the accessibility to various technology platforms such as BIOREN. Thus, UFRO researchers have been able to complement their research with equipment available in Antofagasta or Magallanes, mainly in the determination of isotopes and the sample processing to determine C14. This collaboration has been fruitful in applying FONDEQUIP, awarding Magallanes its first project of this category in the 2020 competition, obtaining equipment for the study of carbon and nitrogen in liquid and solid samples. Considering that these researchers belong to scientific and technological development centers, this network allows us to exchange experiences and knowledge related to activities similar to those developed at the BIOREN-UFRO Center. These activities include biodiversity and interaction of the ecosystems, the adaptation of various species to extreme environments, and analyzing the effects of climate change, and studying biogeochemical cycles in these environments. Moreover, there is a national cooperation framework agreement between BIOREN-UFRO and EWOS Chile Alimentos Ltda. (CARGILL) Chile through the Cargill Innovation Center (CIC). This agreement is aimed at the collaboration of basic and applied research in salmonid aquaculture and food technology. This agreement has promoted the exchange of academics and professionals between CARGILL and UFRO, developing joint research and supervising thesis works. In addition, its multidisciplinary nature allows the exchange of knowledge and experiences between the two centers. In addition, the BIOREN-UFRO proposed the basis for the National Network of Microbial Culture Collections (maintenance of microbiological resources), which is currently being developed by SOFOFA, Chile, with the support of BIOREN-UFRO.

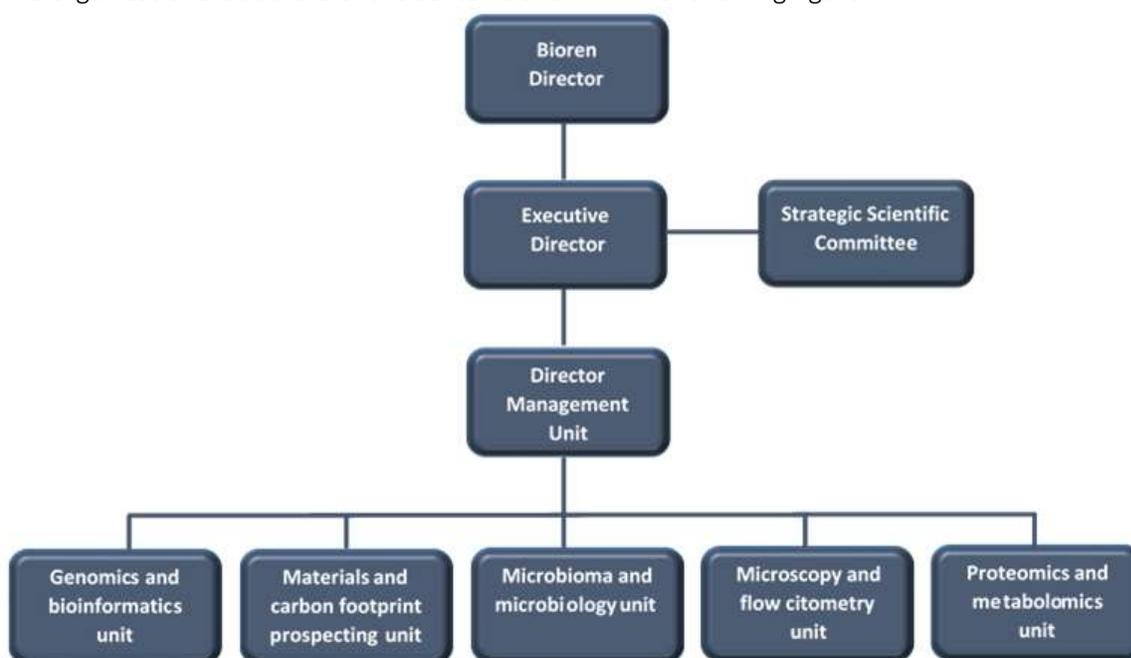
For now, in addition to consolidating and expanding our current national and international collaboration networks, we seek to promote complementary research and analysis, facilitating the use of our equipment to carry out studies of global scope that complement those of our contact networks. Likewise, in the short term, we need to expand national alliances with research and education institutions, private companies, and the public sector. In this way, facilitating the equipment available to the public-private sector outside the university promotes applied research. We are already carrying out this strategy, for example, through the alliance with the SEREMI de Salud - Araucanía and the Ministry of Health, for sequencing of SARS-CoV-2 genomes. However, we still have to increase in the medium term to increase the national collaboration networks and the number of services provided to users outside the University of La Frontera and the scientific and academic world.

