Annual REPORT 2024



CONSEJO NACIONAL DE RECTORES

CeNAT
Centro Nacional de Alta Tecnología

Transforming Knowledge into Development

Centro Nacional de Alta Tecnología

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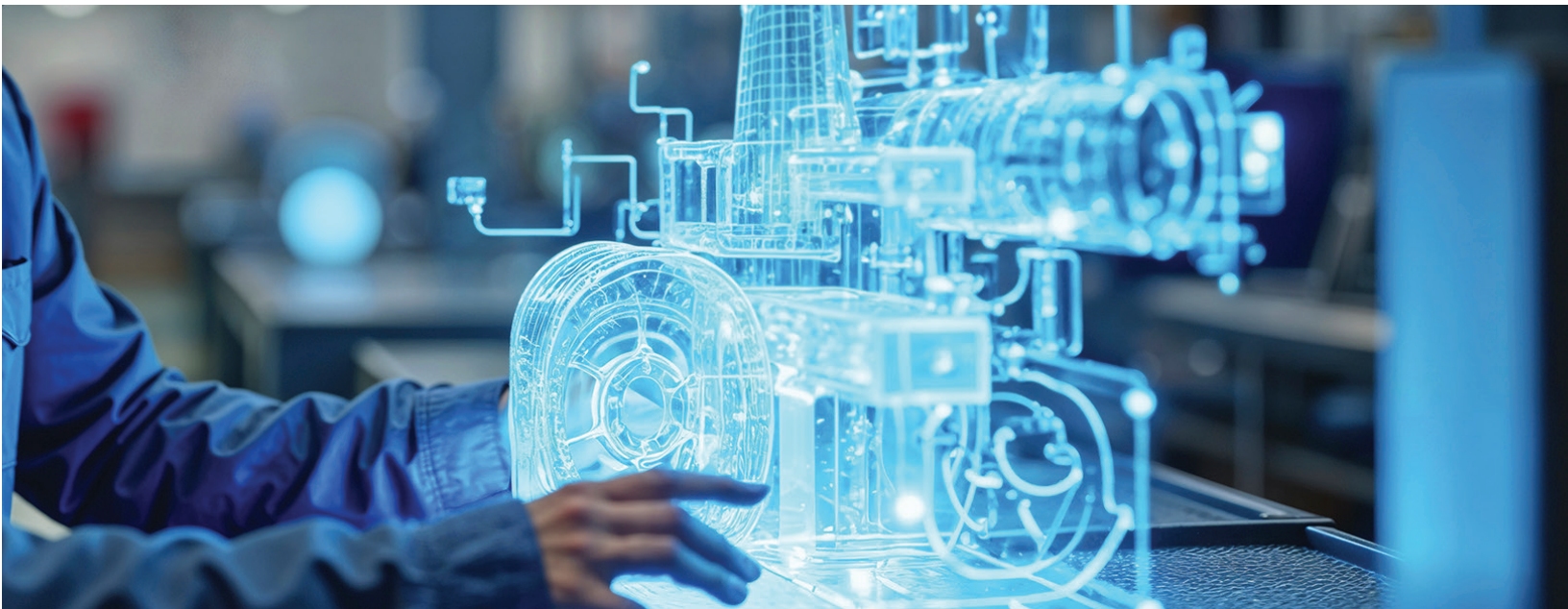
Acronyms

CONARE	National Council of University Deans
CeNAT	Centro Nacional de Alta Tecnología
SDGs	Sustainable Development Goals
UCR	University of Costa Rica (UCR)
TEC	Costa Rica Institute of Technology
UNA	National University
UNED	National University for Distance Education
UTN	National Technical University
AID	Agency for International Development
FunCeNAT	Centro de Alta Tecnología Foundation
LANOTEC	National Nanotechnology Laboratory
CENIBiot	National Center for Biotechnological Innovations
CNCA	National Advanced Computing Collaboratory
PRIAS	PRIAS Laboratory
AGA	Environmental Management Area
ODC	Observatory of Scientific Diplomacy
ESMO	European Society of Molecular Oncology
ADIPLAST	Dominican Plastics Association
WAITRO	WAITROWorld Association of Industrial and Technological Research Organizations
GENFORES	Genetic Improvement of Forest Species
CONCAPAN	IEEE Central America and Panama Convention
CIARP	Iberoamerican Congress on Pattern Recognition
CSUCA	Central American Higher University Council
FEES	Special Fund for Higher Education
CINDE	Costa Rican Coalition of Development Initiatives
INA	National Learning Institute
BIOINNOVA	Business Training Program
MICITT	Ministry of Science, Innovation, Technology and Telecommunications

CCSS	Costa Rica Social Security Fund
Red Clara	Latin American Cooperation of Advanced Networks
ATIC	Information and Communication Technologies Area
CERN	European Organization for Nuclear Research
SICOP	Integrated Public Procurement System
CARLA	Latin American Conference on High Performance Computing
OVSICORI	Volcanological and Seismological Observatory of Costa Rica
CoCeCAR	Central American Consortium on High Performance Computing Socio-environmental Applications
IESTEC	International Congress of Engineering, Science, and Technology
SMEs	Micro, small and medium-sized enterprises
MEIC	Ministry of Economy, Industry, and Commerce of Costa Rica
PIACT	Interactive Platform for Tropical Climate Application
PINN	Innovation and Human Capital Program for Competitiveness
ASOPROA	Association of Agricultural Producers of Santa Cruz
EU	European Union
OEI	Organization of Ibero-American States for Education, Science, and Culture
OLCOCI	Costa Rica Science Olympiad
OLCOQUIM	Costa Rican Chemistry Olympiad
IJSO	International Junior Science Olympiad
IChO	International Chemistry Olympiad
OACACQ	Central American and Caribbean Chemistry Olympiad
OIAQ	Iberoamerican Chemistry Olympiad
ILSI Mesoamérica	International Life Sciences Institute
MEP	Ministry of Public Education
ICAFE	Costa Rican Coffee Institute
COOPETARRAZU	Cooperativa de Caficultores y Servicios Múltiples de Tarrazú R.L.
CORBANA	National Banana Corporation
CIPRONA	Natural Products Research Center
MAG	Ministry of Agriculture and Livestock
MS	Ministry of Health
SENARA	National Groundwater, Irrigation, and Drainage Service
CNE	National Emergency Commission
CGR	Comptroller General of the Republic
BNCR	National Bank of Costa Rica

CAMTIC	Chamber of Information Technologies
SCALAC	Advanced Computing System for Latin America and the Caribbean
SIMOCUTE	National Monitoring System for Land Cover and Use and Ecosystems
MINAE	Ministry of Environment and Energy
RREE	Ministry of Foreign Affairs and Worship
PEN	State of the Nation Program
CATIE	Tropical Agricultural Research and Higher Education Center
NASA	National Aeronautics and Space Administration
REDIES	Costa Rican Network of Sustainable Educational Institutions
DINADECO	National Directorate of Community Development
ENAPROC	National School of Civil Protection
Coopeagri	Cooperativa Agrícola Industrial, Comercial y de Servicios
UCIMED	University of Medical Sciences
NATGEO	National Geographic Channel
JUPEMA	National Teachers' Pensions and Retirement Board
CANAPALMA	National Chamber of Palm Producers
CANAPEP	National Chamber of Pineapple Producers and Exporters
CORFOGA	Livestock Corporation
INEC	Costa Rica National Institute of Statistics and Census
PROCOMER	Foreign Trade Promoter
INTECO	Institute of Technical Standards of Costa Rica
IMN	National Meteorological Institute
DLR	German Space Agency
ESA	European Space Agency
NAVAL	United States Office of Naval Research
NOAA	National Oceanic and Atmospheric Administration
LAICA	Sugarcane Industry Association
OAS	Organization of American States
ULEAD	LEAD University





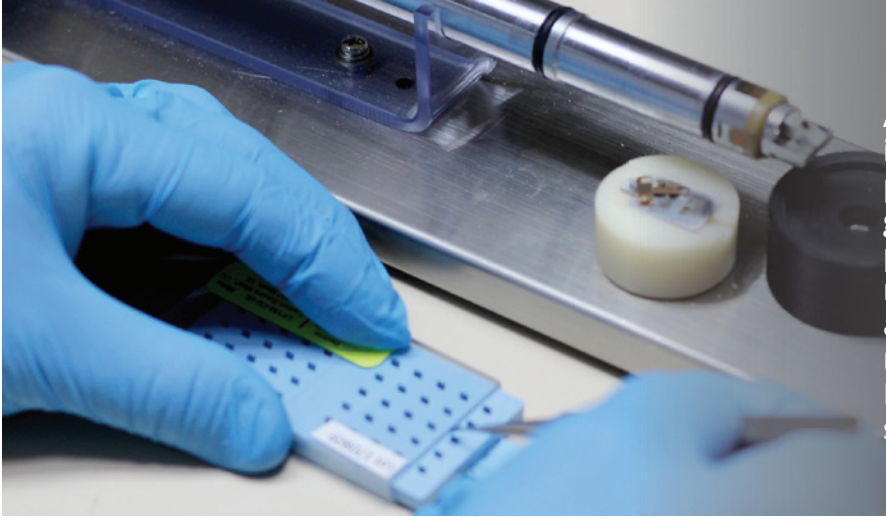
Introduction

Acting Director
Dr. José Vega Baudrit

The Centro Nacional de Alta Tecnología, as a program of the Consejo Nacional de Rectores (CONARE), is pleased to present its 2024 Annual Report. This document summarizes the main scientific advances, research results, innovation projects, and outreach activities carried out during the past year. The report summarizes CeNAT's work toward fulfilling its mission to connect and support the state universities of the Consejo Nacional de Rectores (CONARE), the productive sector, and government agencies, in line with the Triple Helix approach and the United Nations Sustainable Development Goals (SDGs).

The purpose of CeNAT is to promote scientific and technological excellence in Costa Rica through cutting-edge research, training of highly qualified human capital, and articulation of multi-sector efforts. Thanks to the active participation of the University of Costa Rica (UCR), the Costa Rica Institute of Technology (TEC), the National University (UNA), the State University of Distance Education (UNED), and the National Technical University (UTN), numerous initiatives have been strengthened that respond to local and global challenges in areas such as health, sustainable production, clean energy, biodiversity protection and the development of emerging technologies.

In 2024, CeNAT consolidated itself as a space of convergence for innovation and knowledge generation, by offering specialized laboratories, state-of-the-art equipment, and interdisciplinary research programs. Within the framework of the SDGs, the activities carried out stand out for their impact on improving the quality of life of the population, promoting industrial competitiveness, and searching for scientific solutions that support environmental sustainability.

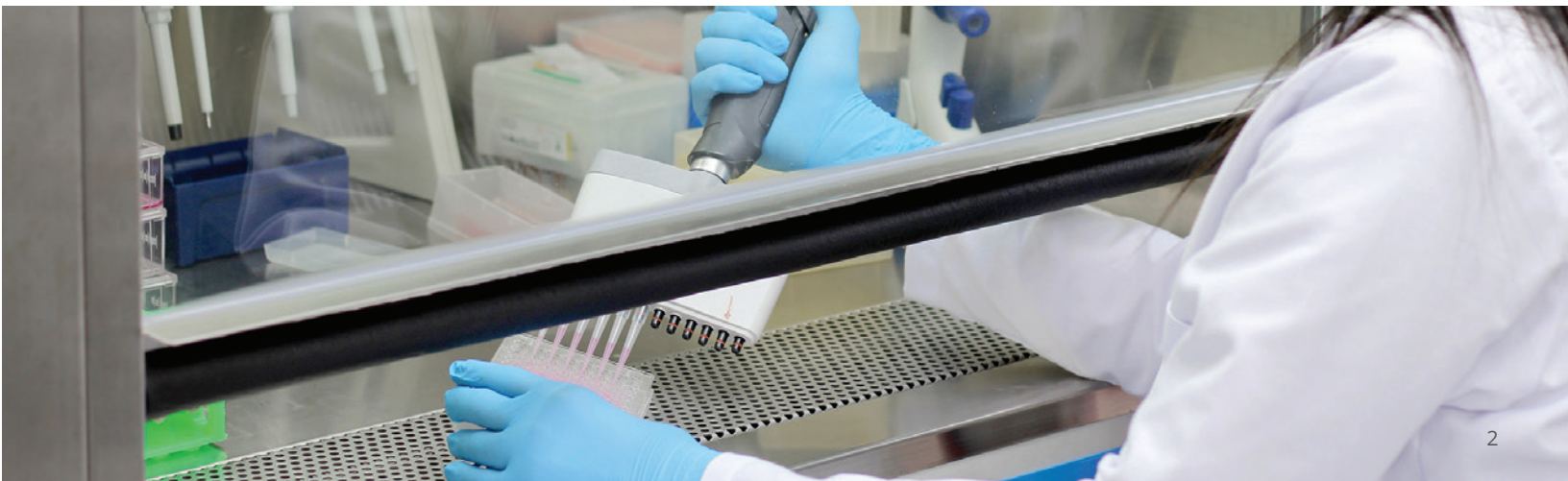


Among the most notable milestones included in this Report, joint projects with public and private entities for technology transfer, the growth of R&D-based ventures, and participation in international research networks are highlighted. This set of achievements not only responds to specific needs of the country but also places Costa Rica in a prominent position within the global scientific community.

This 2024 Report has been structured to offer a comprehensive perspective on the efforts made. First, it describes the institutional management of CeNAT and its strategy for articulation with CONARE universities. Secondly, it presents the scientific and technological advances that illustrate the depth and rigor of the research carried out. Finally, it addresses the projection of our future actions, considering the national and international challenges in science, technology, and innovation.

With this publication, we renew our commitment to the transition to a knowledge-based society, in which science and technology are the key tools to achieve sustainable, inclusive, and competitive development. We encourage the academic community, productive sectors, and decision-makers to continue strengthening cooperation and promoting initiatives that generate a positive and lasting impact in our country. CeNAT's 2024 Report is a living testimony to the transformative potential of collaborative research and a call to continue shaping the future of Costa Rica on the pillars of scientific excellence and social engagement.







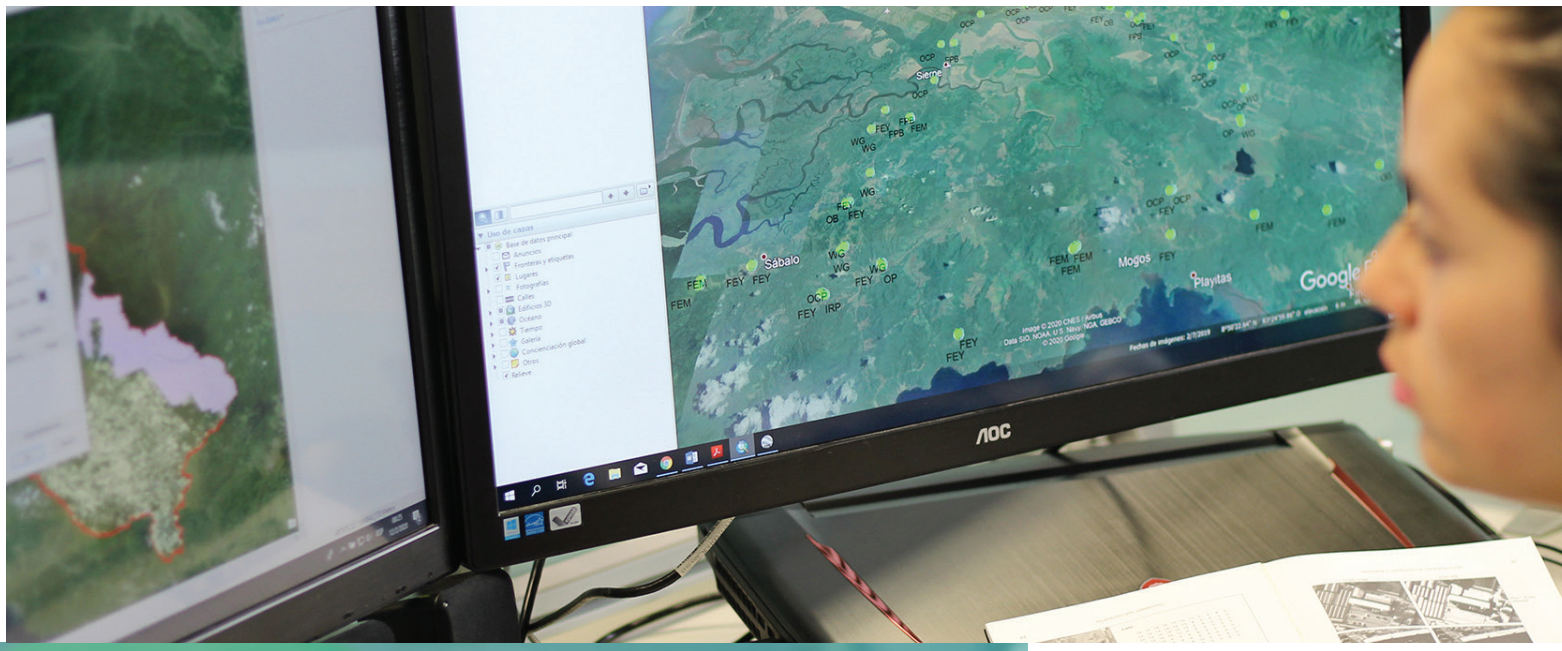
Background of CeNAT

The creation of the Centro Nacional de Alta Tecnología (CeNAT) in Costa Rica was promoted in 1997 by the government in power, in response to the need to strengthen the link between academia and the productive sector, as well as to consolidate an ecosystem of innovation and technological development that would boost investment in high technology. This initiative was supported by state universities, recognizing their fundamental role as generators of knowledge and drivers of scientific development in the country.

In October 1997, the Government of the Republic presented to the National Council of University Deans (CONARE) the proposal to allocate the property used by the former International Development Agency (USAID) for the creation of a national high-tech center. The objective was to promote links between academia and the productive sector in high-impact areas, in order to attract foreign investment and benefit national development. This proposal was inspired by successful examples from countries such as Korea, Singapore, and Israel.

On May 25, 1998, the Legislative Assembly enacted Law 7806, authorizing the transfer of the building to CONARE, to create CeNAT, which was named Dr. Franklin Chang Díaz. Article 3 of this law also defined that the State and its institutions are authorized named after transfer resources to CeNAT, whose administration and management will be the responsibility of FunCeNAT.

In line with this legal and institutional framework, CONARE formalized the creation of CeNAT as an interdisciplinary research center of an interuniversity nature in session 5-99 of March 2, 1999. This decision enabled the consolidation of a collaborative environment between state universities, the Government, and the productive sector, promoting the integration of scientific knowledge with technological innovation, to strengthen national competitiveness.





Thus, CeNAT was established as an inter-university meeting space for the academy, the Government, and the productive sectors of the country, in different high technology fields. It joined forces to leverage the opportunities that technological development offers to countries like Costa Rica, which has invested significantly in the education of their population at all levels.

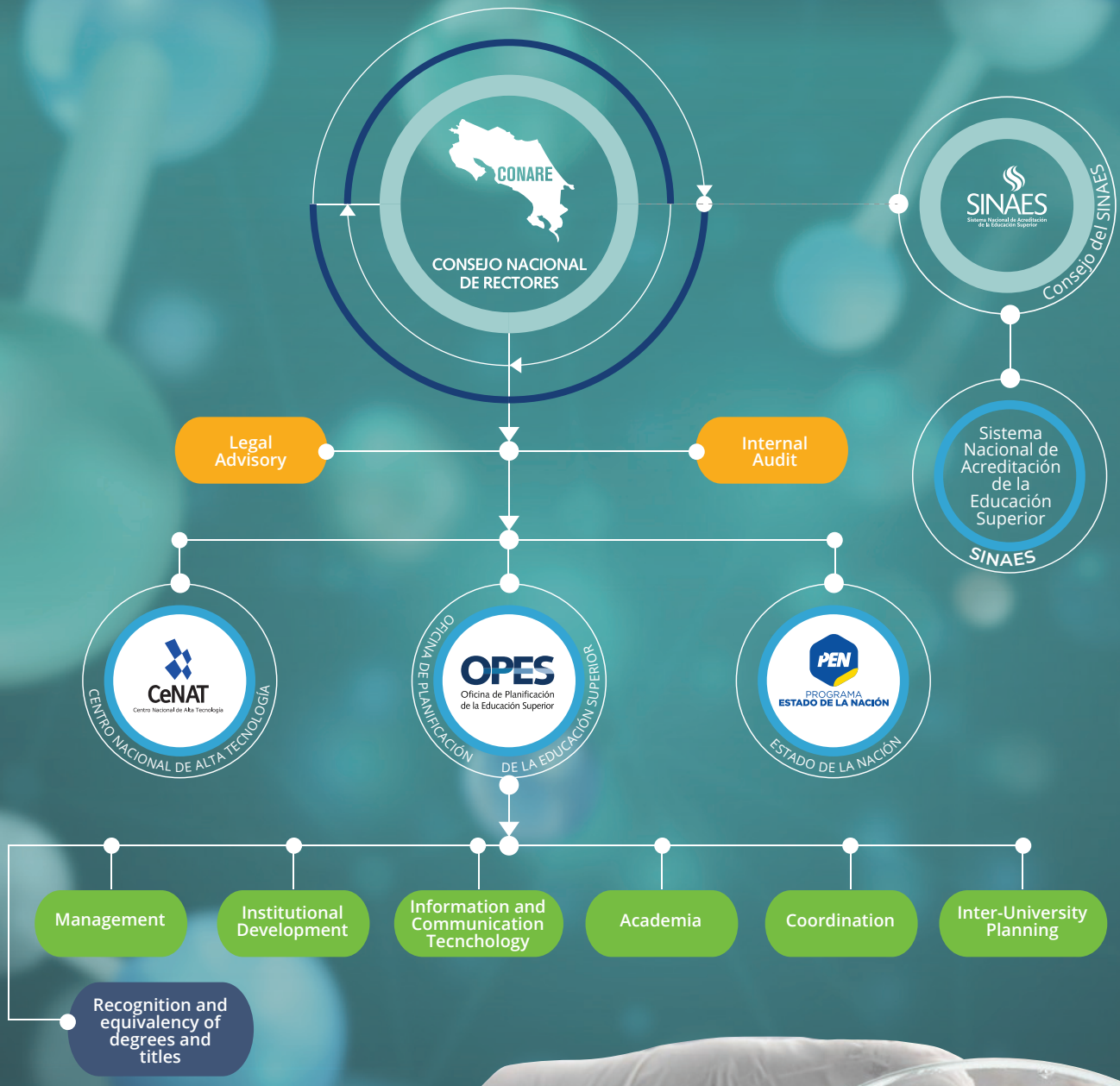
Over the years, thanks to the support of public universities, CeNAT has consolidated a solid working platform. Its structure is based on the technical and professional excellence of its human team, the development of cutting-edge infrastructure, and the implementation of strategic research and technology transfer projects. This dynamic platform has allowed it to transform knowledge into development, thus responding to global challenges and contributing to strengthening Costa Rica as an innovation hub in the region.

CeNAT as a **CONARE program**

Coordination Line

- Level 1: Council
- Level 2: Program
- Level 3: Areas and Divisions
- Level 4: Office

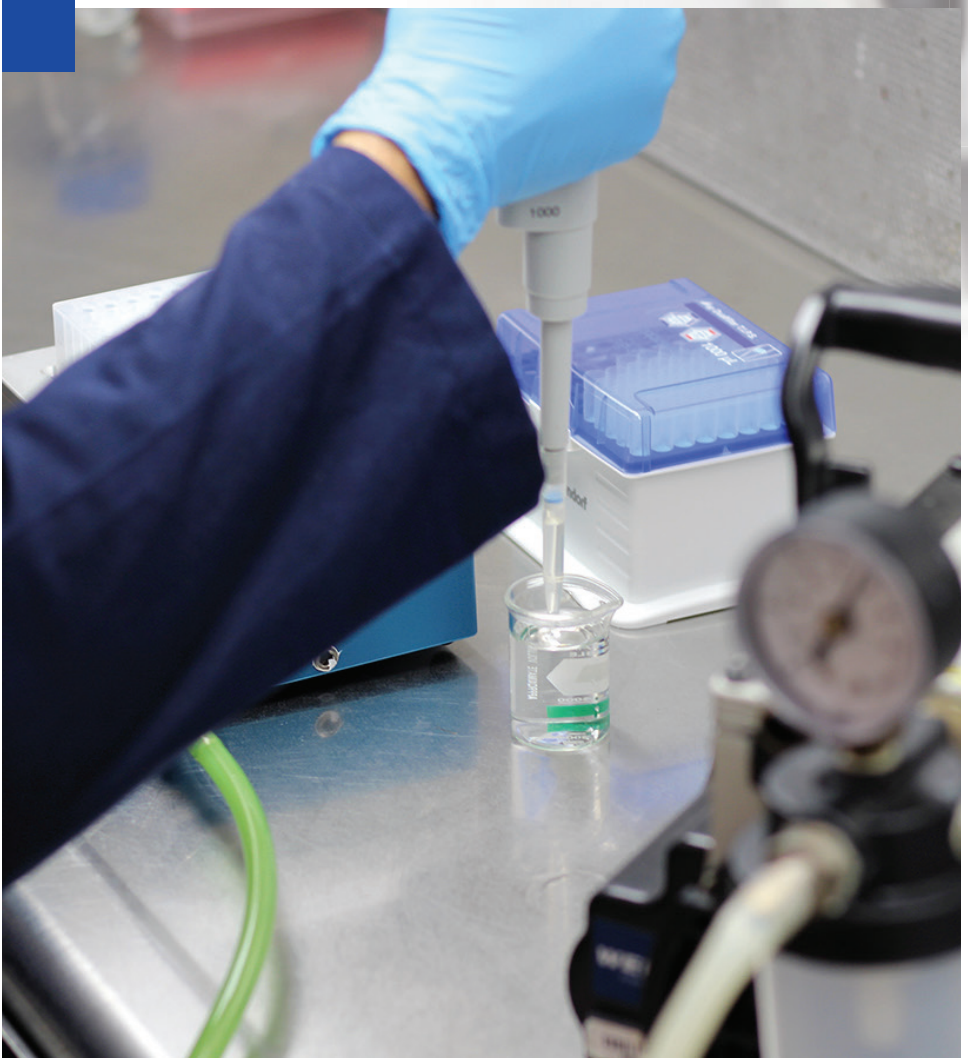
Prepared by: Institutional Development Area





Strategic Planning

The year 2024 was marked by an important occasion due to the change in directorate of CeNAT. Therefore, the Strategic Planning process was paused to evaluate the available resources and identify the needs to implement improvements.



CeNAT already had a philosophical framework of its Strategic Plan and the Strategic Plans of its laboratories in place, including a mission, vision, and development objective to guide the course of the institution during this five-year period. However, this philosophical framework should be updated and adjusted to new realities, in light of the guidelines of the SDG Plans.

Mission of CeNAT

"We are an inter-university coordinating body that facilitates and promotes the proper functioning and systemic development of scientific research in higher education, in various areas of high scientific-technological content, focused on the development of research, linkage, and extension, within a framework of innovation and development with the government, civil society, and the private sector". (Based on the articles of incorporation of CENAT).



Vision of CeNAT

"To be a leading innovative Center that generates high-tech knowledge in the promotion of competitiveness, by fostering scientific publication spaces and learning transfer, strengthening knowledge exchange at the highest scientific level and enhancing the mechanisms that support efficient and transparent interuniversity and institutional coordination, both nationally and internationally".

In addition to its mission and vision statements, CeNAT incorporates the development goal into its philosophical framework, as a contribution by the Center to the development of the country.

Development Goal

To conduct research activities that will provide the country with the necessary, relevant and strategic technology for the competitive development of the different sectors of society, in the economic, social, and environmental scopes, through innovation, development, training, and services in science and technology. (Based on the constitutive act of CENAT).



Objectives of **CeNAT**

The objectives come from the constitutive act of CeNAT, which guides the work of the institution, its contribution and the areas that it should manage to address the impact of the scientific exercise.

Main
Objective

To conduct training and research activities that would provide the country with the necessary, relevant, and strategic technology for the competitive development of the different sectors of society in the economic, social, and environmental areas.

Specific
Objectives

The specific objectives describe the major categories that come from the articles of incorporation, which aim to contribute to the scientific development of the country.

Regarding Science Promotion

To promote the development of research activities to provide the country with the necessary, relevant, and strategic technology, for the competitive development of the different sectors of society in the economic, social and environmental areas.

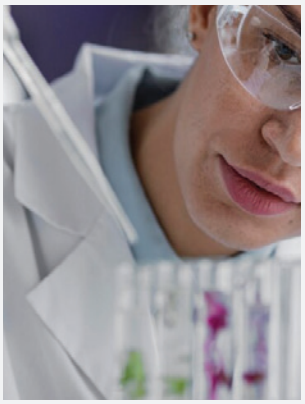
To carry out anything that represents social, cultural, and scientific wellbeing according or pursuant to Article 1 of the Law on Foundations.



Regarding Information and Training

To promote the creation and to provide contributions to support thinking spaces, as well as to coordinate actions that support scientific and technological development and conformation of multidisciplinary teams of researchers with a high level of training and experience (high level of critical mass), especially at the graduate level.

To promote technology extension, through exhibitions, conferences, seminars, technology markets, and training courses, among others.



Regarding Contribution to Postgraduate Specializations

To promote and support the implementation of academic research programs at the graduate level in coordination with state higher education university institutions.



Regarding Inter-Sectoral Linkage

To promote the coordination of public and private sectors involved in generation, training, transfer, and application of high technology.

To encourage and promote the generation of businesses with high technological content and high added value for the country.

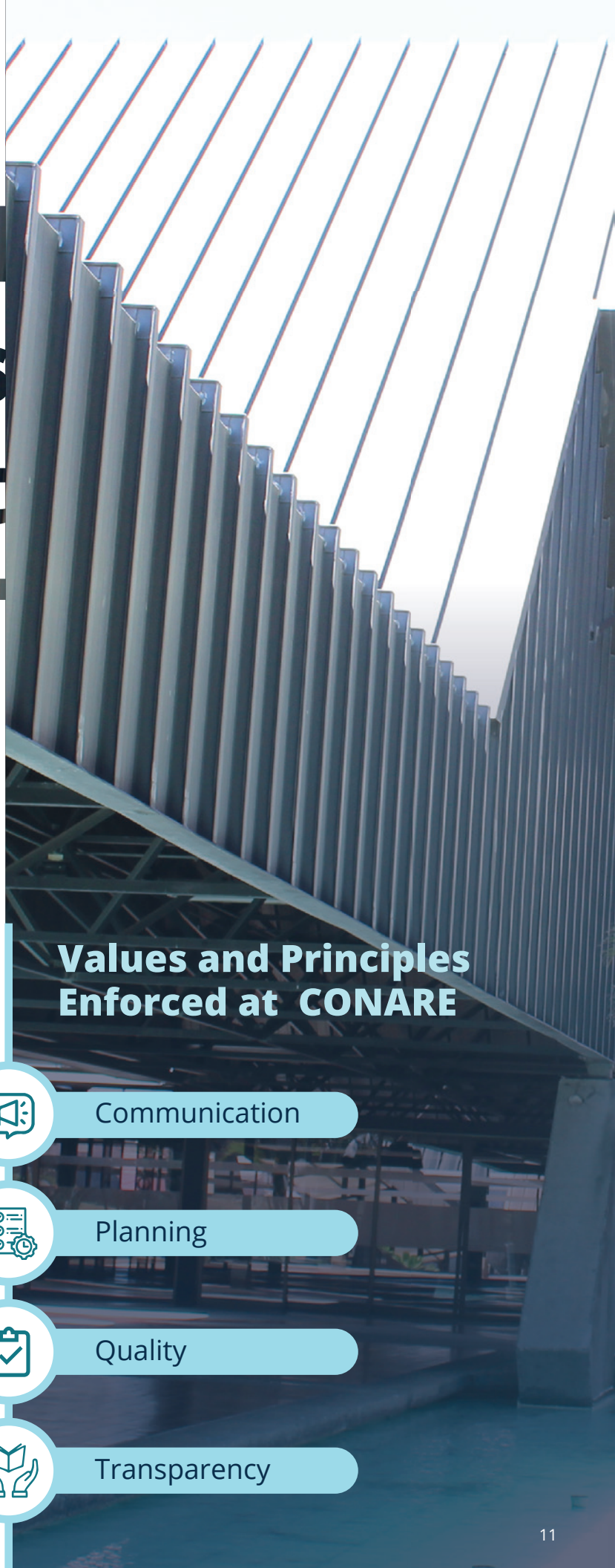


Regarding Contribution to the Country's Development

To conduct -with research purposes- activities for development, licensing, utilization of resources (know-how), donation or purchase of patents, inventions, industrial or utility models.

To publicize and sell publications arising from research; to assign, sell, transfer and grant licenses for use of its patents, industrial, or utility models, as well as any other assets that belong to its intellectual property.

Values and Principles Enforced at CeNAT





Values Enforced at **CeNAT**

- Willingness to excellence in the work that is undertaken.
- Transparency in the exercise of research.
- Tolerance and flexibility in the processes that are developed.
- Ongoing learning attitude.
- Critical and self-critical position to address improvements in all research processes.
- Continuous personal improvement attitude at the scientific level.



Principles Enforced at CeNAT



- Collaborative and integrated work in all processes.
- Scientific rigor in the studies undertaken.
- Work conducted within interdisciplinary complexity.
- Effective communication.
- Accountability in goals and times set for each task.
- Commitment to impact generation on the actions undertaken.



Strategic Areas of **CeNAT**

Materials Science and Engineering	Biotechnology	Advanced Computing	Environmental Management		Science, Culture, and Society
LANOTEC	**CENIBiot**	**CNCA**	**PRIAS**	**Environmental Management**	
Innovation and Development	Genetics	Artificial Intelligence	Geoespatial Innovation	Programs	Programs
Life Sciences	Chemistry	Bioinformatics	Remote Sensing	Innovation and Development	CeNAT Teaching
Standards and regulations	Bioprocesses	High Performance Computing	Spatial Data Infrastructure	Climate Variability and Change	Scientific Diplomacy
Scientific Vocations	Health	Scientific Computing	Earth Observations	Agromatics	CeNAT-CONARE Scholarships
	Biological Assays	Data Science		Clean energy	
	Synthetic Biology	Advanced Networks		Technical Assistance	
		Infrastructure			



Monitoring of organizational management indicators for Laboratories and the Environmental Management Area

Monitoring of organizational sustainability indicators for Laboratories and the Environmental Management Area

These strategic areas highlight the relevance of the collegiate work of each dependency that makes up the organization, where each action contributes to efficiency and projection.

CeNAT
Strategic Lines



The strategic lines are present in the work of CeNAT. They are defined as cross-sectional lines of the substantive activities carried out by the laboratories and the Environmental Management Area.

These strategic lines highlight the importance of the collegiate work of each dependency that makes up the organization, where each action contributes to efficiency and projection.



The strategic lines and their respective definitions are presented below.

Knowledge Generation:

It provides the country with knowledge on relevant and strategic high technology, for the competitive development of the different sectors of society in the economic, social, and environmental scopes.

Internationalization:

It strengthens knowledge exchange at the highest national and international levels, both in the public and private sectors.

Learning Transfer:

It supports learning spaces from interuniversity coordination to articulate actions that support scientific and technological development and the formation of multidisciplinary groups of researchers with high scientific rigor.

Institutional Management:

It strengthens organizational management through mechanisms that support the sustainability of CeNAT, promoting efficient and transparent accountability and the development of scientific relevance.



CeNAT AREAS, LABORATORIES, AND PROGRAMS: **Promoting Scientific Development**

Creation **of the Areas**

In accordance with agreement 5-99 of the Consejo Nacional de Rectores, CeNAT would carry out its activities within a framework of technological innovation, in close collaboration with business sectors and considering national development policies. With the aim of providing the country with the necessary, relevant, and strategic technology to promote the competitiveness of the different sectors of society in the economic, social and environmental fields.

It will focus on the coordination of the following areas:

- Materials Science and Engineering
- Biotechnology
- Computer Science and Information Technology
- Manufacturing Processes
- Environmental Management
- Science, Culture and Society

Areas and Dependencies of **CeNAT**



Areas

- Materials Science and Engineering
- Biotechnology
- Computer Science and Information Technology
- Environmental Management
- Science, Culture and Society

Laboratories and Programs

- LANOTEC
- CENIBiot
- CNCA
- PRIAS
  - Observatorio Climático
  - AGROMATICA
- Cátedra CeNAT
- Diplomacia Científica
- Becas CeNAT-CONARE

Creation of

Laboratories and Programs

After the inception of CeNAT and its research areas, the different laboratories that comprise it were created:

I. **Materials Science and Engineering:** It was constituted in 2004, by the National Nanotechnology Laboratory (LANOTEC).

II. **Biotechnology:** Since 2013, the CENIBiot Laboratory integrates this operational area.

III. **Advanced Computing:** The National Advanced Computing Collaboratory (CNCA) is part of it, since 2009.

IV. **Manufacturing Processes:** There is no operating unit attached to it.

V. **Environmental Management (AGA):** This area includes one laboratory and two programs:

- PRIAS Laboratory: It began as a program in 2003 and became a laboratory in 2015.
- Programs:
  - Variability and Climate Change Observatory. It started in the year 2010.
  - Agromatics, Food Safety, and Slow Food. It started in 2010.

VI. **Science, Culture and Society:** This is a cross-sectional area that is managed directly by the Directorate of CeNAT. It is made up by three Programs:

- CeNAT Teaching, since the beginning of CeNAT in 2000
- CeNAT-CONARE Scholarships, created in 2013
- Scientific Diplomacy Observatory, created in 2024



CONSEJO NACIONAL DE RECTORES

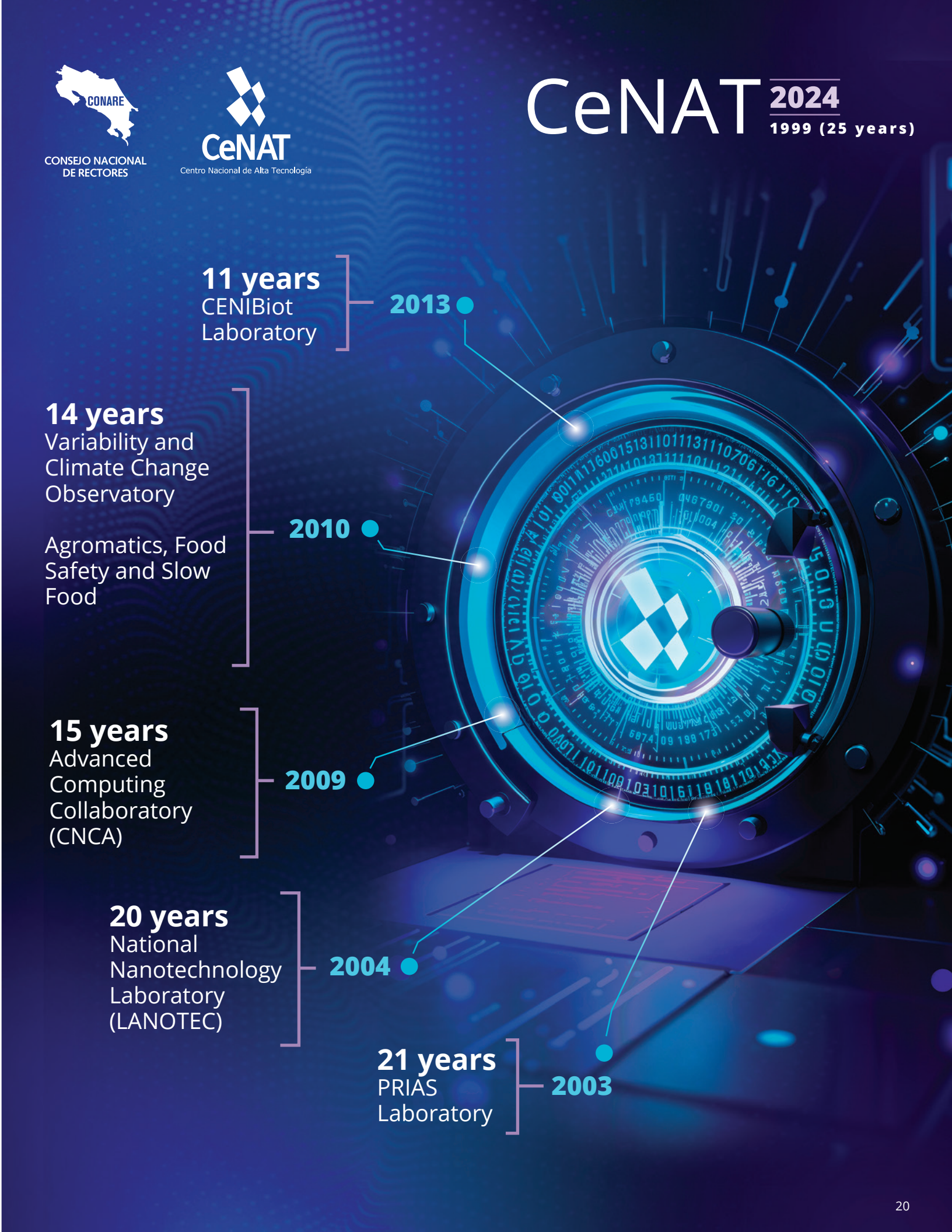
CeNAT
Centro Nacional de Alta Tecnología

CeNAT 2024
1999 (25 years)

11 years
CENIBiot Laboratory
2013

14 years
Variability and Climate Change Observatory

Agromatics, Food Safety and Slow Food
2010



15 years
Advanced Computing Collaboratory (CNCA)
2009

20 years
National Nanotechnology Laboratory (LANOTEC)
2004

21 years
PRIAS Laboratory
2003

Organizational Development of CeNAT



CONSEJO NACIONAL DE RECTORES

Scientific Council comprised by CONARE Vice-Chancellors of Research

Director General of CeNAT

Materials Science and Engineering

LANOTEC

- Innovation and development
- Life Sciences
- Standards and regulations
- Scientific Vocations

Biotechnology

CENIBiot

- Genetics
- Chemistry
- Bioprocesses
- Health
- Biological Assays
- Synthetic Biology

Computing Advanced

CNCA

- Artificial Intelligence
- Bioinformatics
- High Performance Computing
- Scientific Computing
- Data Science
- Advanced Networks
- Infrastructure

Environmental Management

PRIAS

- Geoespatial Innovation
- Remote sensing
- Spatial Data Infrastructure
- Earth Observations

ENVIRONMENTAL MANAGEMENT AREA

Programs

- Innovation and Development
- Climate Variability and Change
- Agromatics
- Clean energy
- Technical Assistance

Ciencia, Cultura y Sociedad

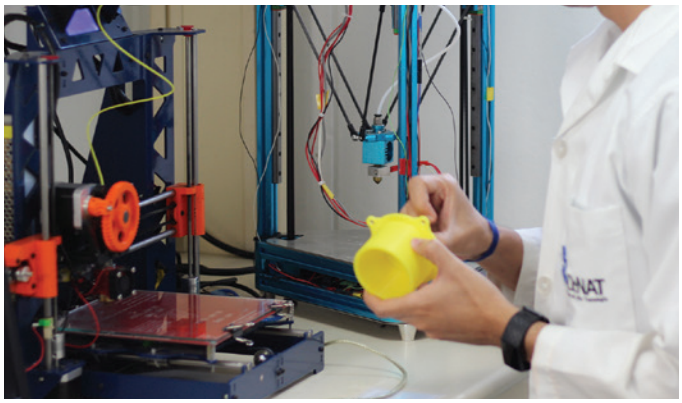
Programs

- CENAT Teaching
- Scientific Diplomacy
- CeNAT/CONARE Scholarships

Monitoring of organizational management indicators for laboratories and the Environmental Management Area

Monitoring of organizational sustainability indicators for Laboratories and the Environmental Area

The managing actions of CeNAT's Directorate are aligned to what has been stated in the articles of incorporation of the Centro Nacional de Alta Tecnología, which is **"To ensure the correct performance of CeNAT, following the guidelines issued by CONARE and the strategic lines defined by the Scientific Council".**





The fundamental basis of the work of the Directorate is to watch over the strategic lines of the Center, such as:

- Monitoring and execution of agreements and conventions of CeNAT
- Establishing the operational tactics and goals to be developed by the organization.
- Continuous follow-up to the actions carried out by each area and program attached to CeNAT.
- Overseeing the Sciences, Culture, and Society areas, which integrates the following programs:
  - CENAT Teaching
  - CeNAT-CONARE Scholarships
  - Observatory of Scientific Diplomacy

CeNAT
Teaching

The Science, Culture, and Society area oversees the CeNAT Teaching program, which envisages promoting knowledge transfer activities. Through **this program, lectures, workshops, and conferences are held, which are aimed at different sectors of society, government, and academia,** taught by world-class national and international experts, and linked to activities and/or projects of CeNAT, in scientific and technological subjects.



In 2024, CeNAT Teaching was not operational. However, several relevant lectures were held in the different areas and laboratories, which are detailed below.

Relevant **Lectures**

LANOTEC



1 Ibero-American Night

Held within the framework of the Ibero-American Science Week and organized by the Ibero-American Science and Technology Network. The participation was led by researchers Dr. Yendry Corrales and Lic. Juan Miguel Zúñiga.

2 Sphingolipid-Based Synergistic Interactions to Enhance Chemosensitivity in Lung Cancer Cells

Presented at the international oncology congress "Cancer Research Advances", held in Madrid, Spain, organized by the European Society for Molecular Oncology (ESMO). The presentation was led by researcher Susana Mesén Porras.

3 CEPlaSt - Dominican Republic

An event organized by the Dominican Plastics Association (ADIPLAST). Researcher Dr. Diego Batista presented advances in biopolymers, as part of his participation.

4 Theoretical-Practical Course on Nanotechnology and Nanomaterials

It was conducted at CeNAT, organized jointly with the Ministry of Health. The training was delivered by researchers Dr. Diego Batista, Eng. Daniela Zúñiga Rivera, Eng. Andrea Rivera Álvarez, Lic. Juan Miguel Zúñiga Umaña, and Reinaldo Pereira Reyes.

5

ISMC 2024 Blurring Boundaries Between Fields

Presented at the ISMC 2024 international conference, held in North Carolina, United States of America, organized by the International Society of Materials Chemistry. The presentation was led by Dr. Yendry Corrales Ureña.



CENIBiot

6

NANOSERIES Poster

This poster was presented at the NANOSERIES 2024 scientific event, held in person in Lisbon, Portugal, by researchers Dr. Yendry Corrales, Dr. Diego Batista, and Reinaldo Pereira Reyes.



1

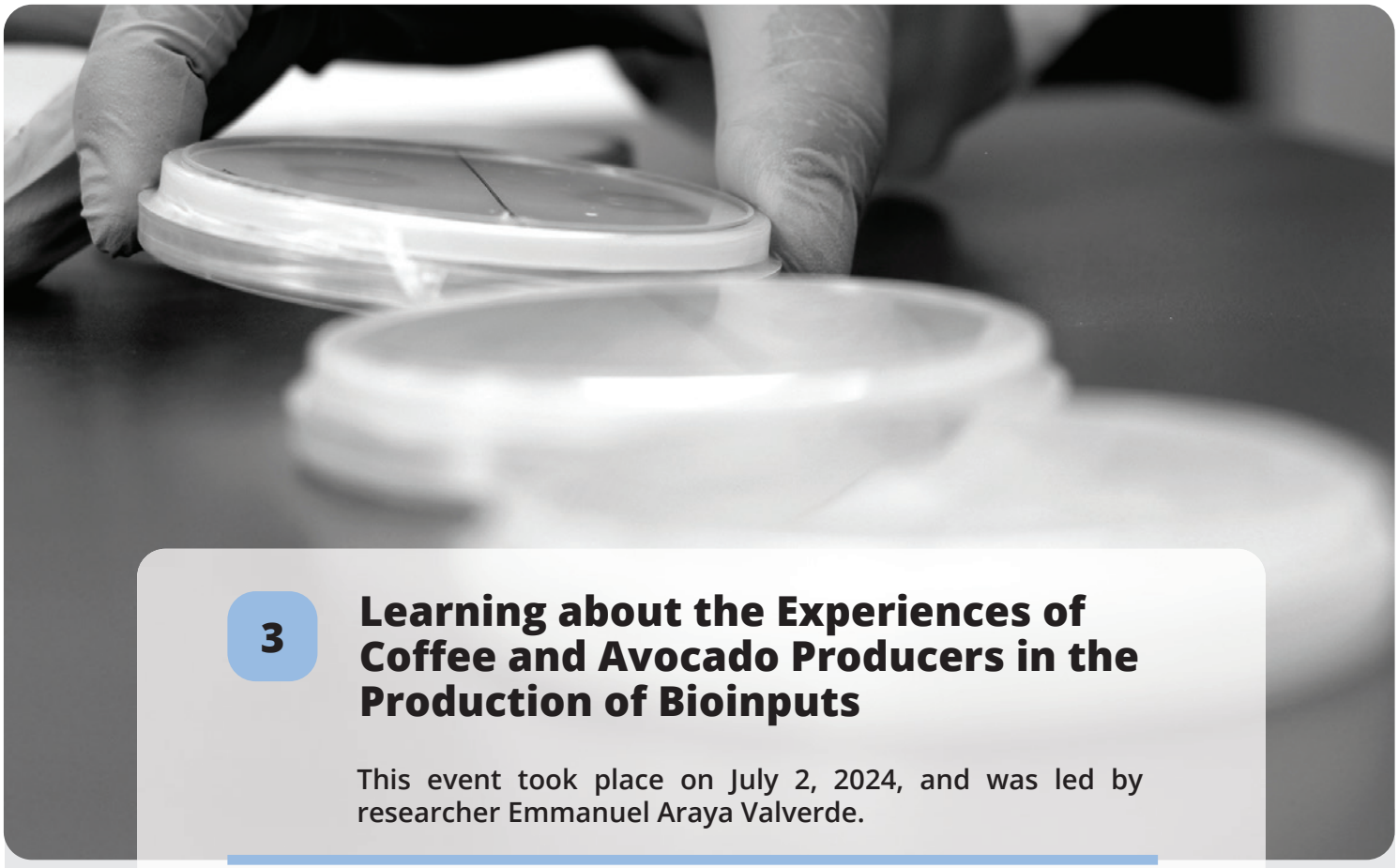
4th Symposium on Genomics and Biotechnology, Santiago, Chile

A lecture was taught as part of the participation at the event, on August 7, 2024, by Dr. Max Chavarría Vargas.

2

"Harnessing Biodiversity and Agro-industrial Residues in Costa Rica: Local Solutions to Promote Sustainable Agriculture Through Novel Biostimulants"

Participation at the WAITRO 2024 Summit, held in Nanjing, China. An in-person lecture was taught on November 13, 2024, by researcher Emmanuel Araya Valverde.



3 Learning about the Experiences of Coffee and Avocado Producers in the Production of Bioinputs

This event took place on July 2, 2024, and was led by researcher Emmanuel Araya Valverde.