## 2. Organization and Management of the Proposal

### 2.1 Organizational and administrative design of the Center. The Associativity between Institutions at the national level will be positively valued.

Describe in detail the organization of the Center. We suggest you review point 2.3.2 of the bidding conditions, where the minimum roles that the structure of the Center must have are detailed. Also describe the management model. If the proposal is submitted by more than one institution, please indicate how the associativity will be carried out and what it will consist of.

The organizational structure of the center is shown in the following figure:



**Figure 2.** Organizational structure of SmartC-Bioren

**Bioren Director:** This position will continue to be directed by Dr. Maria de la Luz Mora, the Director of BIOREN-UFRO. (<https://bioren.ufro.cl/>) since 2009. Her expertise and knowledge in BIOREN-UFRO management will allow the Executive Director to meet the scientific, technical, and financial requirements of this proposal.

**Executive Director:** A commercial engineer (or related professional with experience in the scientific area, with a technological manager profile that allows linking entities and explaining the capabilities of the SmartC-Bioren) will be hired. This professional will be responsible for managing and administering the scientific equipment as well as the assigned budget. The executive director will also have the task of actively searching for new users by linking with other public and private entities to increase the demand for BIOREN-UFRO's services and capabilities. The Executive Director must plan, with the SmartC-BIOREN team, and offer services that involve integral solutions to companies and public, scientific and educational entities concerning the activities undertaken. Additionally, she/he will have the mission of incorporating the service area that is not developed. In addition, he/she must ensure the correct, efficient and timely operation of equipment by coordinating periodic maintenance, implementing new techniques and functions, and organizing the work team. The



Executive Director will also have the mission of selecting the additional staff required within this proposal. Finally, the Executive Director will also supervise and coordinate the correct execution of the project and organize administrative and financial reports to ANID.

**Strategic Scientific Committee:** This committee will be made up of six outstanding researchers, all of them belonging to BIOREN-UFRO. Their functions will be to advise the center technically, scientifically, and strategically. The members that will make up the first committee are **1.** Dr. María Cristina Diez is the director of the Biotechnological Research Center Applied to the Environment (<http://www.cibama.ufro.cl/>), and her research areas are environmental biotechnology; biological processes for wastewater treatment, and biological beds for pesticide degradation. **2.** Dr. María Eugenia González is the director of the Waste Management and Bioenergy Center (<https://bioren.ufro.cl/centros/centro-de-gestion-de-residuos-y-bioenergia>), and her research areas are solid waste valorization and biomaterials and biofuels. **3.** Dr. Milko Jorquera is the head of Laboratory of Applied Microbial Ecology and a member of the Center for Soil-Plant Interaction and Natural Resources Biotechnology (<https://bioren.ufro.cl/centros/centro-de-biotecnologia-de-plantas-suelo-interaccion-y-recursos-naturales>). His main research lines are microbial ecology; microbial bioprospecting for sustainable development and plant-microbe interactions. **4.** Dr. Jennie Risopatron is director of the Center of Excellence for Biotechnology in Reproduction (<http://cebior.ufro.cl/>), and her main research line is reproductive biology and cryopreservation of gamete. **5.** Dr. Luis Salazar is director of the Center for Molecular Biology and Pharmacogenetics (<https://bioren.ufro.cl/centros/centro-de-biologia-molecular-y-farmacogenetica>), and his research areas are the genetic basis of priority diseases; cardiovascular pharmacogenetics; identification of active principles from native plants with therapeutic action. **6.** Dr. Raúl Sánchez is director of the Translational Medicine Center of Excellence (<https://www.med.ufro.cl/cemt/index.php>) and his research areas are physiopathology of inflammatory processes that affect the reproductive system and its effect on sperm function; cryopreservation of sperm, and effect on reproductive parameters. According to the bidding conditions, a Scientific Director will be chosen from among them. From the directors of the centers, a Scientific Director will be chosen. In addition, two independent representatives will be elected, whose function will be the strategic consultancy of SmartC-Bioren.