4 Development of Validated Genetic Fingerprint Methodologies for Applications in Genetic Improvement and Clonal Propagation of Teak And Melina, at the Annual Assembly of the Cooperative for Forest Conservation and Genetic Improvement, GENFORES

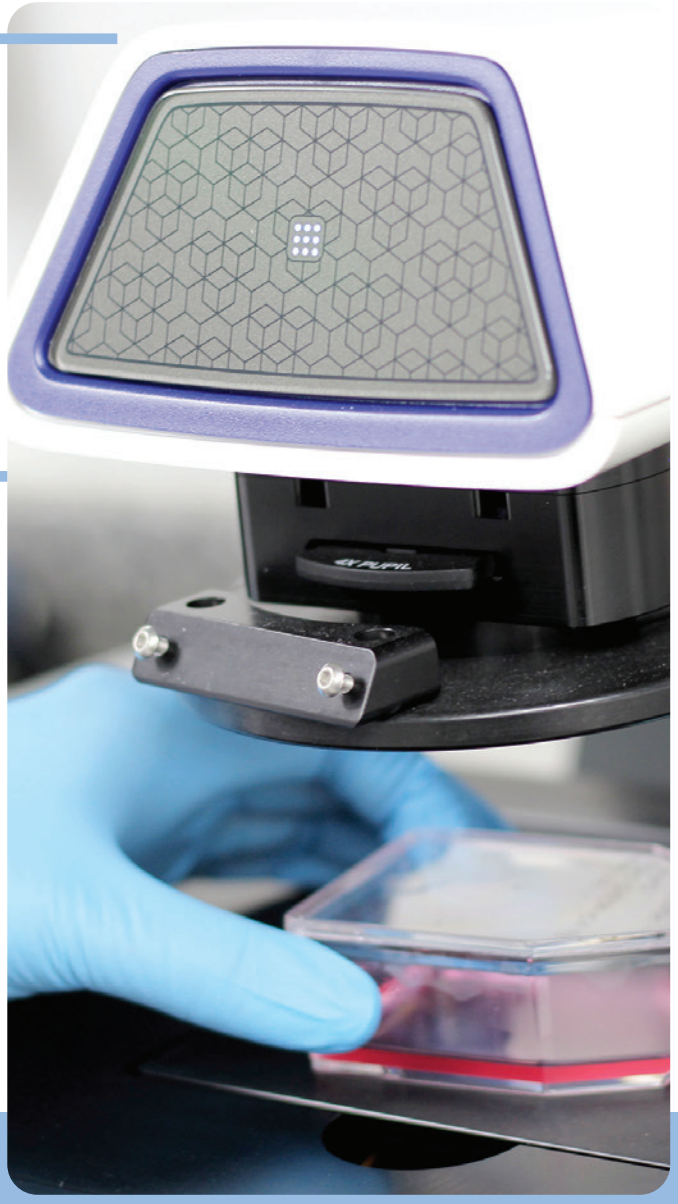
The presentation was led on August 8, 2024, by researcher Emmanuel Araya Valverde.

5 Scientific Display: A look at Science

An in-person scientific display was held on August 30, 2024, by researchers Erika Barrantes and Natalin Picado.

6 Lecture to students of Environmental Biotechnology, UCR

Conducted on September 13, 2024, by researchers Valeria Leandro, Pamela Alfaro, and Rachel Ardón.



7

Applied Science in Solving Problems that Affect Us as a Society

The presentation was led on November 21, 2024, by researchers Erika Barrantes and Natalin Picado.

8

Symposium “Connections to Sustain Science in Latin America”

This event took place in Barranquilla, Colombia, on March 2, 2024. It was led by researcher Pamela Alfaro.

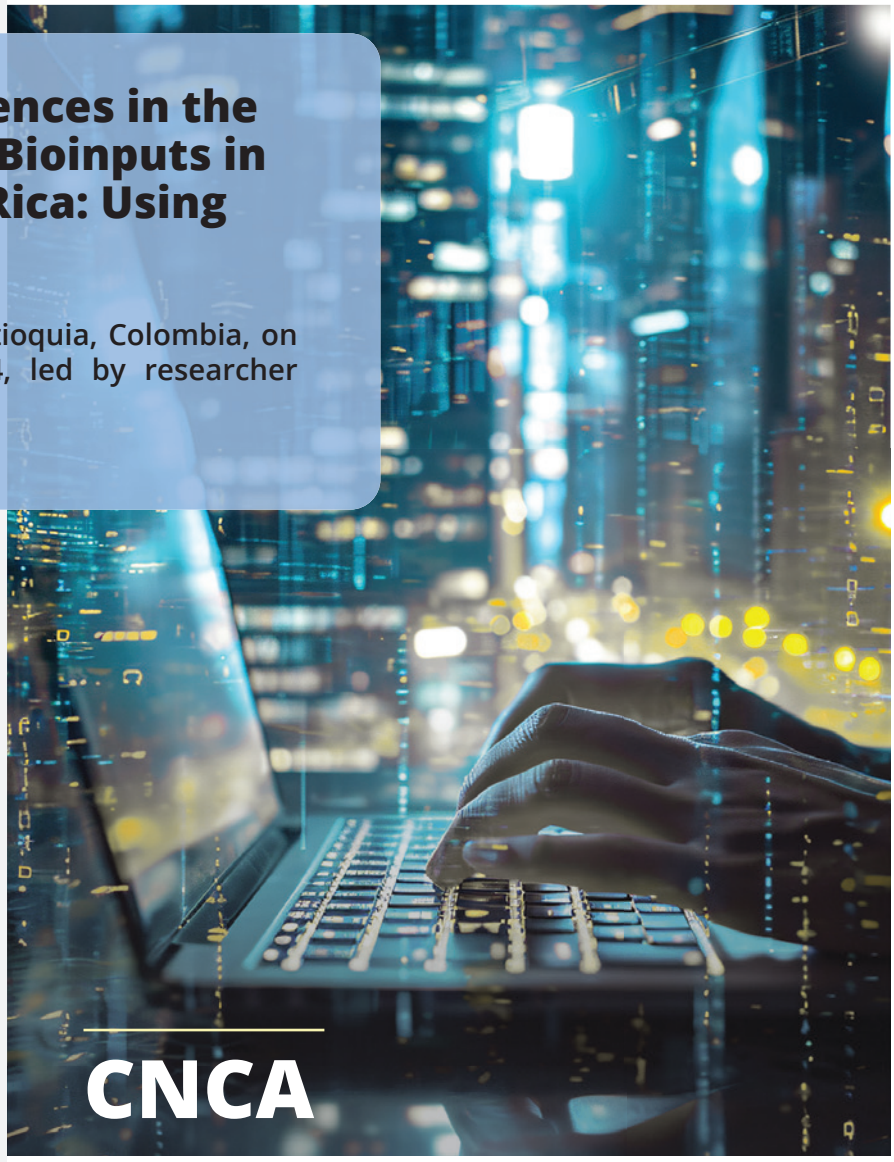
9

Applying Genomics and Metabolics to Explore the Biosynthetic Potential of Actinomycetes from Costa Rica

A lecture held in León, Guanajuato, Mexico, on August 19, 2024, by researcher Melissa González.

10 Experiences in the Use of Bioinputs in Costa Rica: Using Violas

An event held in Antioquia, Colombia, on September 23, 2024, led by researcher Emmanuel Araya.



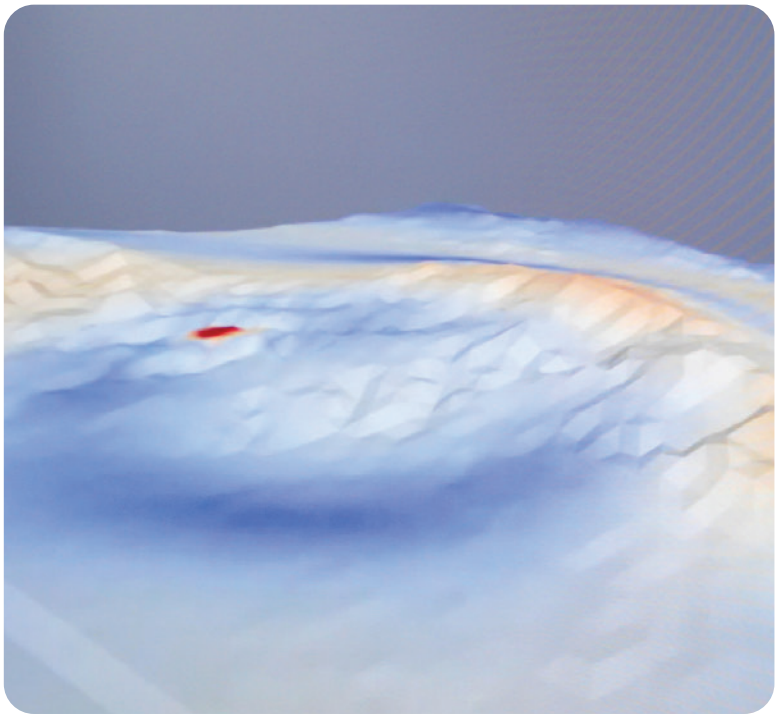
11 I Microbiology Literacy Workshop for Teachers

The presentation at the event was held on November 21, 2024, by researcher Max Chavarría Vargas.



1 I Symposium on Artificial Intelligence Applications in Health

Organized by the Costa Rica Institute of Technology (TEC). Researcher Fabricio Quirós taught the lecture “Analysis of electrocardiographic data for the detection of cardiovascular diseases”.



2 FDI Summit

The FDI Summit is an international event that brings together leaders from various industries to discuss the future of foreign direct investment, innovation, and emerging technologies. Director Esteban Meneses participated in the panel “Responsible AI: From Principles to Practice for Ethical Innovation.”

3

XXIX International Seminar on Natural Sciences for Development

This seminar is an academic space that fosters discussion on advances in natural sciences and their impact on sustainable development. Researcher Carlos Gamboa participated with the lecture “Scientific Innovation and National Networks: The role of the Copernicus Academy in transforming research and education”.



4 Global Quantum Literacy Event + IBM Qiskit Fall Fest 2024

This event is part of a global initiative to foster education in quantum computing, by combining outreach activities with the IBM Qiskit community. Researcher Johansell Villalobos participated with the lecture “Why High-Performance Computing?”

5 20th Brazilian Bioinformatics Congress: X-Meeting 2024

The X-Meeting is a reference event in bioinformatics in Latin America. Researcher Melany Calderón participated with the presentation “Understanding the Influence of Depth on the Global Deep-Sea Plasmidome”.

6 IEEE Central America and Panama Convention (CONCAPAN)

CONCAPAN is one of the most important tech conventions in the region, organized by IEEE, where advances in electrical engineering, electronics, and computing are presented. Researcher Christian Asch participated with the presentation "Quantifying the Performance of Decoding Algorithms Using Graphic Processing Units for the RICH Subdetector at LHCb".

7 Iberoamerican Congress on Pattern Recognition (CIARP)

CIARP is an international conference that brings together researchers in pattern recognition and machine learning. Researcher Fabricio Quirós participated with the presentation "An Effective Artificial Intelligence Pipeline for Automatic Manatee Count Using Their Tonal Vocalizations".



PRIAS

1 Closing conference at the 2nd Conference on Digital Technologies Applied to Sustainability of the Agrifood, Forestry and Environmental Sectors

Director Cornelia Miller gave the closing keynote address at the 2nd Conference on Digital Technologies Applied to Sustainability of the Agrifood, Forestry and Environmental Sectors, held on February 28, 2024, at the Headquarters of the Agricultural Engineers Professional Association. She discussed the topic "Conclusions and aspects for a digital future in agriculture".

2 Geographic Information Systems: Basic Concepts and Applications

This workshop was held for biology students at the University of Costa Rica. It included a description of basic aspects of GIS and SNIT, as well as a practical lesson on their use. It was led by researchers Vanessa Morales and José Umaña.



3 Environmental Conservation Principle and its Relationship with Food

Taught by researcher Vanessa Morales to members of the College of Nutritionists on the occasion of Nutrition Week.



4 Drones in Science: An Approach to their Use in Geospatial Research Projects at the PRIAS Laboratory.

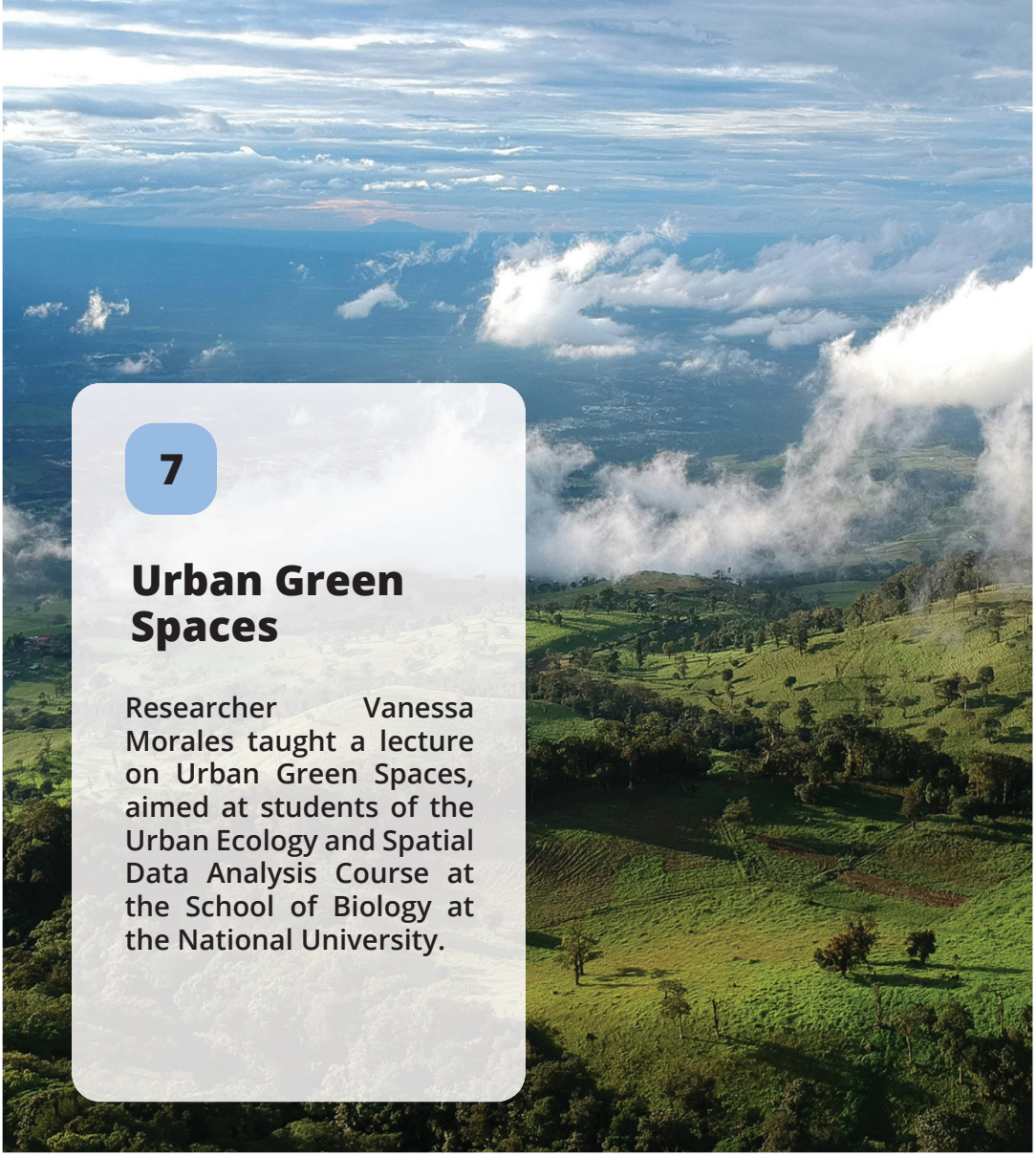
A workshop taught by researchers Vanessa Morales and José Umaña to students of the Forestry Engineering major at the National University. It presented examples of the use of drones in research projects at the PRIAS Laboratory.

5 Introspace, Aerospace Club of the Central University (Proxima UCentauri)

Participation of Director Cornelia Miller and Infrastructure Analyst Stephanie Leitón as speakers at the first in-person activity of the Central University Aerospace Club. The impact that PRIAS has on the development of the aerospace industry in the region was discussed.

6 Diversity and Diet Composition of Two Troops of Howler Monkeys (*Alouatta Palliata*) in Two Dry Tropical Forest Fragments in Tamarindo, Santa Cruz, Guanacaste

Researcher Vanessa Morales gave an oral presentation at the Second Latin American Primate Symposium, held at the University of Costa Rica, Western Campus.



7

Urban Green Spaces

Researcher Vanessa Morales taught a lecture on Urban Green Spaces, aimed at students of the Urban Ecology and Spatial Data Analysis Course at the School of Biology at the National University.

9

Costa Rica Roundtable Discussion

Participation of researcher Heileen Aguilar at the Seminar on Satellite Remote Sensing for Belt and Road Countries, held in Nanjing, China, offered by Nanjing University of Information Science & Technology.

8

20 years of PRIAS: From Costa Rica, Refining the Generation of Geospatial Knowledge by Integrating Emerging Enabling Earth Observation Technologies and Scientific Airborne Missions

Presented by infrastructure analyst Stephanie Leitón Ramírez, at the 2nd Central American Space Congress at the University of Valle, Guatemala.



10

Costa Rica Country Report

Participation of researcher Jose Umaña at the International Seminar on Beidou Satellite and GNSS, held in Wuhan, China, offered by the Wuhan Research Institute of Posts and Telecommunications.

11

Forestry Engineering: A Vision to the Future

Director Cornelia Miller taught the lecture “Forest Engineering: Vision for the Future”, aimed at graduates of the forestry engineering major at the Costa Rica Institute of Technology.



12

Exploring Copernicus Browser: Radar Image Processing for Flood Monitoring and Detection

Researcher Esteban Montenegro, along with Ariana Arguello, Laura Castellana, Copernicus Colombia project coordinator, and Carlos Gamboa, CONARE Network coordinator, taught this workshop. This was the first one of the Copernicus Academy Costa Rica.

13

Creative Space: A Computational Space to Let Spatial Creativity Fly from Costa Rica

Infrastructure analyst Stephanie Leitón presented on the PRIAS Laboratory's computational creative space initiative at the 2024 International Astronautical Congress, organized by the International Astronautical Federation (IAF).



14 PRIAS: 20 years of Trajectory-building Research in Earth Observations for Costa Rica and the World.

Researcher Vanessa Morales presented a poster on a literature review of the 20th anniversary of the PRIAS Laboratory at the 2024 International Astronautical Congress, organized by the International Astronautical Federation (IAF) at the Earth Observation Symposium.

15 Feeding Behavior of Howler Monkeys (A. pAlliata Palliata) in Rwo Dry Tropical Forest Fragments in Costa Rica.

Researcher Vanessa Morales spoke about the Feeding Behavior of Howler Monkeys at the joint APC-SLAPrim Congress (5th Latin American Congress and 4th Colombian Congress of Primatology), held at the National Technical University, in the city of Pereira, Colombia.

Environmental Management

1 Ibero-American Night of Science

This event was held within the framework of the Ibero-American Science Week. It was organized by the Ibero-American Network of Science and Technology. The participation included the presentation of the ENERGYTRAN *Project,* presented by Jazmín Calderón, and the presentation on *Eco-gastronomy and Promotion of Local Products,* by Patricia Sánchez. In addition, Allan Campos spoke about Comprehensive Risk Management And Adaptation to Climate Change with Innovative Communication Strategies, highlighting the CeNAT – CONARE Climate Observatory.



2

Climate Observatory: Using the PIACT Interactive Platform for the Agricultural Sector and Citizen Science

Researcher Jazmín Calderón Quirós presented it, with the aim to disseminate the impacts of climate change on the agricultural sector and cities.



3

Lecture: Comprehensive Risk Management and Adaptation to Climate Change from a Scientific Perspective Applied with Innovative Communication Strategies. A success story in Central America that can be replicated throughout society: the CENAT-CONARE Climate Observatory in COSTA RICA

Presented by director Allan Campos at the *Third Inter-American Conference on Disaster Risk Reduction and Adaptation to Climate Change,* in Manizales, Colombia.

4

Climate Adaptation Systems Promote Support to the Socio-Environmental Sector Through Effective Communication Technology Tools

It was carried out at La Salle University, in order to encourage critical knowledge about the advances that technology has had for the development of climate adaptation systems in the socio-environmental sector. Presented by Jasmine Calderon.



5

Workshop - “Environmental Offset: Climate is a Current Challenge"

This activity was carried out at the Matambú school, where adaptation and mitigation strategies were developed in response to climate conditions, impacting vulnerable communities and strengthening local resilience. Taught by Jasmine Calderon.

6

Training on Action from Institutions and Households within the Framework of the SDGs in the Face of Climate Impact

This event sought to develop an implementation plan under the parameters of water, electricity, circular economy, fossil fuels, and environmental risks. Taught by Jasmine Calderon.

7

Exhibition at the UAEM Tenancingo University Center (Mexico): Importance of the Indigenous Trilogy

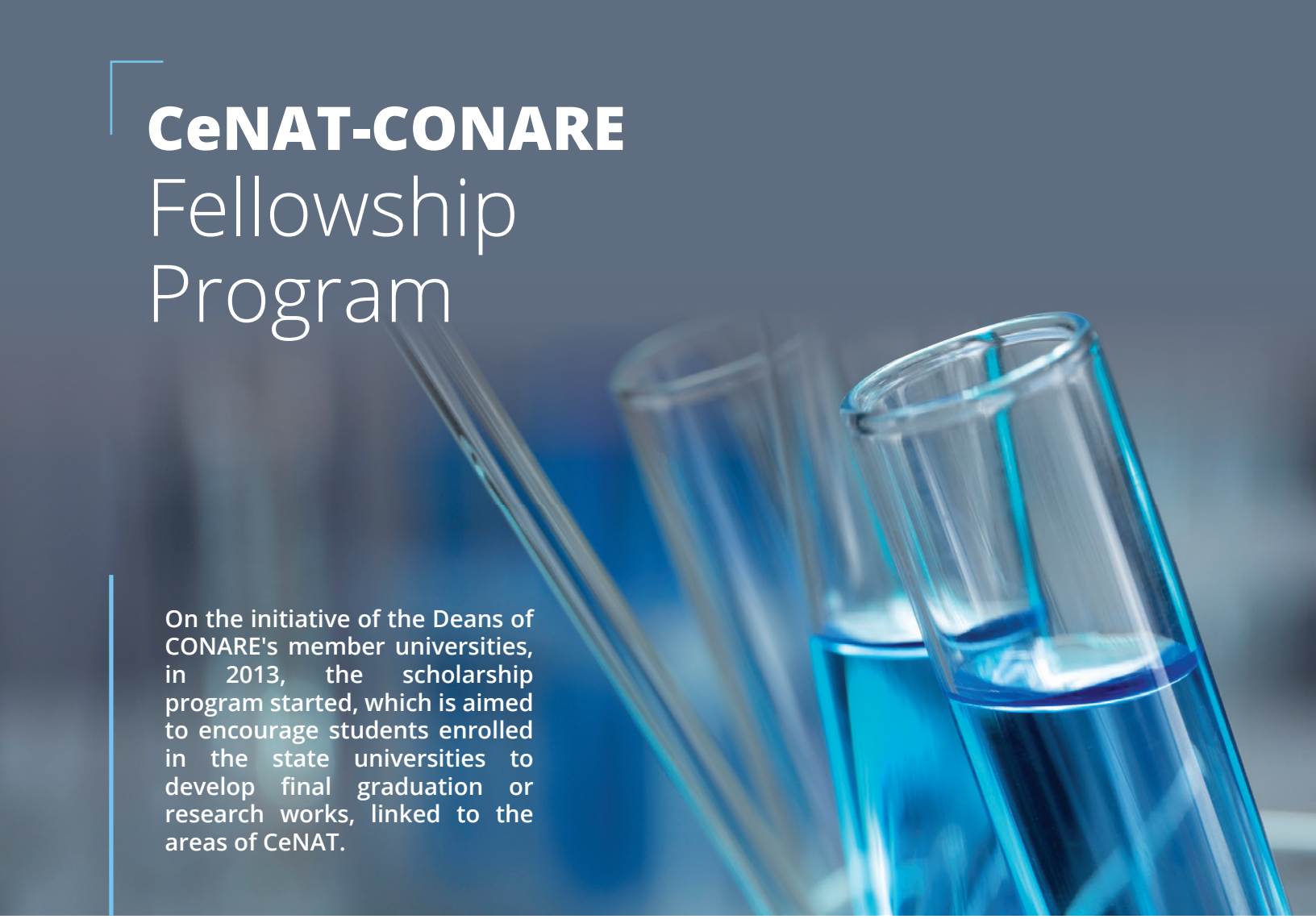
Presentation done by the coordinator of Agromatics Patricia Sánchez in Mexico, highlighting the importance of the indigenous trilogy in agriculture and its impact on sustainability.

8

Workshop on Disaster Risk Management. A Vision Towards Climate Change

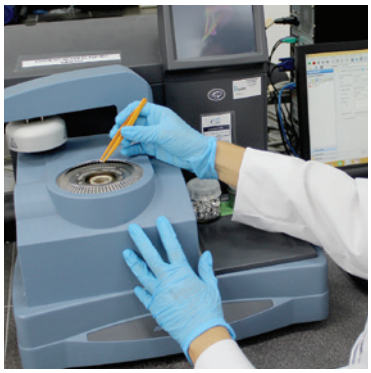
Conducted at CeNAT, as part of the CSUCA COPAGUAR project, with the aim of disseminating and imparting high-level knowledge to different social sectors, including academia, and linking with change agents in communities. Taught by Jasmine Calderon.

CeNAT-CONARE Fellowship Program



On the initiative of the Deans of CONARE's member universities, in 2013, the scholarship program started, which is aimed to encourage students enrolled in the state universities to develop final graduation or research works, linked to the areas of CeNAT.

The goals and topics of these research works and theses should be directly linked to the competence topics of LANOTEC, CNCA, CENIBiot, PRIAS, and Environmental Management, according to specific contests that are held at public universities, which are disseminated by the institutional media and by the Vice-Chancellorships for Research at each university.





The 2024-2025 contest began on December 10, 2023, and the process concluded in August 2024, so the scholarships began in September of that year. Although 18 scholarships were approved, one person resigned, so a total of 17 fellows were awarded.

In order to maximize the number of scholarships allocated during this period, an extraordinary call was made, aimed at those who had not met the requirements, so that they could remedy their shortfalls. The contest was approved by the Vice-Chancellors' Committee and began in October 2024. The final result in December was the recommendation of two new scholarships by the Subcommittee, although approval by the Vice-Chancellors' Committee for Research is still pending. The expectation is to sign the contract and start the fellowships at the beginning of February 2025.

The presentation of the results of the scholarships from the previous period was taught through an in-person presentation of papers, at CeNAT/CONARE, on August 22, 2024.

For the promotion strategy of the fellowship program, five different promotional posters were designed, which were adapted to the affinity of the laboratories. The four promotional videos produced the previous year were reused.





Table 1

Scholarships Allocated (by University and Laboratory by Year) from 2013 to 2024



ALLOCATION OF SCHOLARSHIPS 2013 - 2024

University	LANOTEC	CENIBiot	CNCA	PRIAS	Environmental Management
UCR	39	33	30	9	11
UNA	10	18	1	10	7
UNED	2	0	1	4	5
TEC	13	12	11	15	4
UTN	0	0	0	0	0
TOTAL / LAB	**64**	**63**	**43**	**38**	**27**

Table 2

Allocation of Scholarships in 2024 by Laboratory



LANOTEC:

FELLOW STUDENT	PROJECT TITLE	UNIVERSITY
Juan Diego Chacón Vargas	"Optimization of Crystallization Processes that Present Liquid-Liquid Phase Separation: Application in Isolation of Secondary Metabolites from Costa Rican Crops".	UCR
Christopher Espinoza Araya	"Generation and Transfer of Photoelectrons at the Interface of Photosynthetic Proteins and Nanostructured Semiconductors in Biosensitized Solar Cells".	TEC
Valeria Guadalupe Leandro Aguilar	"Obtaining and Determining Antioxidant Activity of Metabolites from Natural Products Marketed in Costa Rica and Their Evaluation In the Green Synthesis of Nanoparticles."	UCR
Esteban Ulate Rodríguez	"Development of a Bioceramic Repair Cement Based on Tricalcium Silicate in a Polymeric Matrix with Antibacterial Properties".	UCR

FELLOW STUDENT	PROJECT TITLE	UNIVERSITY
Henry Javier Vilchez Pérez	“Evaluation of the Liquid Phase Co-Digestion Process of Household Wastewater with Organic Solid Waste In UASB-Type Anaerobic Reactors.”	UCR
Frandy Arroyo Vargas	“Implementation of an Advanced Algorithm for Editing Images Produced by Atomic Force Microscopy.”	TEC



CENIBiot:

FELLOW STUDENT	PROJECT TITLE	UNIVERSITY
Fiorella Gazo Bryan	"Validation of an In-Vitro Reproduction Protocol of Cocoa (Theobroma Cacao) for Establishing a Microcosm for Evaluation of Bacterial Endophytes In Cocoa Cultivation."	UNA
Jorge Andrés Sánchez Fonseca	"Evaluation of the Use of the Acrocomia Spp. (Coyol) Fruit in a Fermentation Process to Obtain a Fermented Product with Commercial Value."	UCR
Gustavo Solano Gutiérrez	"Analysis of the Impact of Light Quality on Development, Metabolite Biosynthesis, and Genetic Regulation in Callus of Coffea Arabica L".	UCR
Laura Vega Fernández	"Molecular and Biochemical Characterization of Lipoxygenases in the Seeds of Soybean Varieties Grown in Costa Rica and their Influence on the Nutritional Profile of their Oil for Human Consumption."	UCR

CNCA:

FELLOW STUDENT	PROJECT TITLE	UNIVERSITY
Daniel Mora Romero	Fight against tropical diseases: In silico Screening of Amaryllidaceae Alkaloids against Tipanothione Reductase in Chagas Disease.	UCR
Danny Xie Li	Video detection: Pineapple Fruit Video Detection Using Deep Learning.	TEC





PRIAS

FELLOW STUDENT	PROJECT TITLE	UNIVERSITY
David Umaña Monge	Remote Sensing as a Tool to Predict Soil Moisture Content In Agricultural Farms in Cañas, Guanacaste	UCR



Environmental Management

FELLOW STUDENT	PROJECT TITLE	UNIVERSITY
Sebastián Fernández Martínez	"Analysis of the Composition of Fish and Macroinvertebrates in the South Caribbean of Costa Rica" .	UNA
Olga Leitón Gradovich	Environmental Assessment of Forest Biomass Energy Use in the Industrial and Tourism Sector in the Northern Huetar Region of Costa Rica.	UCR
Alexandra Rodríguez Blanco	Evaluation of the Removal Capacity of a Carbonaceous Material Derived from Pineapple Straw Roasting in Removing a Control Pollutant.	UCR
Antonio Sánchez Chinchilla Kevin	Evaluation of the Removal Capacity of a Carbonaceous Material Derived from Pineapple Straw Roasting in Removing a Control Pollutant.	UCR



Extraordinary **Call:**

Due to the existence of remaining funds from this call, permission was requested to the Scientific Council of CeNAT to hold an extraordinary contest among the people who submitted proposals but who did not meet all the requirements. This process took place between October and December, and concluded with the recommendation of two additional scholarships, which are pending approval by the Vice-Chancellors for Research.

All the approved proposals have a high impact both in the generation of new knowledge (through articles, graduation papers, generation of new products, etc.), and in issues related to clean energy, generation of new products, and prevention of natural disasters, among others.



CONARE-CeNAT Scientific Diplomacy Observatory

In view of the relevance of Scientific Diplomacy within the international context, on the XX of XX, 2024, CONARE decided to create the Scientific Diplomacy Observatory (ODC).

The year 2024 was a period dedicated to the organization and formulation of the work path of this program.

The creation of the ODC seeks to provide strategic support to various roles that were already being carried out by both CONARE member universities and CeNAT, but which require strengthening in the face of various challenges that affect international cooperation. These challenges include fundraising in the face of budget cuts in various countries, finding joint solutions to global problems that involve the collaboration of international research networks, strengthening diplomatic decisions through the contribution of science and technology, as well as promoting the international positioning of the activities carried out in the different research centres.

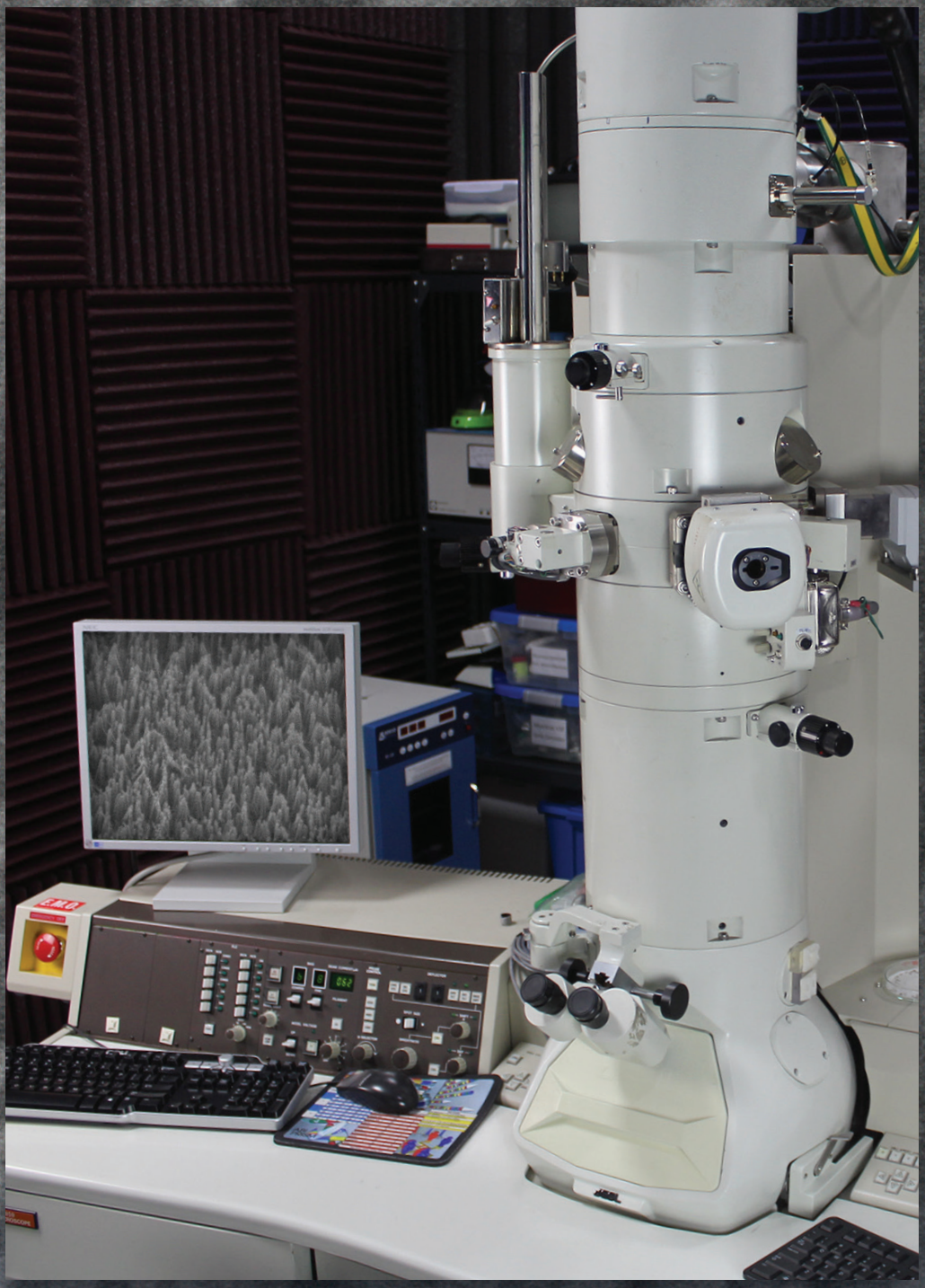
In all these aspects, the ODC will work to strengthen the positioning of research in the country and thus, decisively support the economic and social progress of the nation.

Overall Results of **CeNAT's Indicators**

For CeNAT, the year 2024, in terms of technical achievements, was a very productive year in publications, research, and knowledge transfer, among others, all of which contribute to the development of society.

INDICATOR	PUBLIC COMPLIANCE			PRIVATE COMPLIANCE			TOTAL CUMULATED ACHIEVEMENT
	I SEMESTER	II SEMESTER	TOTAL	I SEMESTER	II SEMESTER	TOTAL	
Number of publications	22	31	53	3	7	10	63
Number of knowledge transfers	68	110	178	10	11	21	199
Number of timely executed projects	63	8	71	21	1	22	93
Agreements signed	3	4	7	0	0	0	7
Student support in academic development projects	119	60	179	18	13	31	210





LANOTEC

NATIONAL NANOTECHOLOGY LABORATORY

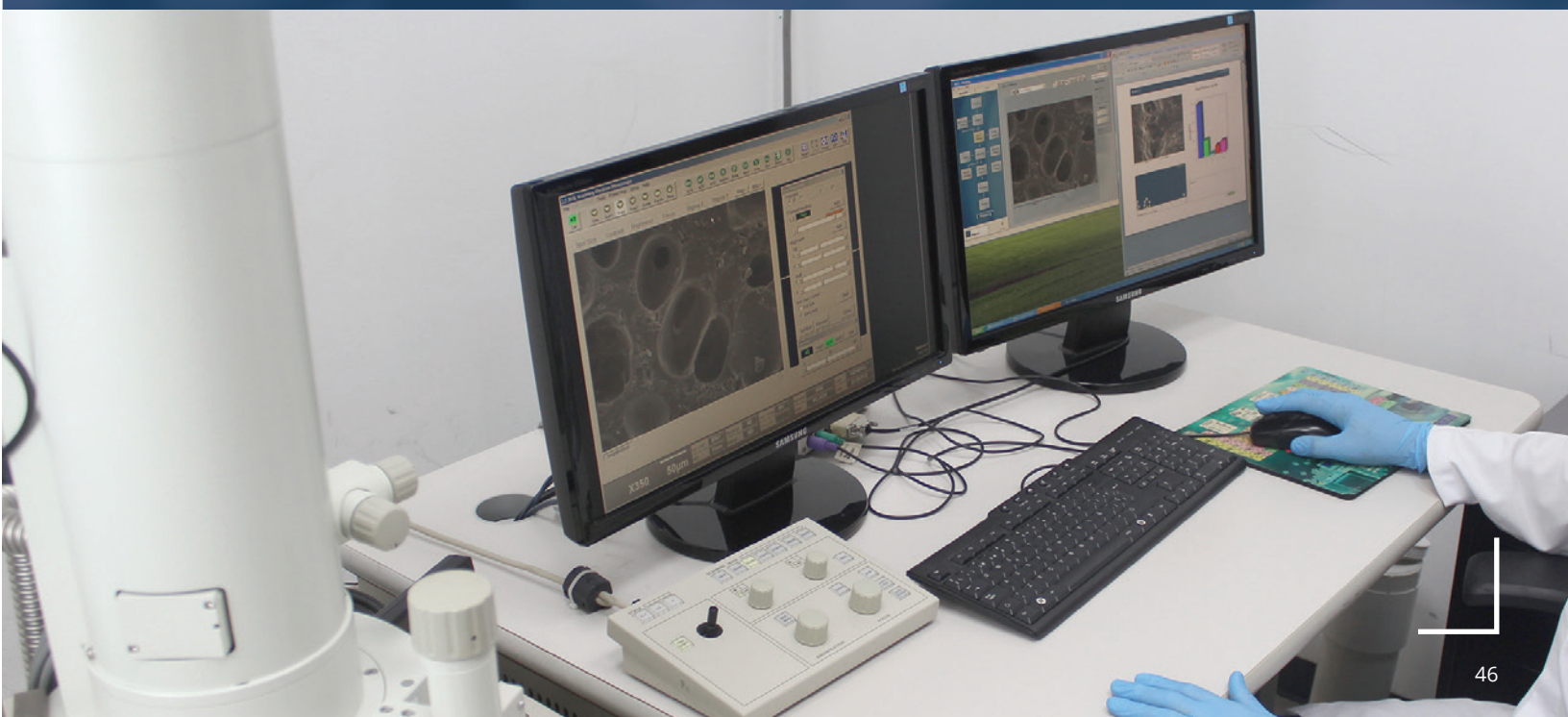
LANOTEC

LANOTEC Annual Operational Plan

(CeNAT-CONARE) 2024



Indicator	Achieved Goals		
	Public	Private	Total
Scientific publications - Dissemination	28	6	34
Knowledge transfer activities	38	4	42
Research Projects	15	10	25
Agreements	1	0	1
Attention to Students	66	17	83



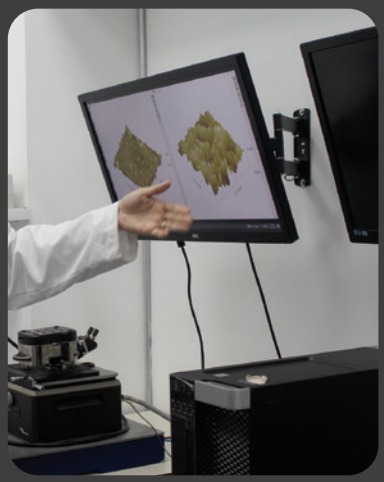




Introduction

The National Nanotechnology Laboratory (LANOTEC), attached to the Centro Nacional de Alta Tecnología (CeNAT), began operations on August 4, 2004, with the purpose of leading technological innovation in Central America and the Caribbean. Since its inception, LANOTEC has positioned itself as a benchmark in the research and development of advanced materials, focusing on design, study, and training in areas related to microtechnology, nanotechnology and materials science, with a strong emphasis on cutting-edge engineering.

As a specialized research center, LANOTEC fosters interdisciplinary knowledge and innovation across various scientific areas, thereby enhancing human talent training and application of new technologies in key sectors such as medicine, geophysics, and space exploration. Its activities are structured around three fundamental axes - scientific research, innovation-entrepreneurship and teaching-extension. Through these pillars, LANOTEC seeks to deliver technological solutions that optimize products and industrial processes, thus contributing to reducing the gap in nanotechnology between developed and developing countries.

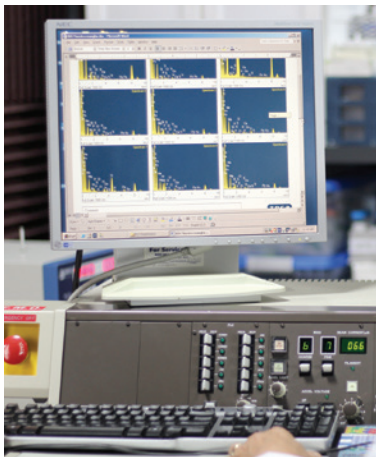


Under the direction of CeNAT and with the support of a scientific committee, LANOTEC defines its strategic priorities, ensuring that its research responds to current challenges and fosters technological advancement in the region. Its commitment to excellence and innovation positions it as a key player in the development of cutting-edge technologies and in promoting a sustainable and competitive future.



Development **Goal**

To generate scientific value from nanobiotechnology to process and product innovation initiatives that impact economic development of Costa Rica.



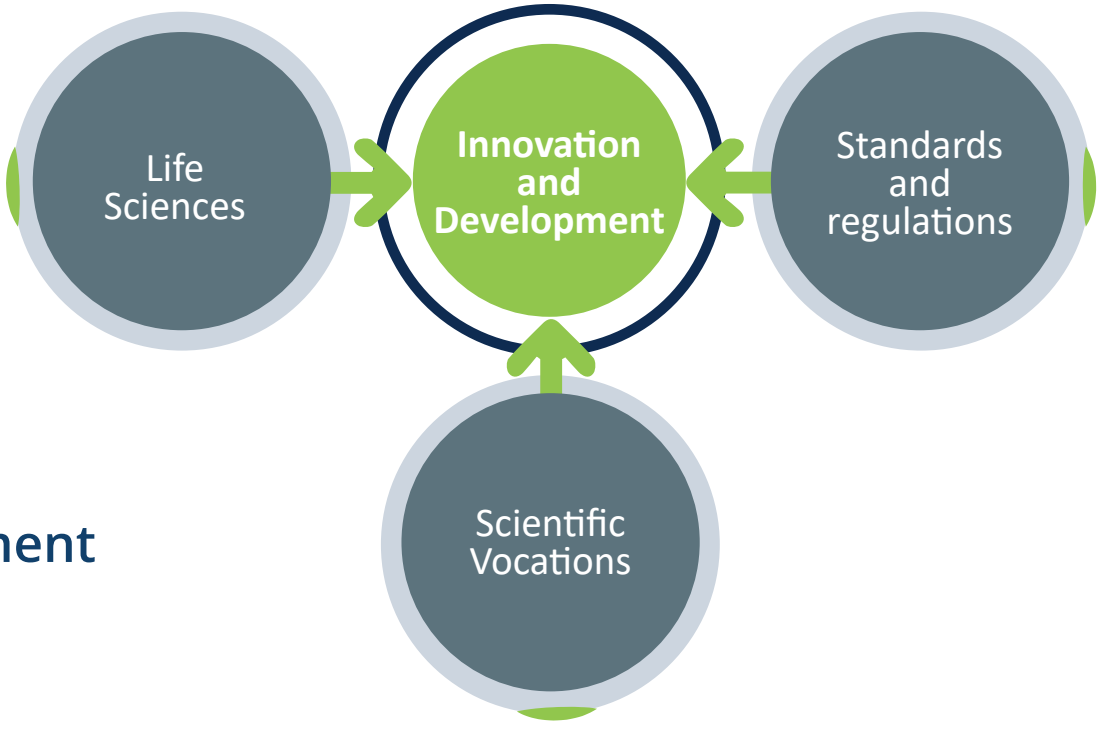
Enforced **Values**

- Collaborative management in the projects that are undertaken
- Socialization of scientific information
- Responsible project management
- Commitment to the processes and products that are undertaken

Principles

- Efficient use of time
- Efficient use of technological infrastructure
- Accountable administrative management of research projects
- Generation of ideas for process improvements





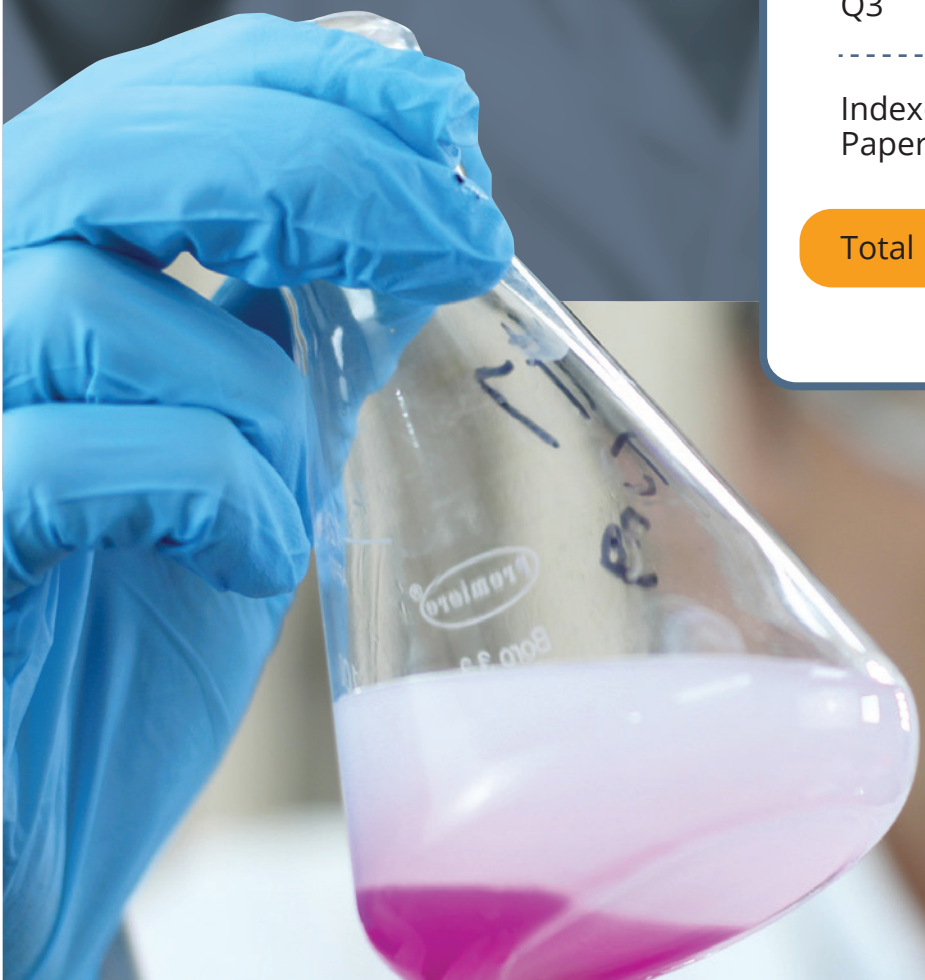
Strategic Development Areas

Impact
Indicators

Publications

34
TOTAL

Classification	Public	Private	Total
Q1	9	1	10
Q2	6	1	7
Q3	7	1	8
Indexed Papers	6	3	9
Total	**28**	**6**	**34**





Knowledge **Transfers**

42
TOTAL

People benefited by knowledge transfers:

1,691

Lectures, Workshops, Presentations

Type	National	International	Total
Public	33	5	38
Private	4	-	4
Total	37	5	42



25
TOTAL

Public

- 1 FEES
- 3 CONARE Funds
- 11 Internal (OPERATIONAL LANOTEC)
- 2 National linkages
- 9 International linkages

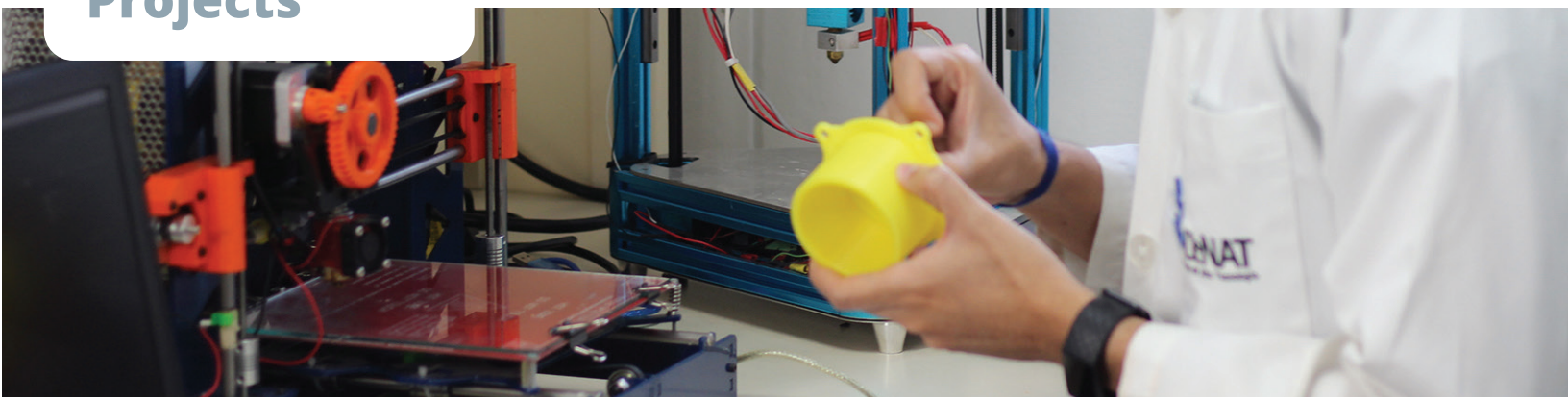
15 TOTAL

Private

- 2 Other public funds
- 8 Private funds

10 TOTAL

Research **Projects**





Summary of **Projects**



Project	Goal

FEES Projects

1	Obtaining Biodegradable Films with Antimicrobial Activity from Agro-Industrial and Marine Waste.	The goal of this proposal is to develop biodegradable chitosan films, with antimicrobial activity, from agro-industrial and marine waste.



Projects	Goal

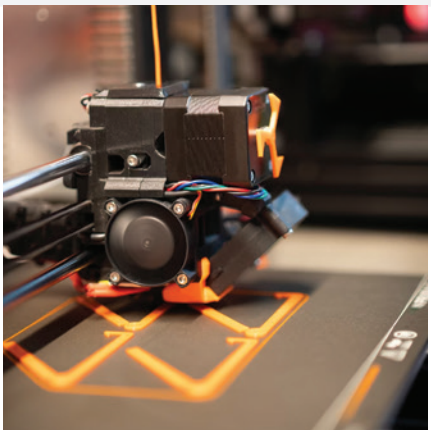
CONARE-Funded Projects

2	LANOTEC Operation.	Fostering scientific development in the region through collaboration between LANOTEC researchers and students, focusing on projects, publications, agreements, and knowledge transfer to positively impact the public, private, and social sectors.
3	Costa Rican Chemistry and Science Olympiad (OLCOQUIM) 2024	The purpose of this project is to encourage scientific vocations among students who participate in the Costa Rican Science and Chemistry Olympiads.
4	Max Planck: Understanding the Velvet Worm Anti-Adhesive Sin Mechanism as a Model for Biodegradable and Low Protein Adsorption Coatings	This project aims to generate fundamental knowledge on the non-stick properties of velvet worm skin and its mechanisms to design sustainable non-stick coatings.