**Management Unit:** This unit will be responsible for operating the scientific and technological equipment according to a model of use and provision of services. Will be led by a professional with knowledge in the use of equipment and management abilities. In addition, the professional, together with the technical team, will meet the objectives proposed by the center. This unit will include five subunits that embrace different research lines (see the above figure). The following specialists are in charge of these units:

- Karina Godoy (Microscopy and Flow Cytometry Unit)
- Nathalia Dias (Proteomics and Metabolomics Unit)
- Michel Abanto (Genomics and Bioinformatics Unit)
- Paola Duran (Microbiome and Microbiology Unit)
- Carolina Merino and Marcela Calabi (Materials and Carbon Footprint Prospecting unit)

## 2.2 Modalities of use and management of access to the equipment, dissemination activities, services offered, target public and estimated demand.

Describe the model of use and access to the equipment, target audience, estimated demand, hours of operation, reservation management and queue management. Dissemination activities of the Service Center.

(Maximum length 3 pages, including this one. You must use Calibri letter 11 and line spacing 1.0)

The BIOREN-UFRO provides highly sophisticated equipment services. This platform is divided into five areas, offering its services through the BIOREN-UFRO website (<https://bioren.ufro.cl/>). The hours of operation of the Equipment are 1,200 hours per year. The agenda and dissemination activities will be coordinated by the SmartC-Bioren.

The types of access will be as follows:

**a) Access to the use of the equipment.** The forms to request the analysis will also be available to download from the BIOREN-UFRO website (<https://bioren.ufro.cl/>). Thus, researchers, postdoctoral researchers, pre and postgraduate students, public and private users must submit the forms with the requested information to the email: [bioren@ufrontera.cl](mailto:bioren@ufrontera.cl). The hours will be assigned every Friday (9:00 - 17:00 hrs.) by the assistant of the management unit along with professionals in charge of each unit. Requests are could be submitted by researchers from other national and international universities and centers as well as public and private users. The use of the equipment and access plans are based on a collaborative research model, advanced human capital training, and service provision. The operation of the equipment involves six stages, including request of an hour, sample reception (9:00 - 13:00 hrs. according to the assigned request), sample preparation, sample evaluation, analysis, delivery of results.

The access plan considers two access types for the use of the 1,200 annual hours of operation by technological unit:

**Access Type 1 (Main institution).** Access to the equipment services will be assured for all researchers from the Principal Institution (pre and postgraduate students, academic researchers).

**Access Type 2 (External):** This access will be assigned for external entities, such as Universities, Institutes, and Companies, among others, that require the use of the equipment (public/private). External Entities can request access to the equipment after submitting the request form, detailing the analysis to be performed and the type of sample to be processed, to technically and financially evaluate the costs. The Executive Director and his/her assistant will coordinate this request. The queue management will be processed considering the reception order.

**b) Training and dissemination activities of the equipment (all access types).**

Outreach activities: it considers talks to the community by application specialists of the Technological Units and/or researchers linked to BIOREN through the Research Centers associated: 1. PROMUEVE-BIOREN, whose coordinator is Dra. Jacqueline Acuña, this program is aimed at elementary and high school students, 2. Participation at the Research fair FIUFRO at the Universidad de La Frontera, which is open to the regional community, 3. Annual participation in the International Workshop Advances in Science and Technology of Bioresources, and 4. Tour on the platform for visits by national and international researchers (available on Fridays).