Projects	Goal

Internal Projects

5	Structural Elucidation of Irbesartan Form A, Using Rietveld and Le Bail Methods	Determining the crystal structure of Irbesartan Form A to improve its quality control and stability in pharmaceutical formulations, thus avoiding bioavailability problems and providing accurate data for the development of optimized drugs.
6	Crystalline Polymorphism in Nanomaterials and Soft Systems: Basic Aspects and Technological Relevance	Studying how crystallite size influences the stability of optimal polymorphs of saquinavir and curcumin. The results could be applied to other molecules of interest.
7	Identification of Vascular Basement Membrane Proteins and Surrounding Extracellular Matrix to Which Snake Venom Metalloproteinases Bind by Immunoelectron Microscopy Studies	Identifying the interactions of hemorrhagic metalloproteinases from snake venoms with vascular proteins and extracellular matrix in murine muscle tissue by immunoelectron microscopy.
8	Development of a Prototype of a Medical Device that Allows for Minimally Invasive Treatment of Neurological Pathologies	Developing minimally invasive access mechanisms for complex neurological surgeries, using 3D printing.
9	Development of Nanoparticle Carriers of Natural Polyphenols to Control Grain Contamination by Mycotoxins	Creating and evaluating polymeric nanoparticles with polyphenols from Costa Rican plants to control mycotoxins in grains, thus improving their stability and ensuring safety during storage.
10	Interaction of Metal Oxide Nanoparticles of Relevance in Soils with Phosphate Ions and Organic Matter	Comparing the reactivity of mineral nanoparticles of iron and aluminum oxides in the retention of phosphate and organic matter in soils and generating knowledge about their impact on ecosystems.







Projects	Goal

Internal Projects

11	Safety, Sustainability, and Resilience in Domestic and Small-Scale Biogas Utilization Systems in the Agricultural and Agroindustrial Sectors	Optimizing anaerobic biodigestion systems in Costa Rica, by improving the safety and efficiency of biogas through nanotechnology applied to methane purification.
12	Manufacture of Biosolar Cells from Microalgae Biomass: Double Harvest of Solar Energy for Production of Photosynthetic Proteins and Photovoltaic Energy	Developing biosolar cells based on renewable biomass, using nanotechnology to improve energy efficiency and promote sustainable technologies in Costa Rica.
13	Microfluidic Biosensor for Detection of Brucella Abortus: Proof of Concept for Detection of Infectious Agents under WHO standards	Converting a microfluidic device into a biosensor for the rapid and specific detection of bacteria in biological fluids, by meeting WHO diagnostic standards.
14	Generation and Transfer of Photoelectrons on the Interface of Photosynthetic Proteins and Nanostructured Semiconductors in Biosensitized Solar Cells	Optimizing photoelectron transfer on the interface of photosynthetic proteins and nanostructured semiconductors, improving the efficiency of biosensitized solar cells.
15	Evaluating the Potential of Sphingomyelin-Like Fluorescent Sensors to Identify Mechanisms of Chemotherapeutic Interactions in Cancer Cells	Analyzing the sphingolipid metabolism and chemotherapy in a lung cancer model, exploring cellular interactions to improve therapeutic strategies.



Projects	Goal

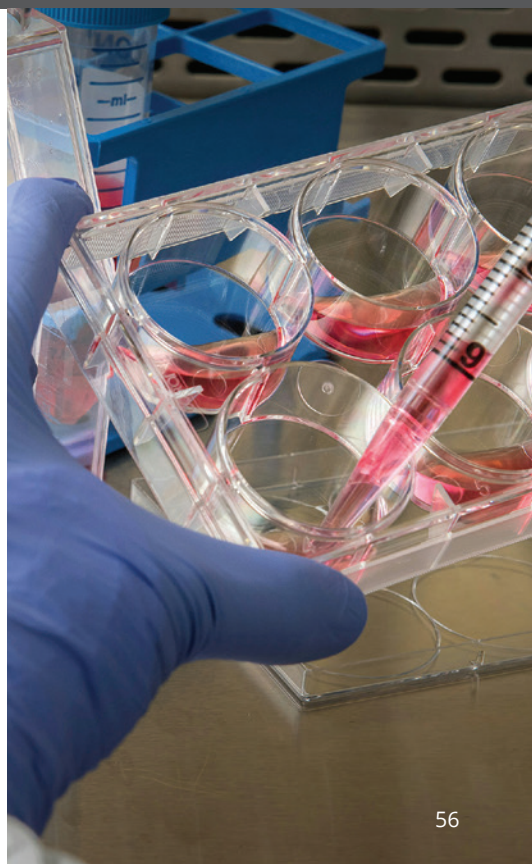
Private-Funded Projects

16	Alternatives for Interface-Modified And 2D/3D Perovskite Absorbers for Perovskite Solar Cell Application (NAVAL)	Optimizing perovskite solar cells by synthesizing and characterizing mixed 3D-2D perovskites, by evaluating hole transporters and surface modifiers to improve their performance and stability.
17	Biomaterials Prototype Development Program 2023 (CINDE – INA)	Providing the necessary technical support to small businesses to promote the development of 10 product prototypes.
18	LANOTEC UPS	Generating scientific value through the development of projects at LANOTEC, promoting publications, agreements, and knowledge transfer with impact on the public, private, and social sectors.
19	H2020 – Automated Functional Screening of IgGs for Diagnostics of Neurodegenerative Diseases (AUTOIgG) (H2020)	Developing experimental cellular models and diagnostic technologies for neurodegenerative diseases -with emphasis on amyotrophic lateral sclerosis- using immunoglobulins and automated fluorescence microscopy.
20	Development of a Sensor system for Rapid Determination of Biomolecules (Panama Project)	Developing a sensor system for achieving rapid determination of biomolecules.

Projects	Goal

Private-Funded Projects

21	Prototype of Biopolymers Obtained from Pineapple Biomass Waste (BIO TAG)	Creating a biopolymer prototype using biomass waste from the pineapple industry.
22	Biosynthesized metal nanoparticles from agro-industrial waste applied in functionalization of bioplastics for use in the industrial chain of berries (Bioplastics)	Developing metal nanoparticles through biological synthesis using agro-industrial waste and applying them in the functionalization of bioplastics intended for use in the industrial berry chain.
23	INA: Bioinnova	Providing the necessary technical support to small businesses to promote the development of 10 product prototypes.



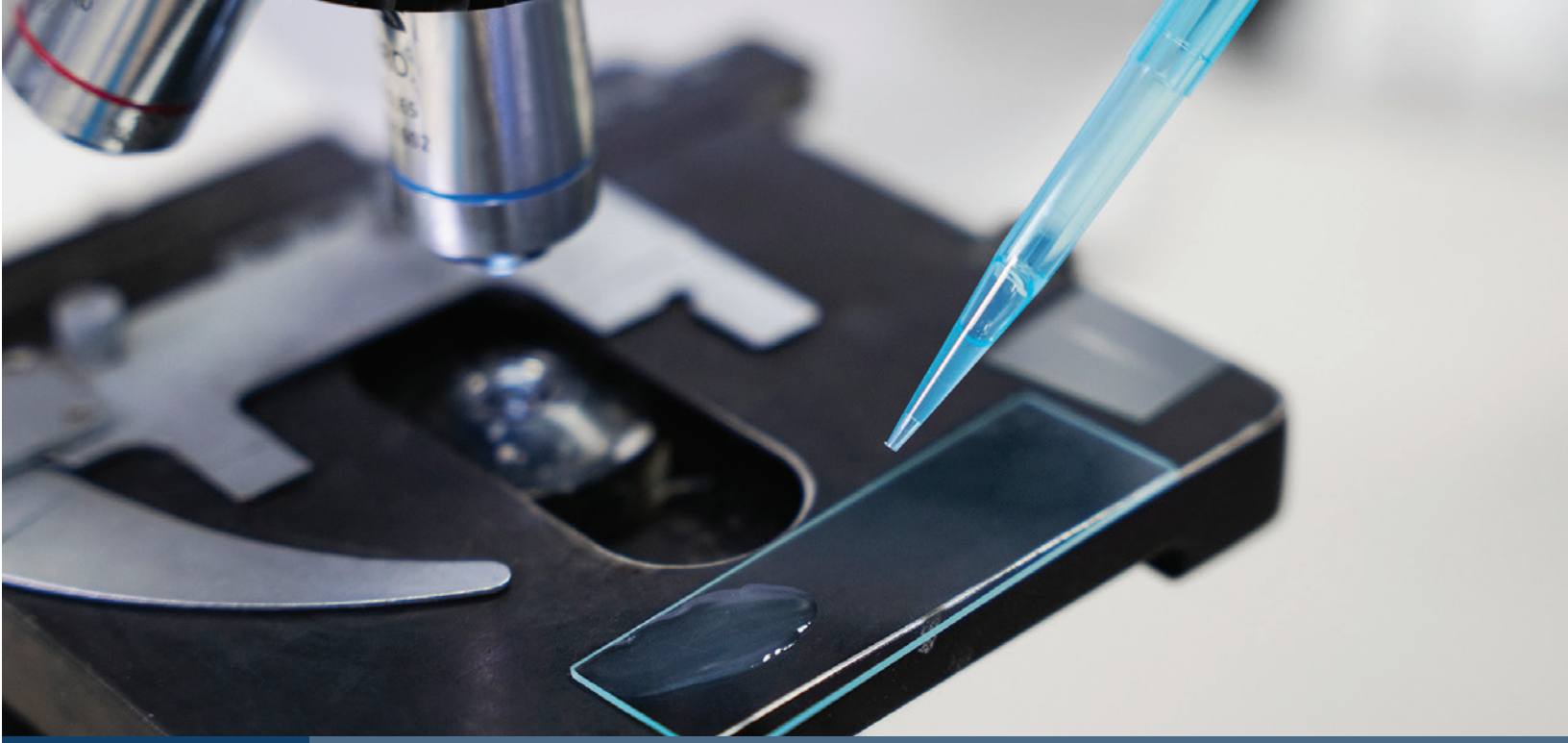


Projects	Goal

Other Public Funds

24	FI-55B-19: Revaluation of Coffee Brush as an Alternative Adsorbent Material to Activated Carbon in the Removal of Bromacil from Water Sources	Obtaining new low-cost adsorbent materials from coffee biomass as an alternative to activated carbon in the removal of bromacil from water sources.
25	FI-0002-2022 Cancer Therapy Through Micellar Release of Drugs Based on Costa Rican Natural Products	Developing smart micelles to release substances extracted from Costa Rican flora with potential in the treatment of cancer.





Agreement

Public

Paris Cité University

1 TOTAL



Student Support

83 TOTAL

	Public	Private	Total
Scholarships	12	-	12
Interns and final graduation thesis	50	3	53
Assistant students	4	14	18
Total	**66**	**17**	**83**



CENIBiot
LABORATORY

CENBiot

CENIBiot Annual Operating Plan

(CeNAT-CONARE) 2024



Indicator	Achieved Goals		
	Public	Private	Total
Scientific publications - Dissemination	18	1	19
Knowledge transfer activities	30	2	32
Research projects	28	4	32
Agreements	2	0	2
Attention to Students	71	6	77

Introduction

The CENIBiot laboratory is an interuniversity space focused on applied research, technological development, and innovation in biotechnology. It is attached to the Centro Nacional de Alta Tecnología (CeNAT) and operates under the support of the National Council of University Deans (CONARE), with the aim of strengthening the country's biotechnology ecosystem.

Through its work, CENIBiot promotes the development of biotech solutions with applications in various industries, fostering collaboration among the academic field, the productive sector, and government institutions. It focuses on generating value through research, development of advanced technologies, and connection between entrepreneurs, companies, and universities.





The laboratory is committed to creating high-impact scientific projects that contribute to the country's sustainable growth, addressing environmental, economic, and social challenges. It also facilitates access to specialized knowledge and technological services, thus promoting technology transfer and the adoption of innovations in different sectors.

As part of its growth strategy, CENIBiot promotes internationalization and linkages with global research networks, keeping up to date and attracting new funding opportunities. Its operating model prioritizes openness and efficient use of its capabilities, thus consolidating itself as a meeting space for researchers, entrepreneurs, and policy makers, where ideas and technologies converge to transform biotechnology in the country.

Development **Goal**

To generate biotechnological research that contributes to the Sustainable Development Goals for Costa Rica, through scientific projects and impact innovation that contribute to society in the economic, social, and environmental fields, through the exchange of knowledge, services in science, and alliances with the business sector.

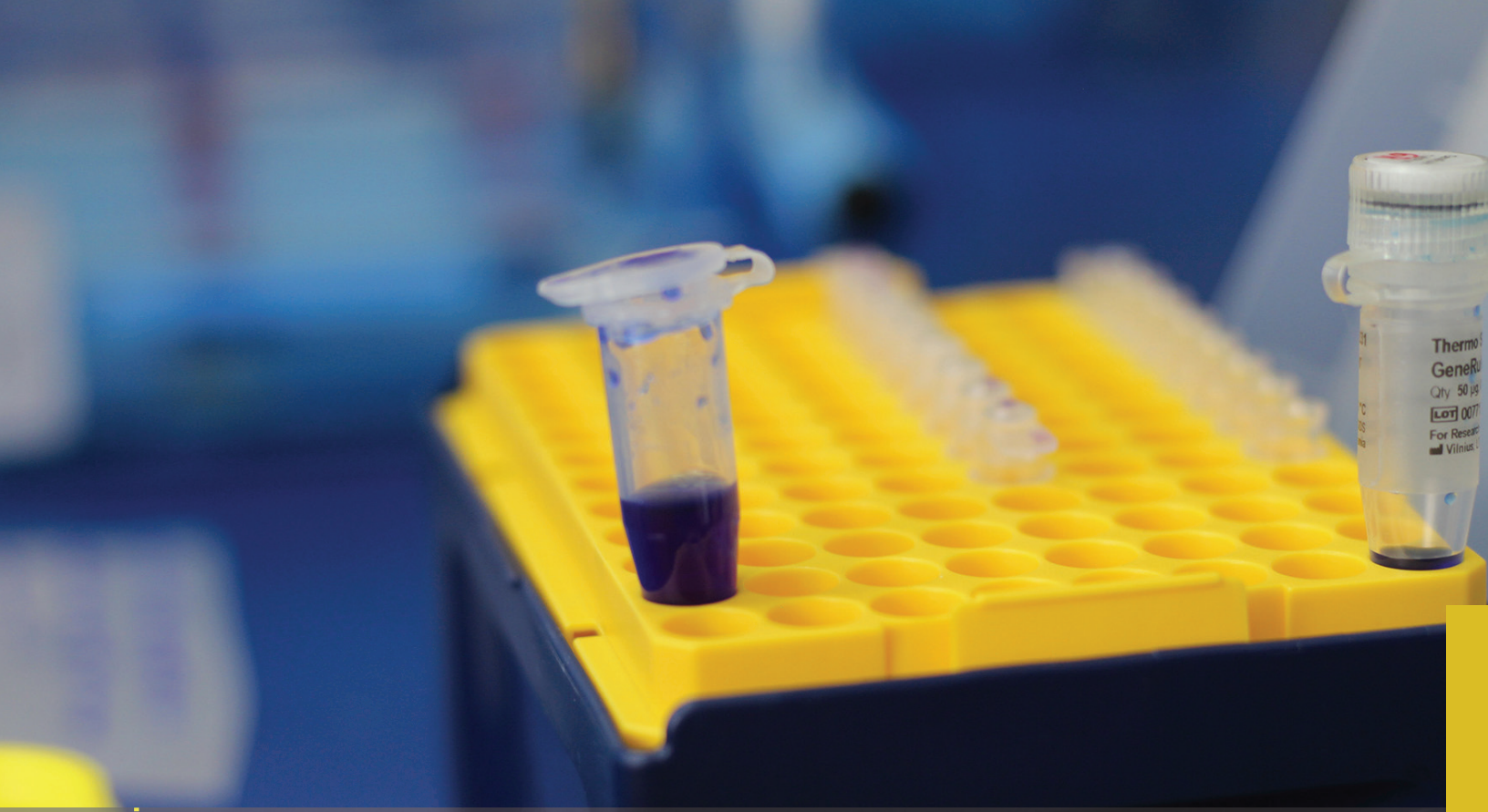


Enforced **Values**

- Human team care
- Ongoing learning attitude
- Attitude of amazement at the findings and achievements obtained
- Collaborative management in the projects that are undertaken

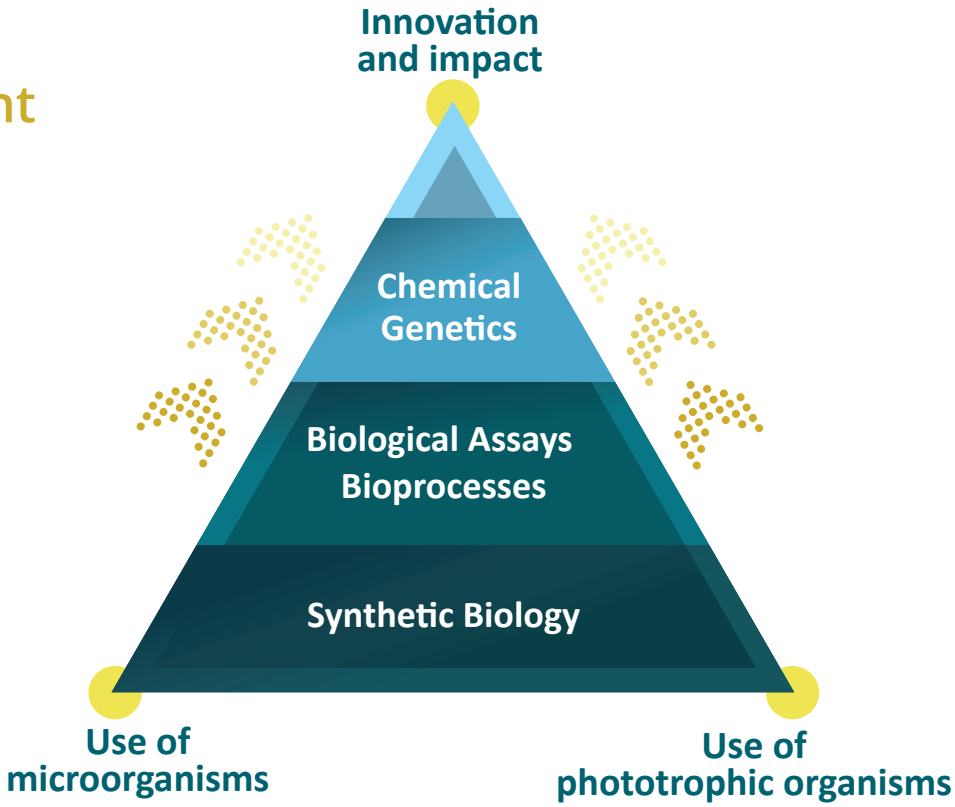
Principles

- Supportive and efficient use of scientific equipment
- Accountable administrative management of research projects
- Willingness for constant improvement of the projects that are undertaken



CENIBiot

Strategic Development Areas





Impact Indicators

Publications

19
TOTAL

Classification	Public	Private	Total
Q1	8	-	8
Q2	6	-	6
Q3	1	-	1
Not indexed	3	1	4
Total	**18**	**1**	**19**



Knowledge **Transfers**

32
TOTAL

People benefited by knowledge transfers:

668

Lectures, Workshops, Presentations

Type	National	International	Total
Public	17	13	30
Private	2	-	2
Total	**19**	**13**	**32**



32
TOTAL

Public

- 2 FEES
- 1 CONARE Funds
- 25 Internal Projects
  - 11 National linkages
  - 1 International linkages
  - 13 Internal without linkages

28
TOTAL

Private

- 4 Private Funds

4
TOTAL

Research **Projects**





Summary of **Projects**

Projects	Goal
FEES Projects	
1 Contamination of Costa Rican Corn by Toxigenic Fusarium Species (FEES)	This study focused on identifying factors that influence contamination by fumonisin B1 in maize. A key outcome achieved was the publication "Factors influencing fumonisin B1 contamination in maize: insights from two production regions in Costa Rica" in Mycotoxin Research.
CONARE-Funded Projects	
2 Operational CENIBiot	It focused on carrying out activities to generate a positive impact on Costa Rican society in areas such as science, education, and health. The scheduled activities were successfully completed.

Public Funded Projects	Goal
3 Evaluation of the Efficacy of an Experimental Treatment for Chagas Disease Using Purified Fractions from Plants of the Hamelia Genus, Collected in Sarapiquí and the Osa Peninsula	Evaluation of an experimental treatment against Chagas disease and analysis of factors affecting performance metrics in statistical models. This generated the manuscript titled "Impact of Sample Size and Class Imbalance on Performance Metrics of Zero-Inflated Count Models", which was accepted for publication.
4 Transcriptomic Study and Phenotyping Characterization of Pseudomonas Putida KT2440 and UndA Mutants	The main focus was on optimizing protocols for RNA extraction in Pseudomonas putida KT2440 and ΔUndA, achieving the generation of transcriptomic profiles for future studies.
5 Validation of Necessary Protocols to Evaluate the Cardioprotective Effect of Natural Products and Medications	It sought to validate protocols to evaluate cardioprotective effects of natural products, achieving DNA and RNA extractions necessary for studies in cardiac and intestinal tissues.

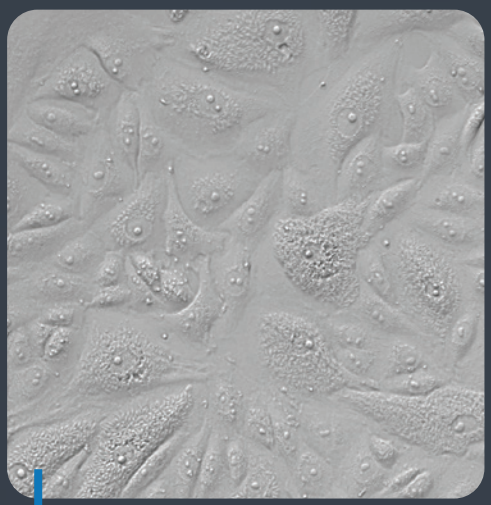


Image of animal fibroblasts infected with Trypanosoma cruzi after a period of infection, obtained at 4X. Intracellular amastigotes can be observed within host cells, thus indicating the presence of the parasite in its replicative phase

Public Funded Projects	Goal
6 Evaluation of Potential Hydrocarbon-Degrading Microorganisms Isolated from An Abandoned Oil Well Located in the Cahuita National Park	Identifying microorganisms capable of degrading aliphatic and aromatic hydrocarbons, generating a publication highlighting the potential of Pseudomonas spp. C11 and A. johnsonii C4, for future applications in bioremediation.
7 Study of the Physicochemical and Microbiological Defense Mechanisms of the eggs of Costa Rican Forest Birds	It studied antimicrobial mechanisms in wild bird eggs, optimizing antimicrobial activity protocols and preparing DNA extractions for sequencing.
8 Development of a Metabolic Syndrome Model in Mice	This project sought to develop protocols to correlate proanthocyanidin intake with obesity and biological variables in mice, laying the groundwork for future research.
9 Role of Sorcin in Lymphocyte In-Vitro Proliferation	It studied the role of sorcin in lymphocytes, culminating in the drafting and submission of a manuscript to Analytical Biochemistry for publication.
10 Zymobacter Associated with Honey from the Tetragonisca Angustula Bee: A New Species with Biotechnological Potential?	Evaluation of the growth of Zymobacter SID-22 and SID-37, in comparison to Zymobacter DMS, establishing a foundation for future testing under semisolid conditions.
11 Non-targeted Metabolomic Analyses	This project sought to develop protocols in the area of Chemistry for metabolomic analysis using UHPLC-MS/MS, and validating them with real samples and alternatives to caffeine as an internal standard.

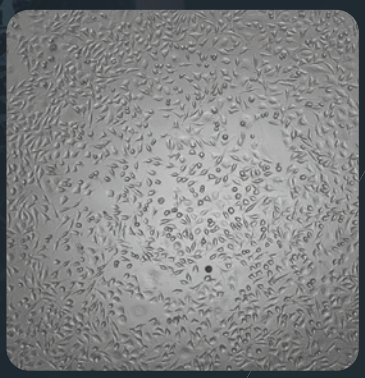
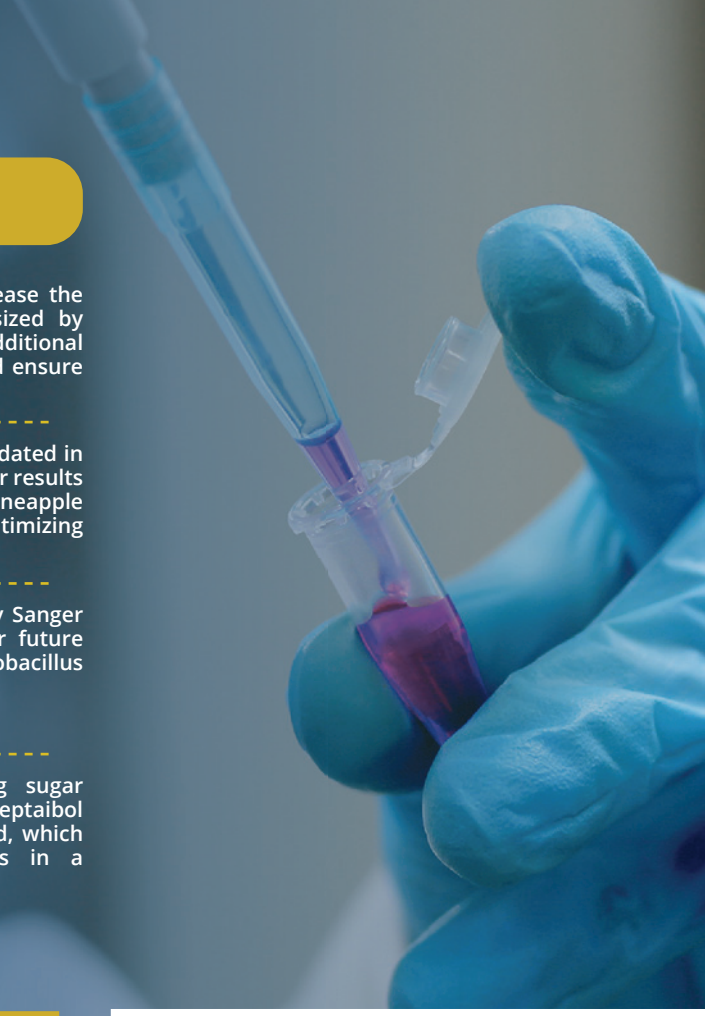


Image of L929 cells used as a negative control in cytotoxicity assays, cultured in DMEM medium with 10% FBS and 1% S/P, obtained at a 4x magnification

Public Funded Projects	Goal
12 Children's Literacy Project: A Child-Centric Microbiology Education Framework	It fostered knowledge of microbiology among children and educational communities, through scientific fairs, workshops for teachers, and dissemination of multimedia content. As a result, the "I Microbiology Literacy Workshop for Teachers" was developed.
13 Comparison of Fungal Mycelium Growth in Bioreactors: A Homemade Airlift Versus a Stirred Tank Bioreactor (CSTR)	It evaluated how spore concentration affected fungal mycelium morphology in different bioreactor configurations, laying the groundwork for future larger-scale testing.
14 Detection of T. Cruzi in Blood Clots for Propolis Activity Assays Against Chagas Disease	The focus was on optimizing protocols for detecting T. cruzi in blood clots, achieving advances in DNA extraction and quantification.
15 Flow Cytometry Capacitance Assays	It was based on developing and applying flow cytometry protocols, achieving precise protocols so that the project goals were met.



Public Funded Projects	Goal
16 Ultrastructural, Microbial, and Metabolomic Analysis of Spider Webs of the Phoroncidia Genus	It identified compounds in spider silk through metabolomic and ultrastructural analyses, and isolated bacteria to evaluate their antibiotic potential.
17 Shotgun Metagenomics for Biole Production to Search for Genes and Growth-Promoting Microorganisms	Bioles were analyzed to identify growth-promoting microorganisms through metagenomic analysis.
18 Evaluation of the Enzymatic and Microbial Potential of Beetle Larvae to Degrade Pineapple Plant Residues	This project evaluated the potential of Zophobas morio and Tenebrio molitor larvae for degrading plant residues, identifying key microorganisms and enzymes through metagenomics.



Public Funded Projects	Goal
19 Metabolomics of Bacterial Strains with Antimicrobial Activity	A protocol was optimized to increase the production of antibiotics synthesized by actinobacteria, implementing additional improvements to reduce costs and ensure replicability.
20 Validation of RNA Extraction Protocols in Plants, DNA from Soil, and Other Organic Matrices	RNA extraction protocols were validated in three plant species, obtaining better results in upper leaves and stems of pineapple plants, thus providing a basis for optimizing future extractions.
21 Gene Expression of Indole-3-Acetic Acid (IAA) Biosynthesis in Lactic Acid Bacteria Strains Induced with L-tryptophan	Gene sequences were obtained by Sanger sequencing, designing primers for future gene expression assays in Lactobacillus spp. strains.
22 Optimization of the Biofungicide Prototype Formulated from Trichoderma Asperellum Peptaibols	Tests were carried out, varying sugar concentrations. An increase in peptaibol production at 15 g/L was observed, which was validated by fermentations in a bioreactor.



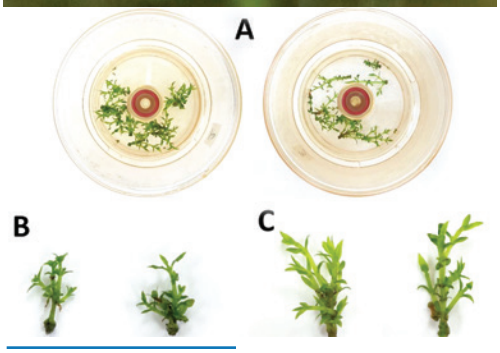
Micrograph of L929 cells, using doxorubicin as a positive control for cell death in cytotoxicity assays. Cells cultured in DMEM medium with 10% FBS and 1% S/P, obtained at a 4x magnification

Public Funded Projects	Goal
23 Evaluation of Bacterial Growth of Biole Isolates in Agro-Industrial Waste as a Culture Medium Substrate	Microscale tests were carried out in different commercial media to determine optimal conditions for bacterial growth in agroindustrial substrates.
24 Analysis of Microbiota and Metal Resistance Genes in Galvanized and Waste Piles from an Aluminum Manufacturing Company	Minimum inhibitory concentration tests against metals were performed on isolates. Bioinformatics analyses are pending to complete the study.
25 Optimization of the Spray Drying Process of Biological Matrices for Potential Application in the Agricultural Industry	The spray drying process of fungal spores was optimized, and the optimized technique is planned to be applied to bacteria, for potential agricultural use.
26 Assessment of Coastal and Continental Water Quality by Measuring the Presence of Antibiotics, According to Seasonality in Jacó Beach	The project assesses water quality in Jacó Beach by seasonally measuring antibiotics. The quantification of the first sampling has already been carried out, thus making progress in the study and its future development.



Public Funded Projects	Goal
27 Undirected Metabolomics of the Biole Production Process for the Search for Beneficial Chemical Markers for Crops	An extraction method focused on organic acids and siderophores was established for the metabolomic analysis of bioles, in search of beneficial chemical markers.
28 Evaluation of the Potential of Strains of the Streptomyces Genus Isolated from Rice Soils as Biocontrol Agents of Phytopathogenic Fungi Associated with Rice Cultivation	Liquid cultures and inhibitory activity tests of Streptomyces strains against phytopathogenic fungi were performed, observing promising results for biocontrol.





Propagation of Psidium friedrichsthalianum (cas) in the RITA system

	Public Funded Projects	Goal
29	FP-001-2024 Large-Scale Microbial Diversity Study in Costa Rica (Basecamp Research)	Two field trips were conducted in different regions of Costa Rica, specifically in CoopeTarrazú, Santuario de Osos Perezosos, and Los Charcos de Osa, where 20, 50, and 40 samples were collected, respectively, along with the measurement of the corresponding physicochemical conditions. In addition, a total of 420 samples have been processed, obtaining their genetic material and evaluating their quality and concentration. In parallel, progress has been made in identifying possible new sites for future field trips, as well as in meetings and negotiations with already established contacts.
30	FP-002-2024 CENIBiot UPS	Sales of services were performed with different national and international institutions, thus enabling the laboratory to project its capacity in its focus areas.
31	FP-003-2024 Bioles as a Source of Inspiration for the Generation of New Native Microbial Biostimulants for Costa Rican Agricultural Innovation, FI-041B-19 (MICITT)	The project was completed as scheduled, generating the expected products such as the publication "Characterization of lactic acid bacteria isolated from bio-inputs with the capacity to produce indole compounds. UNED Research Journal".
32	FP-004-2024 Endowment	The project was successfully executed, with the acquisition of equipment for working with anesthetized mice and horizontal autoclaves, thus meeting the laboratory's needs for the required laboratory equipment.

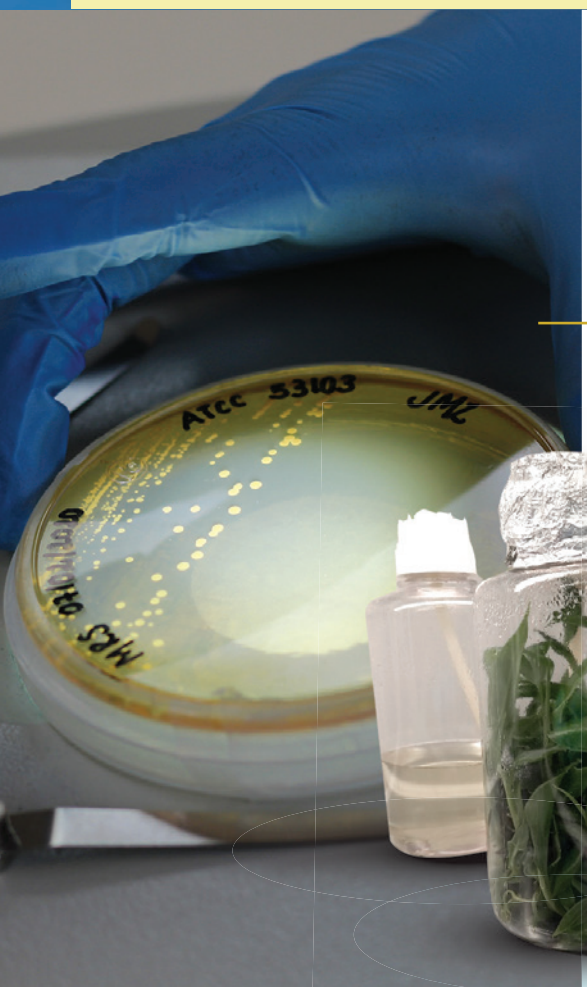


Agreements

Public with the University of Costa Rica:

2 TOTAL

- Study of microbiome and metal resistance genes in galvanized and waste piles from an aluminum manufacturing company.
- Study of microbial communities in velvet snake (Bothrops asper) venoms and their resistance to clinically relevant antibiotics.



Student Support

77 TOTAL

	Public	Private	Total
Scholarships	9	-	9
Interns and final graduation projects	52	-	52
Assistant students	10	6	16
Total	**71**	**6**	**77**

This image shows the propagation of Musa textilis (abaca) in the BIT system. Both SIT (figure 5 and 6) use liquid culture medium and proved to be more efficient than the conventional in-vitro propagation system in semi-solid medium.



CNCA

NATIONAL ADVANCED COMPUTING COLLABORATY



CNCA

CNCA Annual Operating Plan

(CeNAT-CONARE) 2024

Indicators	Distribution of Goals		
	Public	Private	Total
Scientific publications - Dissemination	3	-	3
Knowledge transfer activities	60	5	65
Research projects	17	2	19
Agreements	1	-	1
Attention to students	14	5	19
Essential activities			
Cluster operation	138.139h	-	138.139h
Cluster Usage	347 days	-	347 days



Introduction

The National Collaboratory for Advanced Computing (CNCA) holds an interdisciplinary and multisectoral environment that establishes a bridge between academic, government, industry, and society. Its distinction lies in the high quality of research and innovation. This is reflected both in its institutional management and in its philosophy, which highlights transparency and accountability in all dimensions of its work, ranging from projects to collaborations and knowledge transfers.

CNCA is a multidisciplinary space where scientific discovery and technological innovation are accelerated, through the use of advanced computing infrastructure. This infrastructure includes not only specialized and updated hardware but also a set of efficient applications and a highly trained professional team maximizes the use of this technology. This allows CNCA to address the key areas of research project development, training, and service delivery.

The main objective of the CNCA is to provide two essential pillars for scientific advancement both nationally and internationally. In addition to theory and experimentation, the critical relevance of simulation and data analysis is recognized for exploring new frontiers of knowledge. To achieve this goal, computational tools, both in terms of hardware and software, are essential. Thereby, CNCA members concentrate their efforts on the computing cluster and related applications, with the aim of offering a computing infrastructure of excellence that facilitates the delivery of projects and services with a significant impact on society.

Development **Goal**

To encourage the use of advanced computing in research, using complex information to boost science and technology development and innovation in Costa Rica.



Enforced **Values**

- Willingness to good human relationships
- Willingness to continuous learning
- Collaborative innovation at the laboratory work

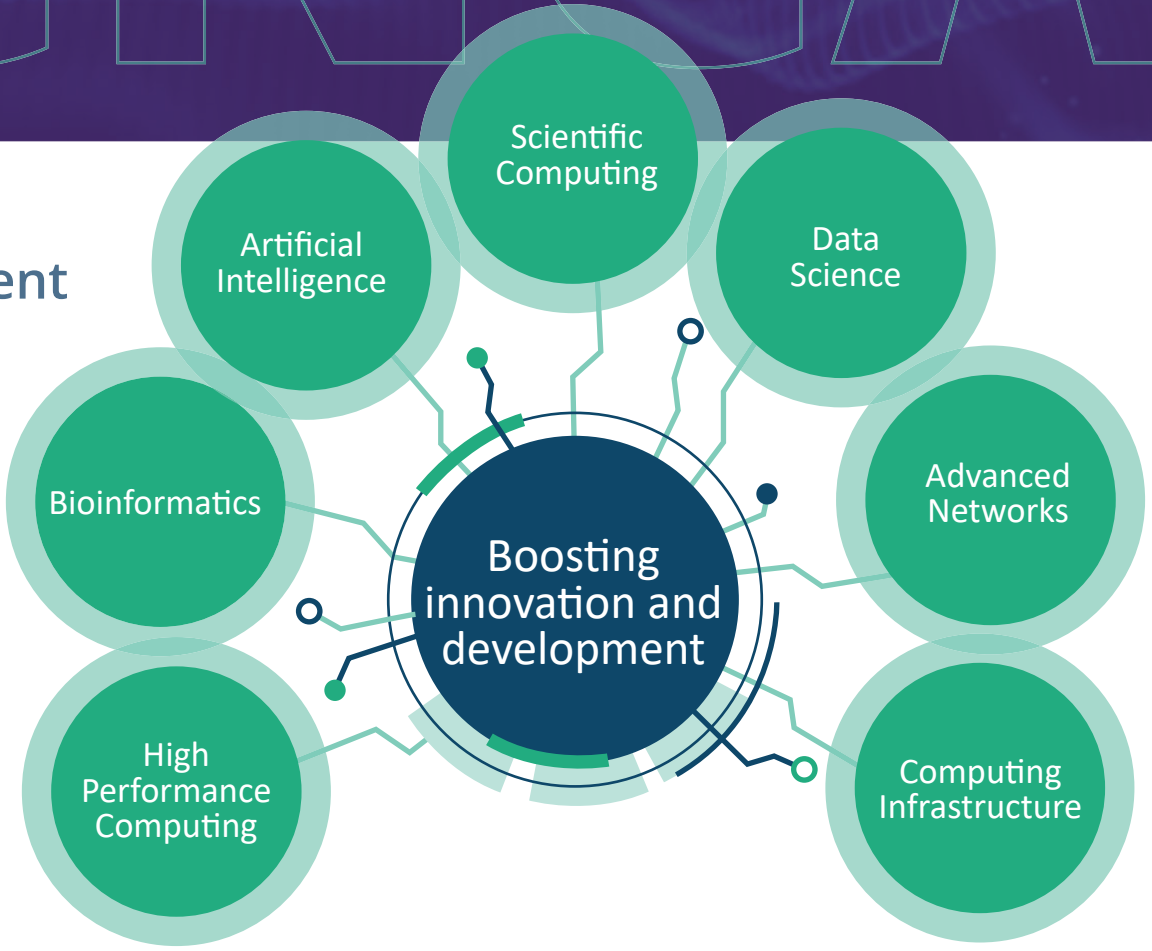
Principles

- Creativity in knowledge transfer
- Permanent communication within the work team
- Efficient use of resources
- Collaborative management in the projects that are undertaken

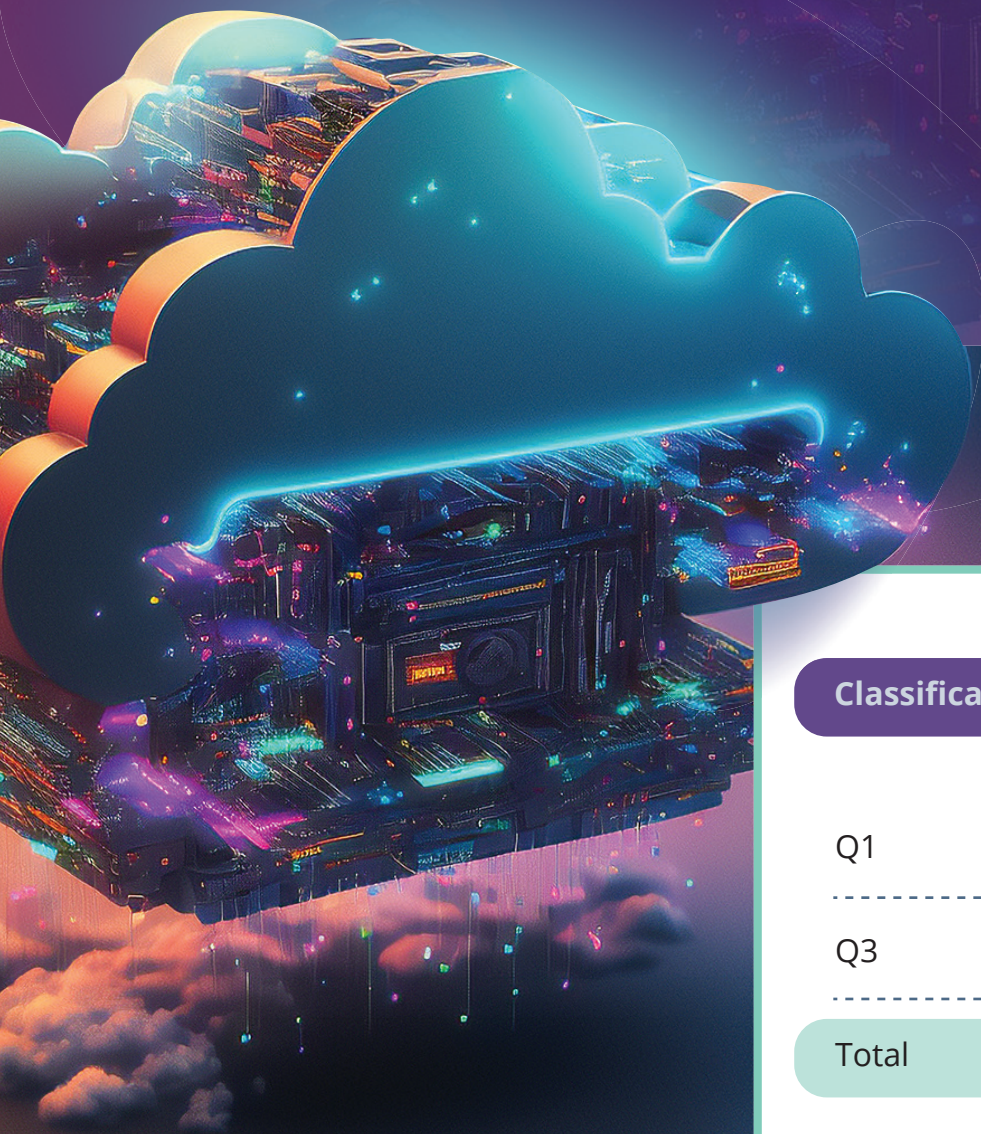


CNCA

Strategic Development Areas



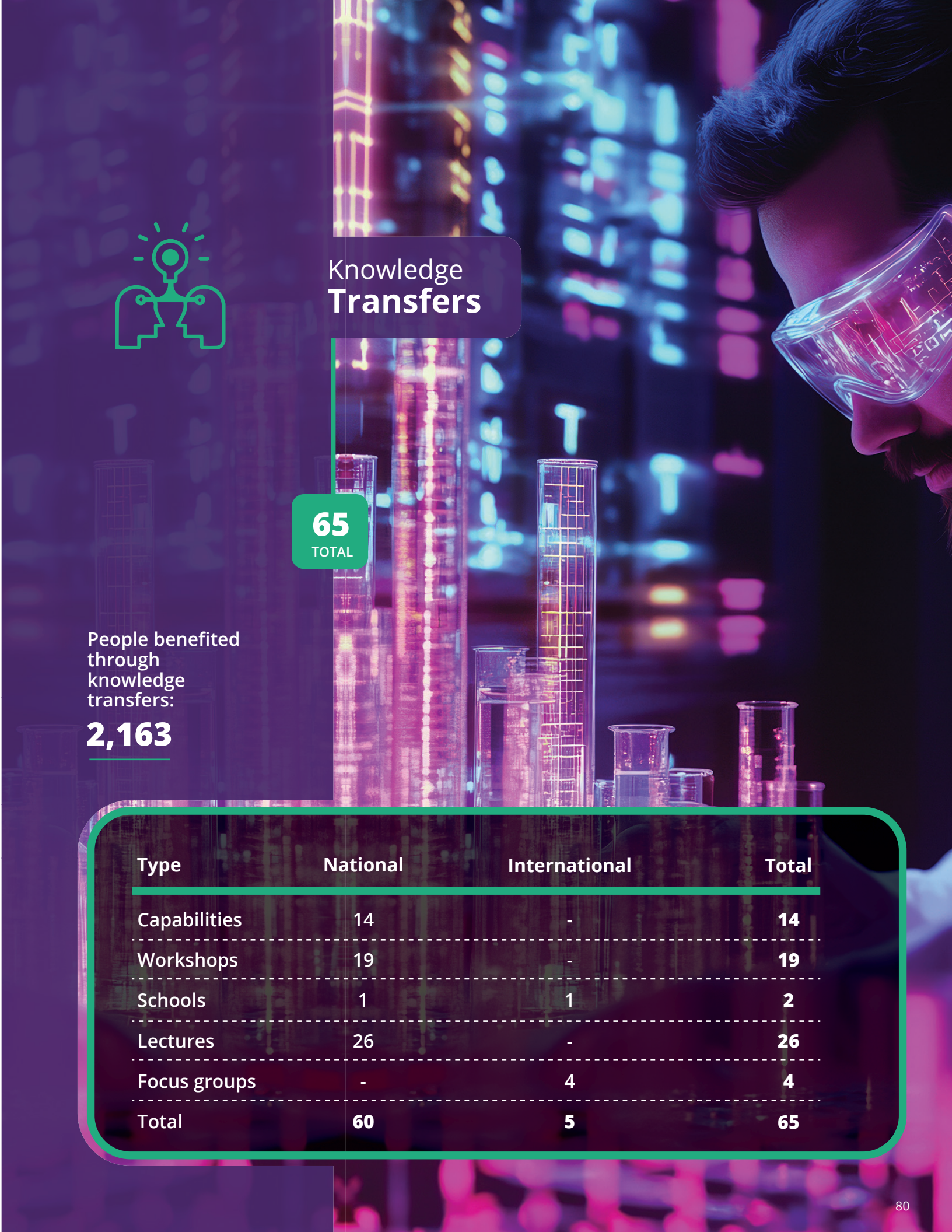
Impact
Indicators



Publications

3
TOTAL

Classification	Public	Private	Total
Q1	2	-	2
Q3	1	-	1
Total	**3**	**-**	**3**



Knowledge **Transfers**

65
TOTAL

People benefited through knowledge transfers:

2,163

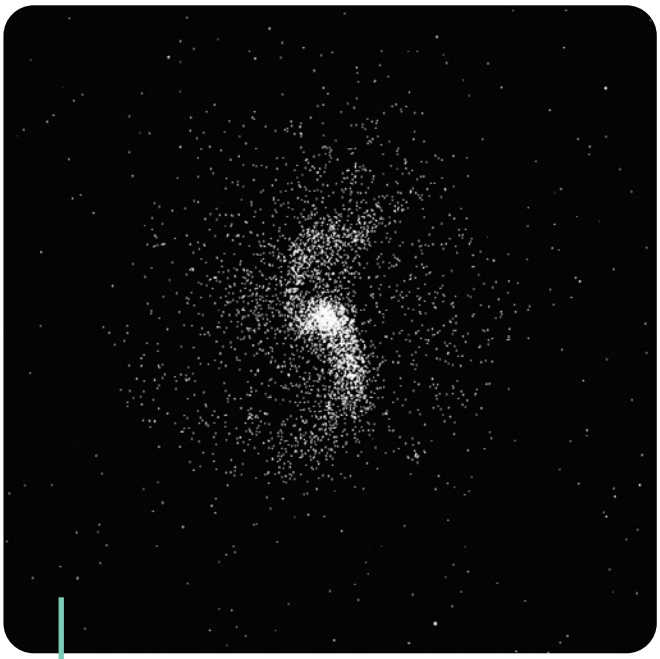
Type	National	International	Total
Capabilities	14	-	**14**
Workshops	19	-	**19**
Schools	1	1	**2**
Lectures	26	-	**26**
Focus groups	-	4	**4**
Total	**60**	**5**	**65**





Research **Projects**

19 TOTAL



N-body simulation. It is used to study different portable parallel programming infrastructures such as OCCA, RAJA, Kokkos, and OpenMP target. In practice, these simulations study the evolution of celestial bodies and their interaction.

Public

- 1 FEES
- 3 CONARE-Funded Projects
- 13 Internal Projects
  - 9 National linkages
  - 4 International linkages

17 TOTAL

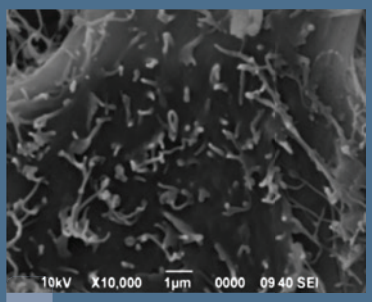
Private

- 2 Private Funds

2 TOTAL

Summary of **Projects**

Proyects	Goal
FEES Projects	
1 Analysis of the Microbial Plasmidome in Polluted Water and its Possible Effects on Health and the Environment	Metagenomes from deep waters and the Virilla River were analyzed to study the plasmidome, developing a pipeline and post-processing scripts. Articles were drafted on the influence of depth on the marine plasmidome and the anthropogenic impact on plasmid diversity and resistance genes. Antibiotic and metal resistance genes were identified, evaluating the contamination gradient. Finally, post-processing was completed and a manuscript on the riverine metaplasmidome was drafted for publishing.
CONARE-Funded Projects	
2 Uncovering Novel Microbial Symbioses Occurring in Wasps and Beetles from Costa Rica	The genomics and pangenomics of Weissella were studied using Anvi'o, exploring its phylogeny and symbiosis. Samples for metagenomics were collected and a manuscript on 16S rRNA tools was drafted. A paper was presented at the 6th IEEE Conference on Taxonomic Classification. Using amplicon data, microbial composition, diversity, and abundance in passalises were analyzed using QIIME2 and microeco. The results were shared for a paper.
3 Big Data Analysis on Subjects Related to Social Security and Other Topics of Interest	A database of hospital admissions from the CCSS was analyzed, performing data-wrangling and quality assessment. Key analytical variables -intrinsic and derived- were created to optimize processing. In addition, external sources were reviewed to assess their integration into future stages, thus strengthening the analysis and ensuring more accurate and contextualized results.
4 RedCONARE	We helped coordinate the Copernicus Academy in Costa Rica, by organizing webinars and workshops, also working on the Bella II project with RedCLARA and ATIC, redefining its focus. Relations with the European Union and Micitt were strengthened, with the participation at TICAL 2024. The RedCONARE website was optimized, tests were carried out for the Open Window for Researchers, the Big Data School was organized, and support was provided for the purchase of equipment to improve Kabré's connectivity.