Undergraduate scientific dissemination program CAPÍTULO ESTUDIANTIL-BIOREN, coordinate by Dr (c) Karina Godoy. This program includes 1.-Undergraduate Science Symposium, open to all students from the Universidad de La Frontera and students from all the National Universities. The program involves Talks by National and International Researchers, Oral and Poster presentations by undergraduate students. 2.-Summer schools, theoretical-practical (demonstrative) modules in different techniques



(Microscopy, Flow Cytometry, Proteomics, Genomics, and Physico-chemical Analysis), are represented by each Technological Unit. 3.-Coordination of Undergraduate Activities, internship management, practices, degree activity, and/or thesis.

Advanced postgraduate courses: specialty courses are currently being held for Postgraduate students of the University's Doctorate programs: 1. Advanced Instrumental Analysis Techniques (BRN-601) involving all Technological Units and their Specialists and 2. ProteoGenomics (BRN-701) by Dr. Michel Abanto and Dr. Nathalia Dias. Both courses are offered by the BIOREN-UFRO. Moreover, the unit specialists participate in another advanced courses: including “Análisis Instrumental Avanzado, Plataforma Científica y Tecnológica BIOREN- Equipamiento Mayor” (PBM011), aimed to the doctoral program Applied Cellular and Molecular Biology, Universidad de La Frontera. Participation in the Advanced Instrumental Analysis course (DEM009) “Análisis Instrumental Avanzado, Plataforma Científica y Tecnológica BIOREN- Equipamiento Mayor” aimed to PhD in Morphological Sciences, Universidad de La Frontera.

In addition, other activities are considered, including meetings for the development and/or support of internal, associated, and external research projects. Moreover, through the office of activities coordination, additional hours are available for consultations on practical activities, internships, and an undergraduate and postgraduate thesis. It is also considered to disseminate the equipment services to other public and/or private institutions about technological applications to promote its use.

Our services' target public corresponds mainly to research centers, universities, and companies. In this last target group, a greater possibility of growth in demand is visualized, mainly for new services. Hence, we have focused our interest on the agronomic, aquaculture, and food sectors since BIOREN-UFRO is located in the same region where these economic activities predominate.

Regarding the estimated demand, it is important to mention that this was calculated considering an annual increase of 6% in its use for those equipment considered with high projected demand. In contrast, for equipment with regular demand, a yearly increase of 2% was assumed. These increases in demand will be achieved mainly due to the marketing actions and procedures that the Executive Director will carry out. It is important to note that the year 2019 was considered the base year for calculating the estimated demand, considering that due to the health crisis, this was the last period where BIOREN carried out its operations normally.



### 3. Financial and economic evaluation.

#### 3.1. Consistency between the Center's financial planning and the proposed management model.

It is intended that the financial planning of the Center is consistent with the proposed management model.

(Maximum length 2 pages, including this one. You must use Calibri letter 11 and line spacing 1.0)

As can be seen in the previous sections of this proposal and from the internal analysis that we have carried out in the BIOREN-UFRO, several needs and opportunities have been detected. The main needs consist of increasing the visibility and services provided outside the University of La Frontera, the lack of budget for maintenance and implementation of new techniques and services, lack of sufficient qualified personnel to implement these new techniques and services, as well as, for the active search for new users. In addition to the above, there is the fact that in 2022 the agreements to extend the guarantee and maintenance of equipment will end, which means new costs to be financed by the BIOREN-UFRO. But we also have the great opportunity to diversify and increase income and portfolio of services to be offered internally and externally, taking advantage of human capital, infrastructure and equipment that is currently available, since on average only 42% of the maximum possible annual capacity is used in BIOREN.

Considering the above, it is necessary to transform the management model with which BIOREN currently works, generating modifications aimed at the sustainability of the Nucleus, mainly promoted by linking actions with various productive areas to raise priorities and new services to offer according to demand. To achieve this transformation in the management model, the incorporation of a full-time executive director is essential. He/she will have the mission of leading and managing different actions that allow reaching the goals established in terms of numbers of services provided by BIOREN and effective linkage with other public and private institutions. The profile of this professional must have previous experience in business and in management of scientific research activities, since he/she will not only be responsible for managing the scientific equipment but they must also execute the budget efficiently.