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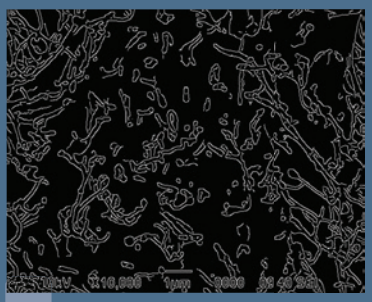
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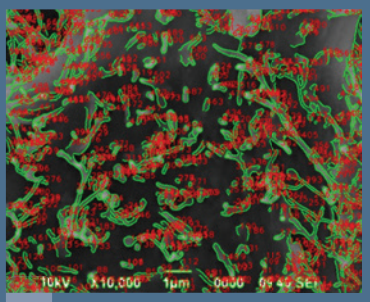


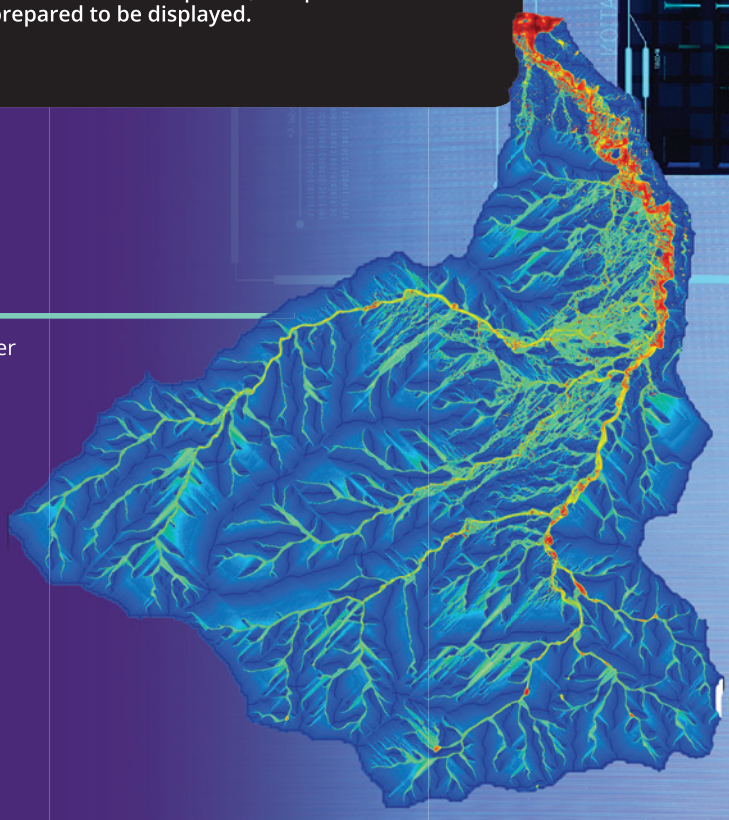
c

Visual outputs of image processing for recognizing microvilli in an SEM image: (a) Enhanced grayscale, (b) binary image, and (c) identified microvilli.

Projects	Goal

Internal Projects

5	Implementation of a Bio-Acoustic Solution Based on Artificial Intelligence that Executes the Automatic Counting of Buffalo Dolphins and the Study of their Marine Environment in the Golfo Dulce for a population analysis	The research proposal for the DIES ProGrant program was reformulated, incorporating a computational approach and adjusting objectives, methodology, and budget. The manuscript on detection and classification of underwater sounds was completed and optimized after peer review. Following the departure of a colleague, new partners and funding sources were sought, applying the project to the AI for Climate and Nature Grand Challenge, with the support of a marine biologist from UNA. After submitting the documentation, the funding decision is being awaited, which has limited further progress.
6	Development of Artificial Intelligence Tools for the Analysis of Electrocardiographic Data	A multi-classification system for cardiovascular diseases was developed using neural networks and electrocardiographic data analyses. Models and preprocessing techniques were optimized, applying data augmentation to mitigate imbalances. A functional architecture with convolutional and recurrent layers was achieved. The results were presented at a TEC symposium and at IEEE BIP 2024, where the paper was accepted. However, access to CCSS DICOM data remains limited. Finally, the paper's documentation was completed, and presentations were prepared to be displayed.

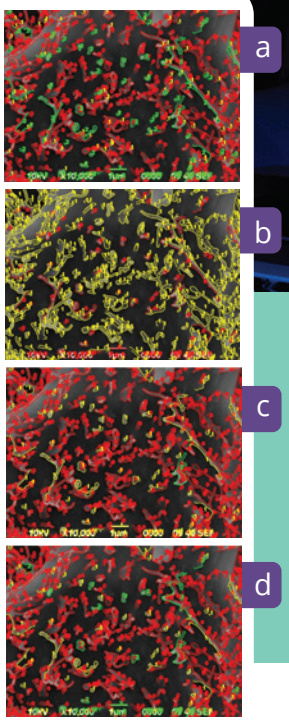


Simulation of the Cañas River flood, September 2022. The height of the water above the river and its overflow in the vicinity can be seen. A study using 4 NVIDIA A100 GPUs in the JUWELS BOOSTER system - Jülich Supercomputing Center.

Projects	Goal

Internal Projects

7	Exploration and Prototyping of Digital Twins in Costa Rica to Establish Integration with Simulation, Modeling, High Performance Computing, and Advanced Networks	An article on Digital Twins in agriculture was drafted. Progress has been made in the introduction, state of the art, and literature review. We coordinated with researchers and a writing plan was established, achieving 70% progress in the second quarter, although with some difficulties due to the low participation of collaborators. In parallel, the FIWARE platform for IoT was explored, installing its code and studying its documentation, especially on Smart Data Models and IoT protocols. However, the project is currently on hold.
8	GPU-accelerated RICH Decoding in Allen	A new wizard was integrated, and progress was made on merge requests to improve code testing and transfer data between the Moore and Allen frameworks. Technical issues such as text analysis for the RICH detector and pixel reconstruction have been resolved. The solutions were validated with LHCb counterparts, a binary dump of geometric data was performed, and a paper was drafted for CONCAPAN. In addition, collaborators were sent to CERN and another assistant was hired to speed up the progress of the project.
9	In-situ Analysis Techniques for Computer Simulations	Libraries for in situ analysis were researched and a load imbalance visualization library was developed using ADIOS2 and PAPI, integrated into SERGHEI. The build system was edited to include these libraries and a systematic review of visualization tools in scientific simulations was performed. The initial plan was to integrate a library into SPECFEM3D_Cartesian, but since it did not meet the requirements, SeisSol was chosen. After compiling SeisSol locally, an attempt was made to compile it on the ALCF Polaris system, but problems arose on GPU due to the lack of the AdaptiveCpp library, requiring a complex process for manual compilation.
10	Quantum CR: Building Quantum Computing Research Capabilities for the Costa Rican Context	The project focused on exploring Quantum Computing by adapting the qsim code for Kokkos and testing it on the Kabré supercomputer. Quantum Machine Learning was researched, comparing classical and quantum random forests, and a summer school was organized with IBM and EnLuz Strategies. The outcomes were presented at IBM's Qiskit Fall Fest event.

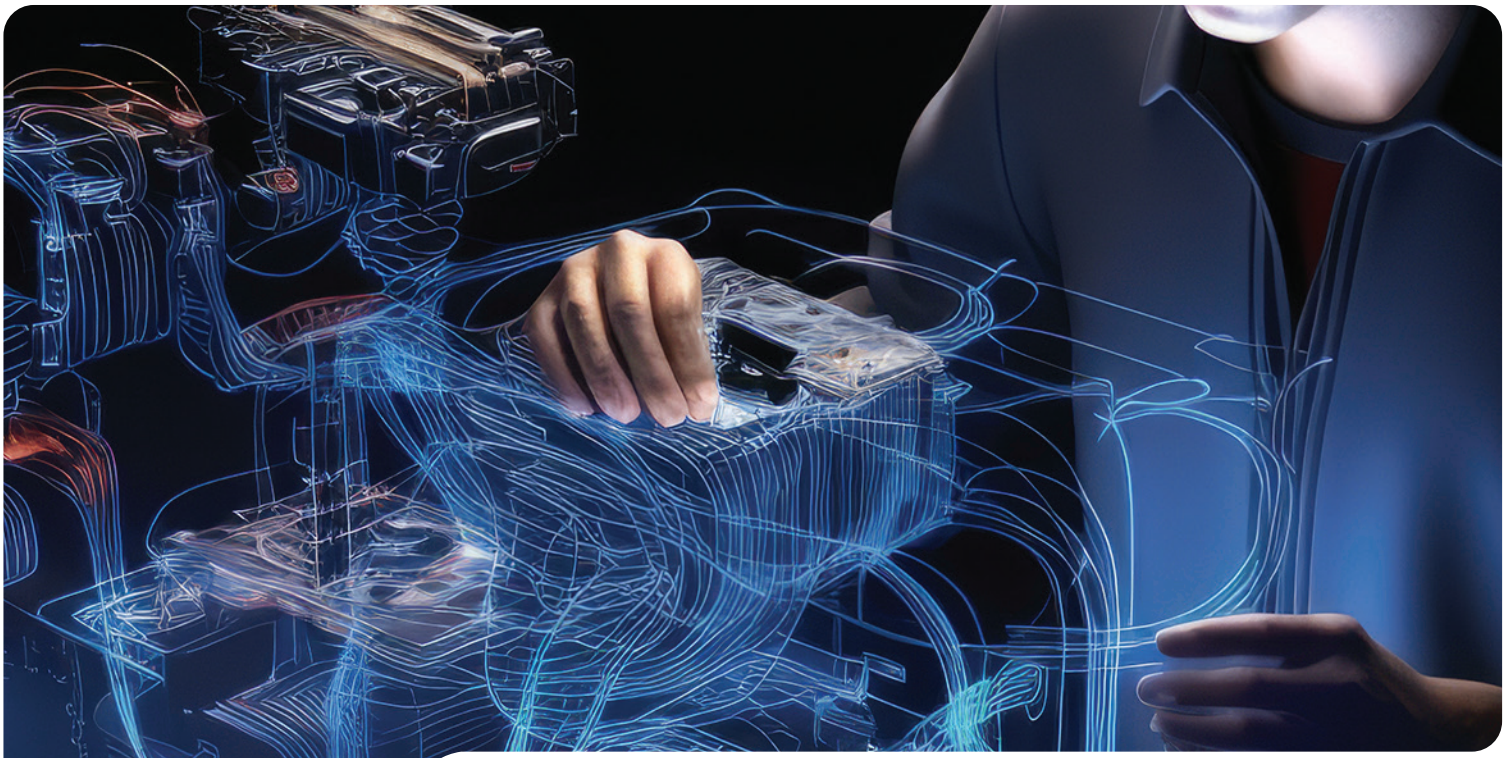


Semantic segmentation outputs in SEM with an unsupervised algorithm to analyze morphological changes in neuronal microvilli and detect ALS. Simulation 1: N-body simulation. It is used to study different portable parallel programming infrastructures such as OCCA, RAJA, Kokkos, and OpenMP target. In practice, these simulations study the evolution of celestial bodies and their interaction.

Projects	Goal

Internal Projects

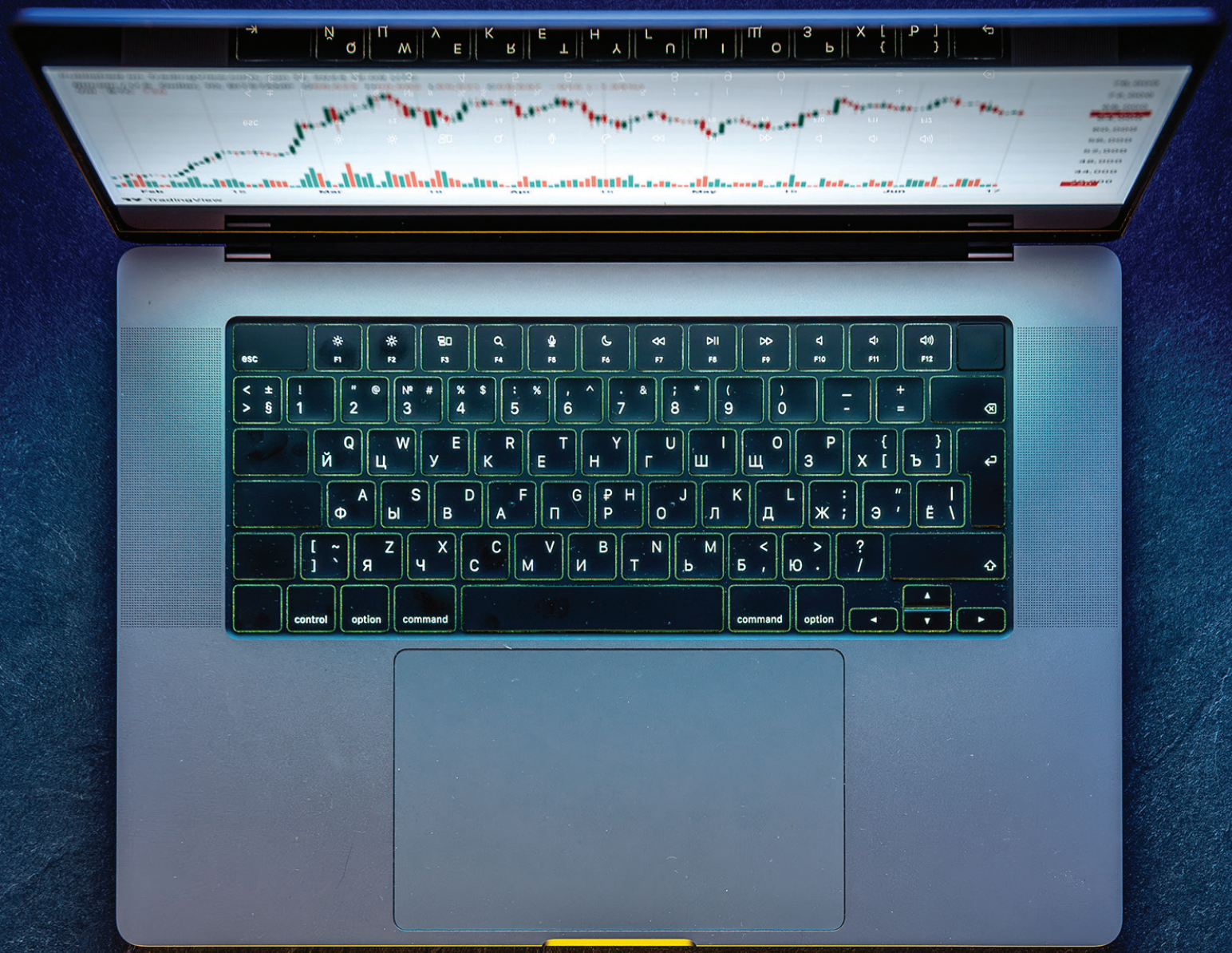
11	Improvement of the Kabré Computing Platform	Key progress was made on the Kabré cluster, adding 12 nodes, installing AlmaLinux, and optimizing NFS filesystems through benchmarks. The infrastructure was improved after an emergency, the network was analyzed, and new equipment was quoted, focusing on servers with GPUs. RStudio Server was optimized, job prioritization algorithms were researched, and the new cluster web page was published. In addition, progress was made in purchasing nodes and switches to improve the infrastructure.
12	Detection and Exploration of Anomalies in the Public Procurement Process in Costa Rica Using the SICOP Platform, Big Data Tools, and Advanced Statistical Algorithms	The SICOP data analysis project began with the exploration of the platform and the design of a UML diagram for suppliers. Types of database diagrams were studied and ideas for descriptive graphics were proposed. In the second quarter, Time Series were analyzed, and meetings were held with the CGR, awaiting an agreement to access the data. In the third quarter, bureaucratic delays led to a temporary shift in focus, delaying technical progress.
13	Multivariate Statistical Analysis in Biological Experiments: Integration and Interpretation of Microbiological Data for Understanding Phenomena of Interest to the National Center for Biotechnological Innovations (CENIBiot)	The Chagas disease data analysis project progressed with initial meetings to understand the problem and the execution of preliminary statistical models. The data were refined, Bayesian methods were studied, and a logistic model of the cure probability was developed, complemented by Monte Carlo simulations. Two key inputs were delivered: a code to analyze differences in lettuce crops and a paper on counting models that was partially accepted at the BIP conference. The project goals were considered to have been satisfactorily met.
14	Hydrographic and Hydraulic Simulation of Rivers on GPUs	The SERGHEI project advanced with an in-situ visualization module, integration of precipitation and sediment data, and code development for portability on Kokkos. Machine learning was applied for segmentation of land use images and performance tests were carried out on Intel, AMD, and NVIDIA GPUs. The code was also optimized for each architecture and a Deep Learning workflow was developed. A meeting was held with the CNE on flooding projects.



Projects	Goal

Internal Projects

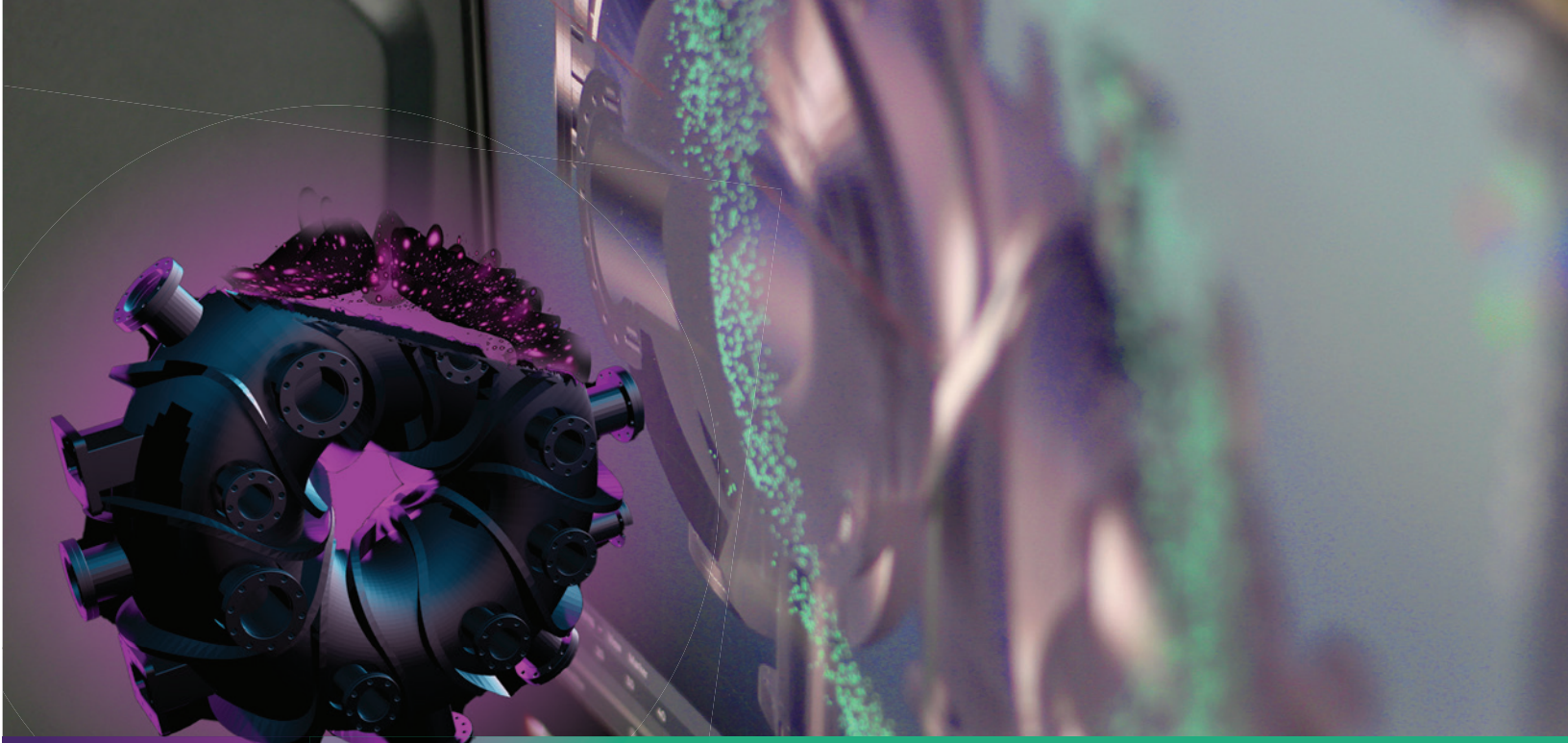
15	Advanced Parallel Programming Paradigms in Scientific Computing	The project focused on performance portability, machine learning-assisted simulation, and in-situ visualization. Papers were drafted for CARLA 2024 and CONCAPAN 2024, analyzing portability libraries and simulations in multiple frameworks. Work was done on the integration of accelerators in scientific computing and on the portability of QSim to Kokkos. In addition, progress was made on in-situ visualization with Paraview Catalyst and a tutorial on Kokkos was prepared. The paper for CONCAPAN 2024 was accepted, and the code continued to be optimized.
16	Machine Learning Models for Assessing Bioaccumulation of Chemical Substances	A system was developed to assess the bioaccumulation of chemical compounds, using machine learning models to predict octanol/water and octanol/air partition coefficients from SMILES representations. The models were optimized with feature selection and hyperparameter tuning, and then eployed to Colab for prediction and evaluation. A tool based on neural networks on graphs was created, capable of calculating atomic contributions. In Q4, a tool was added to estimate confidence in predictions using methods such as CONFIDE and CONFINE, while optimizing the neural network with advanced techniques.
17	Automatic System for Detection and Localization of Earthquakes in Real Time with Deep Neural Networks	Uncertainty in deep learning mechanisms applied to seismic event detection was explored using EQT with OVSICORI data. The experiments showed variations in results according to the computational architecture, identifying configurations for deterministic results. A paper and a presentation were prepared for an international conference. The paper was submitted to the Computer and Geosciences Journal and the OKSP workflow was strengthened in collaboration with OVSICORI. In the fourth quarter, tools were added to the OKSP workflow and feedback was received on the article. Also, work was carried out on revising it based on the reviewers' suggestions.



Projects	Goal

Private-funded Projects

18	Central American Consortium on High Performance Computing for Socio-Environmental Applications (CoCeCAR)	During the year, key events were organized such as the Costa Rica High Performance Computing School, the Central American Meeting for Computational Study of Hydrographic Basins, and the launch of CoCeCAR. A dissemination strategy was established on networks, seminars were held, and there was participation in conferences such as CARLA and IESTEC, strengthening networks and exploring new opportunities. In addition, progress was made in research on watersheds and water quality, culminating in the successful forum on High Performance Computing (HPC) Applications in Central America at IESTEC.
19	SPIDER	Throughout the year, the SPIDER project advanced with various activities and collaborations. We participated in the initial meeting of the consortium, the WG1 and WG2 working groups were created, and the Community of Practice (CoP) started. In addition, experts were identified for a Focus Group on Digital Transformation and Advanced Networks. CeNAT was selected for the Twinning Programme. The Digital Dialogues Forum, the TICAL event in Brazil, and a workshop on Horizon Europe were held. Finally, the dissemination of activities on social networks and the website are ongoing.



Agreement

Public

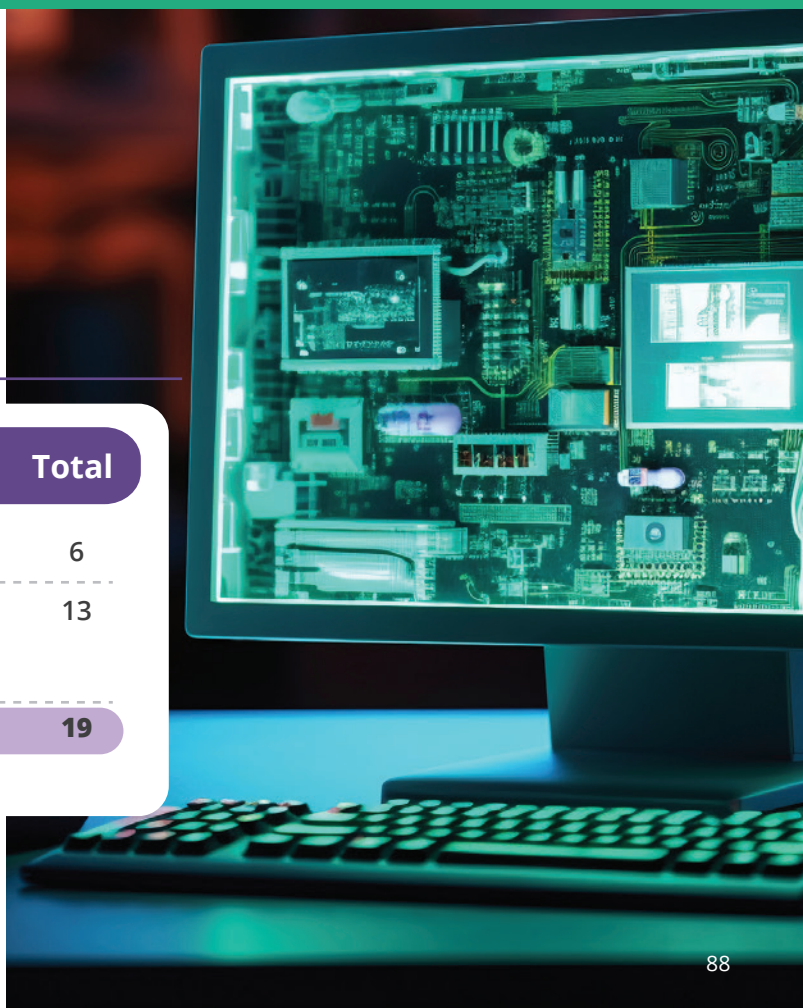
1
TOTAL

Addendum to the Framework Agreement for Cooperation with the Office of the Comptroller General of the Republic

Student Support

19
TOTAL

	Public	Private	Total
Scholarships:	6	-	6
Student, assistant, and graduate assistant hours:	8	5	13
Total	14	5	19





Computational Infrastructure

347 days per year of operation of computer services.

752 accounts with access to computing infrastructure services.

138,139 science hours in simulations and data processing.

RedCONARE

One of the services of RedCONARE and the ICT departments of the universities is Eduroam, which has the following indicators:

- Network services are available to approximately 164,000 students, staff, and teachers.
- Access to Eduroam internationally in 106 countries that participate in the deployment of the connectivity network.
- There are more than 4 billion Eduroam network authentications in the national territory in 2024.
- Eduroam network deployed in the headquarters and campuses of the 5 public universities. Research centers and the CONARE-CeNAT building.