Likewise, a marketing plan will be implemented, whose dissemination and marketing actions, such as the creation of service capsules, press releases, workshops for productive sectors, website, graphic material, service brochure and participation in activities in priority productive areas, will be essential for make the services offered visible and attract the necessary customers to meet the estimated demand.

To support administrative tasks such as; preparation of budgets, purchasing management, expense reports, customer services and delivery of results, an assistant director will be hired, who will be under the supervision of the Executive Director and will support the different tasks carried out by the Management Unit.

On the other hand, the hiring of two new professionals in the Management Unit is proposed, in charge of supporting the work of the application specialists in relation to processing / preparation of samples and standardization of new techniques and services, activities that are time-consuming. The first of these professionals will be hired from the first year of project execution, allowing to satisfy the projected demand, while the second of them will join the work team from the second year of execution, since it is estimated that during this period the demand for services will increase to a greater extent due to the expected effects of the marketing plan implemented in the first year of project execution.

Regarding maintenance of the scientific-technological equipment and in coherence with the new proposed management model, which seeks to constantly increase the use of the equipment for the



provision of internal and external services, it is essential to carry out preventive maintenance that allows to extend the useful life, improve operability and avoid possible failure of these equipment. Due to the above, it has been calculated that the maintenance for all the equipment used in BIOREN-UFRO amounts to an approximate amount of \$117,000,000 (USD 150,000) per year, but considering the scarcity of resources and the high cost of these services, it has been decided to carry out maintenance under a regime biannual allocating \$85,000,000 (USD 108,874) annually for this item. This maintenance will be complemented with contributions from the University of La Frontera destined to ensure the equipment and infrastructure of BIOREN-UFRO (institutional policy). Taking into account that as of the year 2022 the maintenance and extended warranty agreements of the medium-sized FONDEQUIP equipment previously acquired end, it is important to note that approximately 40% of the requested budget will be allocated to the maintenance of equipment given the high specialization and use of them, which is consistent with the new proposed management model, allowing the estimated demand to be addressed without setbacks due to lack of maintenance.

Regarding the training item, the financial planning contemplates an amount of \$12,000,000 (USD 15,384) per year for the training and acquisition of knowledge of new and pre-existing application specialists and/or professionals of the technological units, which will allow to take greater advantage and profitability of the equipment applications, increase the operational capacity and efficiency of SmartC-Bioren and increase the number of services to be offered. These trainings include costs related to travel expenses, tickets or to bring specialists to the university, which will be decided considering the most efficient way to use the resources.

Finally, financial planning includes other operating expenses, which are added to those mentioned above related to the implementation of the marketing plan.

These expenses are necessary to ensure a correct operation of the equipment and a fast resolution speed in the event of eventual setbacks with parts belonging to the equipment. That is why they are considered expenses for the purchase of supplies for the medium FONDEQUIP equipment, for a total of \$40,000,000 (USD 51,282) per year, distributed as follows: inputs for the operation of the equipment \$32,000,000 (USD 41,025) per year (to purchase inputs such as filaments, stubs, tapes, matrix-calibrators, plates, sample holders, gases, maintenance and cleaning solutions, cuvettes-cells, and other reagents necessary for commonly used assemblies such as solvents). It also considers an amount of \$8,000,000 (USD 10,256) per year for corrective maintenance and/or replacements of parts (spare parts) for the equipment in the event of any eventuality that occurs with them.

The University of La Frontera, specifically BIOREN-UFRO, will contribute to the proposed financial planning by valorization the pre-existing operational and administrative personnel in the Management Unit, which includes 4 application specialists, 3 research support professionals, 2 administrative support professionals and a cleaning assistant, personnel necessary for the application and operation of the equipment, administration and cleaning. These contributions in personnel are quantified at \$ 161,000,000 (USD 206,410) annually.

All the proposed actions and the proposed financial planning seek to approach and distribute resources to efficiently develop the new management model, allowing progress towards the sustainability of the center by increasing the supply of both external and internal services, generating new income that will lead to a growth of the BIOREN-UFRO