PRIAS
LABORATORY

PRIAS

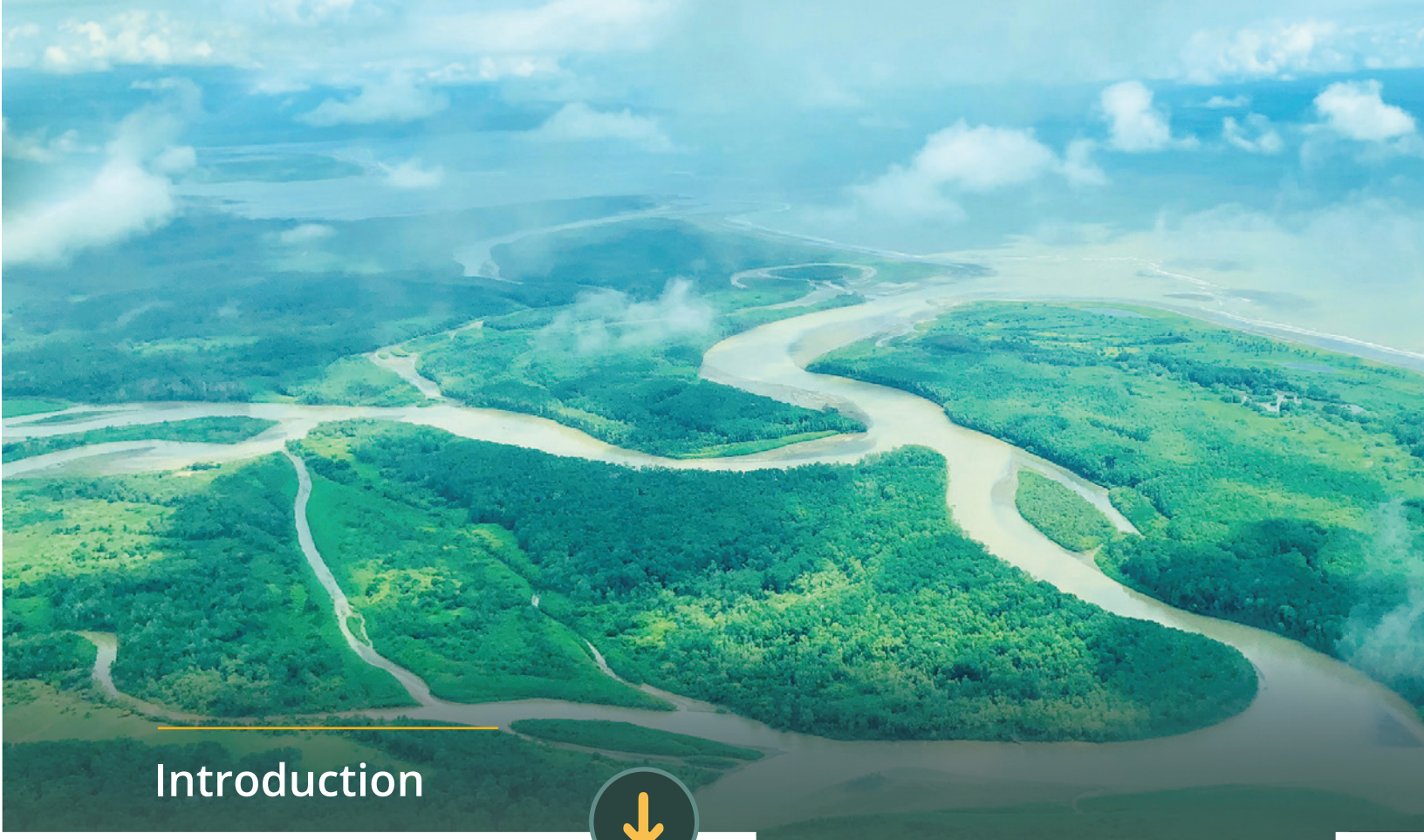
PRIAS Annual Operating Plan

(CeNAT-CONARE) 2024



Indicator	Achieved Goals		
	Public	Private	Total
Scientific publications - Dissemination	2	3	5
Knowledge transfer activities	29	1	30
Research Projects	9	1	10
Agreements	3	-	3
Attention to Students	16	-	16





Introduction

PRIAS is a Geomatics laboratory with an emphasis on Earth Observations that provides the country with high-precision information that is available to all users worldwide, with the aim of addressing challenges and promoting studies on national and international territories. Attached as a Laboratory to the Centro Nacional de Alta Tecnología (CeNAT), it is a program of the National Council of University Deans (CONARE) that conducts the promotion and development of scientific research activities in various fields.

The PRIAS laboratory is a national link for scientific airborne missions that positions Costa Rica as one of the few countries in the world to have a collection of aerial photographs, with different sensors, which has recorded more than 80% of the national territory. From an Earth Observation perspective, it develops research and tools for informed decision-making based on data, in the areas of Earth observations, remote sensing, and spatial data infrastructure.

Linked to these areas, PRIAS leads research in risk management, environmental education, sustainable cities and communities, health, and environment, among others. They provide decision makers with the tools to define the course to follow in solving the challenges that the country needs to address in order to meet the nation's goals and commitments; as well as to support the creation of national and international public policy and the coordination of aid from different donors.



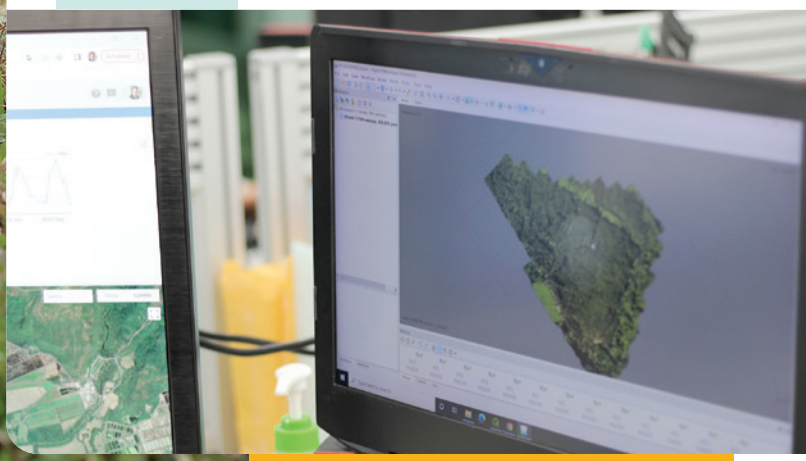
In addition, the aim is to enhance the multiplier effect with respect to the synergy between institutions under the triple-helix concept that highlights the way CeNAT works and that implies an impact on the efforts carried out in Costa Rican territory.

PRIAS is comprised by a multidisciplinary and interdisciplinary work team that maintains a close relation with national and international institutions in the academic, public, and private sectors. It aims at fostering scientific research, innovation, and knowledge transfer through the acquisition, treatment, storage, analysis, representation, and dissemination of information. It focuses on Earth Observation supported by Geomatics science, mainly in the disciplines of Global Positioning System, Remote Sensing, Photogrammetry, Geographic Information Systems, Spatial Data Infrastructure, Geodesy, and Computer Science.



Development **Goals**

To conduct research in Earth observations that contribute to the knowledge of the Costa Rican territory, through applied geo-aerospace science projects that foster decision-making capacity in the academic, socioeconomic, and environmental fields.



Enforced **Values**

- Effective communication in collaborative work
- Willingness to multidisciplinary learning
- Creativity to face improvements
- Commitment to the goals set in each project
- Openness to change management

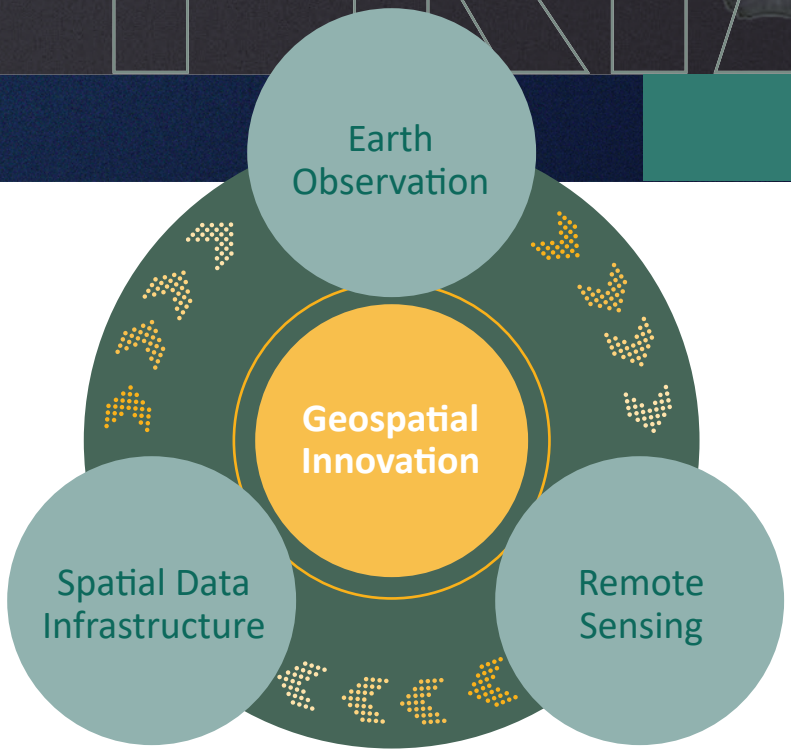
Principles

- Efficient use of technological infrastructure
- Interdisciplinary collaborative work
- Knowledge transfer adapted to populations
- Willingness for constant improvement of the projects that are undertaken



Analysis of the exposure of agricultural hotspots and multi-production zones in Costa Rica under the natural threat of flooding.

Strategic Development Area PRIAS



Impact
Indicators

Publications

5
TOTAL

Classification	Public	Private	Total
Q2	-	1	1
Q3	-	2	2
Q4	1	-	1
Indexed SCIMAGO Scopus	1	-	1
Total	**2**	**3**	**5**



Knowledge **Transfers**

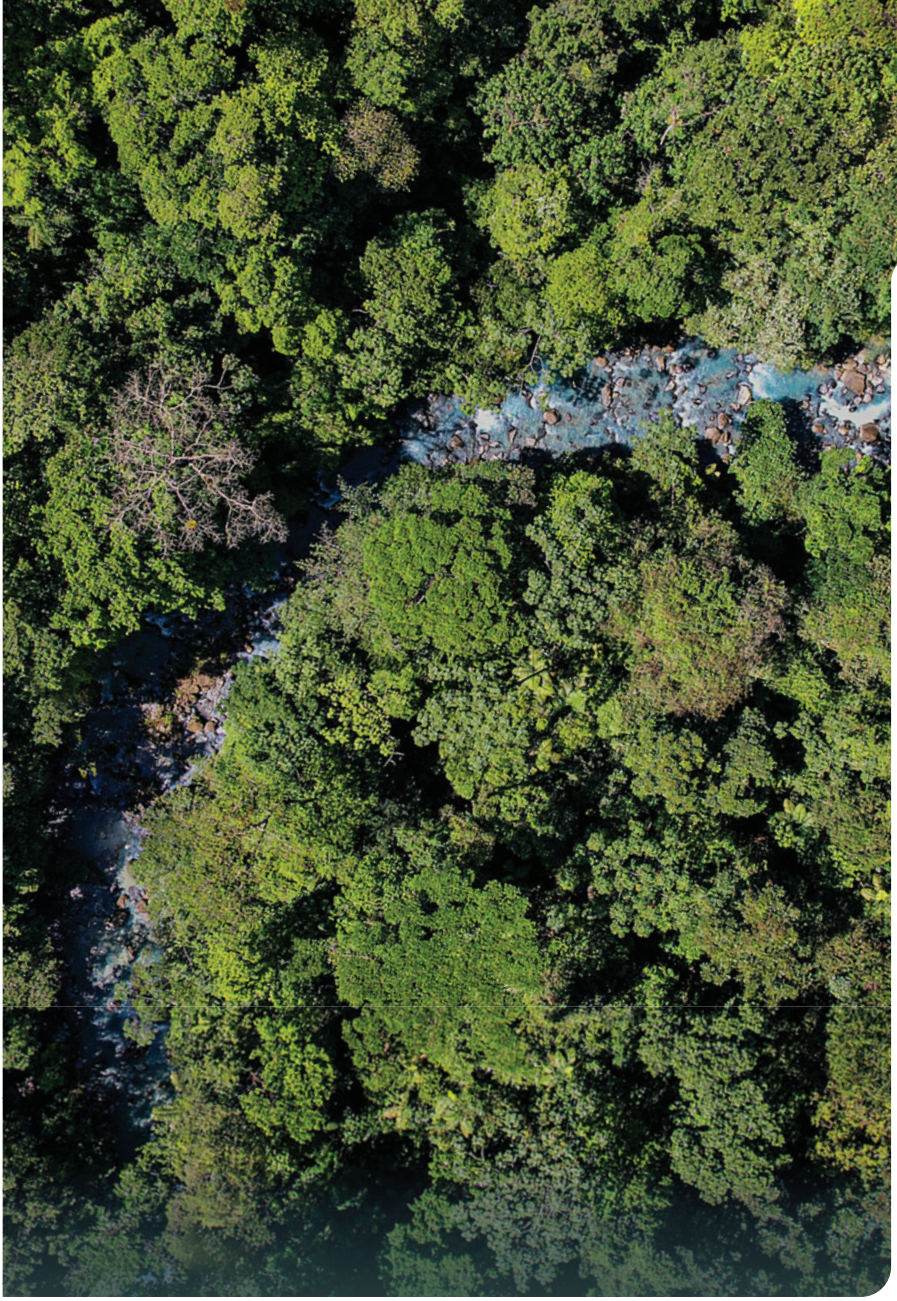
30
TOTAL

People benefited by knowledge transfers:

1,069

Lectures, Workshops, Presentations, and Symposia

Type	National	International	Total
Public	**14**	**15**	**29**
Private	**1**	**-**	**1**
Total	**15**	**15**	**30**



Research **Projects**

10 TOTAL

Public

- 1 CONARE-Funded Projects
- 8 Internal Projects
- 8 National linkages

9 TOTAL

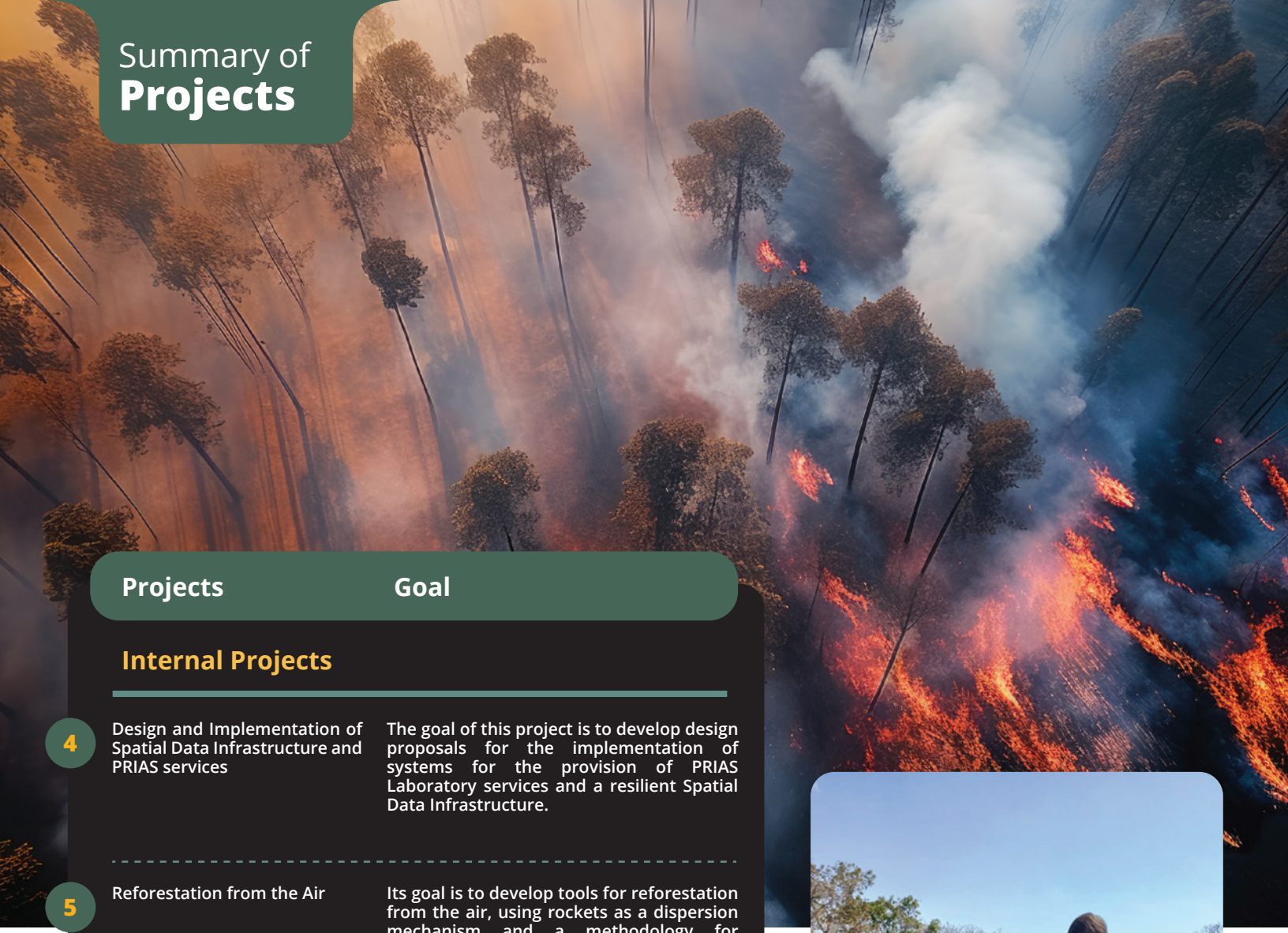
Private

- 1 Private Funds

1 TOTAL

Projects	Goal
CONARE-Funded Projects	
1 Operational PRIAS	The development of this project is linked to the fulfillment and development of the different operational indicators of the laboratory.
Internal Projects	
2 Design of a Distributed System Implementation in GeoCenter	The purpose of the project is to take advantage of the GeoCenter resources to implement a distributed system of container orchestration technologies within the PRIAS data center.
3 Library of Spectral Signatures	Development of a tool that allows cataloging, managing, and sharing spectral signature data collected in different internal and external research projects. Another goal is supporting the range of research in the country by mentoring students and collaborating in the generation of hyperspectral data information from institutions within the triple helix.

Summary of **Projects**



Internal Projects

	Projects	Goal
4	Design and Implementation of Spatial Data Infrastructure and PRIAS services	The goal of this project is to develop design proposals for the implementation of systems for the provision of PRIAS Laboratory services and a resilient Spatial Data Infrastructure.
5	Reforestation from the Air	Its goal is to develop tools for reforestation from the air, using rockets as a dispersion mechanism and a methodology for measuring the progress of reforestation.
6	The Forest Fire Regime in Costa Rica: Possible Strategies for Mitigating Its Impact on the Tropical Dry Forest	This project seeks to analyze fire behavior through fire regime variables to generate predictive models of the spatial distribution of forest fires, thus providing strategic information for mitigating damage in tropical dry forests.
7	Spatialization of the Tree Flora of Costa Rica Pilot Study for the Greater Metropolitan Area	The project aims to develop a proposal for spatialization and mapping of tree flora in the Greater Metropolitan Area to contribute, through land observations, to the conservation and management of Costa Rican species.
8	PRIAS Laboratory Computational Creative Space	Its goal is to develop a collaborative website to share geoinformation and aerospace activities in a creative way.
9	Analysis of the Exposure of Agricultural Hotspots and Multi-Productive Zones in Costa Rica to the Natural Threat of Flooding	Its objective is to evaluate the degree of exposure of agricultural and multi-productive areas in Costa Rica to the natural threat of flooding.

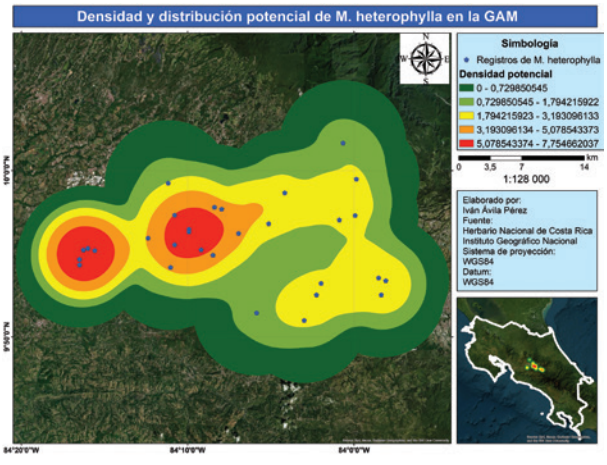


GNSS equipment used to collect hyperspectral data to study forest fires in the Guanacaste Conservation Area, to support early warning systems for risk management.

Projects	Goal

Private-Funded Projects

10	FAO-SEPAL Project	The goal is to develop a pilot digital system for monitoring illegal logging, using the SEPAL tool and satellite images in the Golfo Dulce Forest Reserve and the AMISTOSA Biological Corridor.



Spatialization of the Tree Flora of Costa Rica Pilot Study for the Greater Metropolitan Area.

Maps of potential species distribution within the Greater Metropolitan Area to improve spatial knowledge of the natural distribution of species for climate change studies. Example: Mauria heterophylla

Agreements

Public

3
TOTAL

- Department of Chemistry, Costa Rica Institute of Technology
- MTF Teca
- National Museum



Student Support

16
TOTAL

Public	Total
Scholarships	3
Interns and final graduation thesis	8
Assistant students	5
Total	16

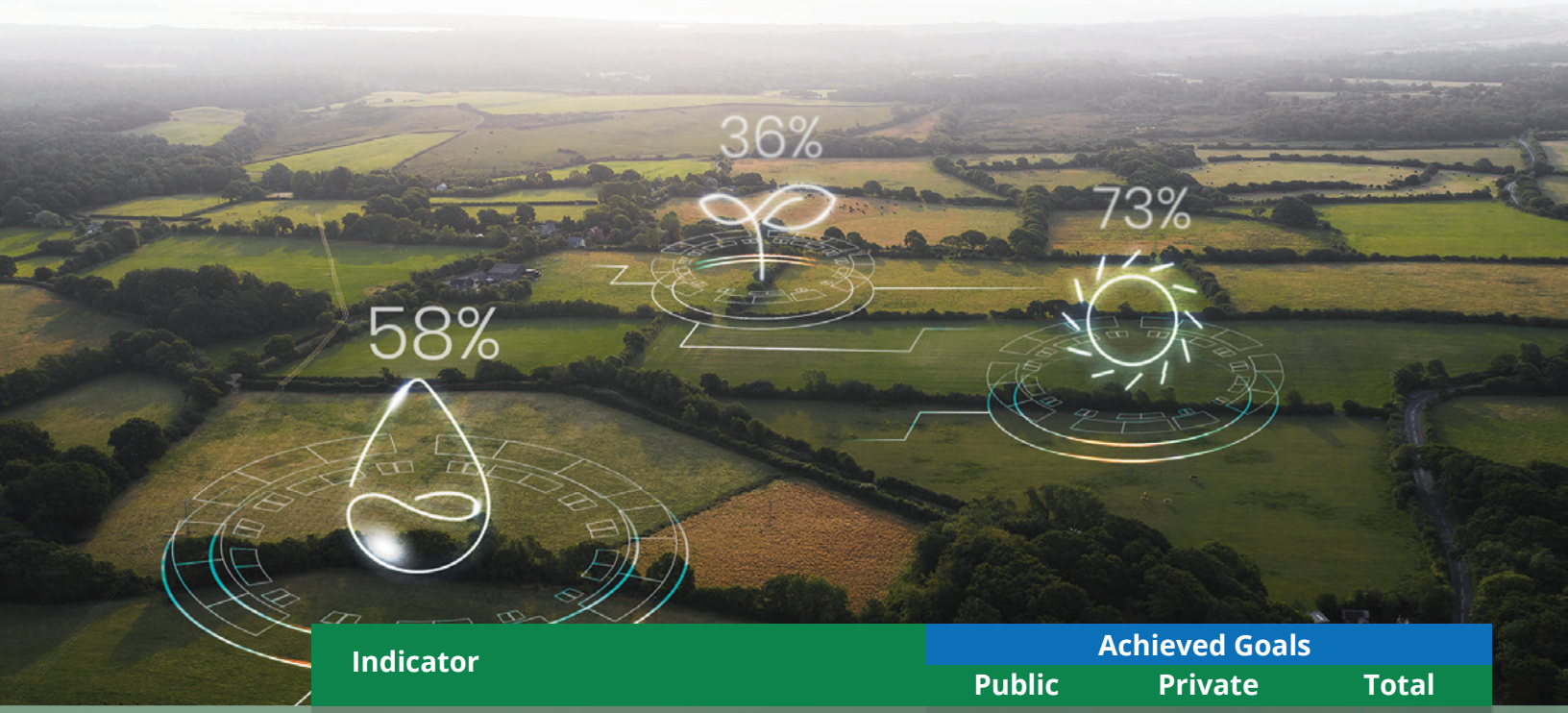


Environmental **Management**

Environmental Management

Environmental Management Annual Operational Plan (CeNAT-CONARE) 2024





Indicator	Achieved Goals		
	Public	Private	Total
Scientific publications - Dissemination	2	-	2
Knowledge transfer activities	21	9	30
Research Projects	2	5	7
Agreements	-	-	-
Attention to Students	12	3	15

Introduction

The Environmental Management Area (AGA) is one of the six constituent areas of the Centro Nacional de Alta Tecnología (CeNAT) of the National Council of University Deans (CONARE). Its purpose is to promote sustainability through research, innovation, and development of strategies that contribute to environmental protection, clean energy use, and food security.

Since the creation of CeNAT, AGA has worked on generating knowledge and strengthening environmental policies in the country. It develops scientific research and offers technical assistance on environmental issues, water quality, and atmospheric phenomena, among others. Subsequently, in 2010, the Observatory of Climate Variability and Change and the Agromatics, Food Security, and Slow Food programs were created, thus consolidating its commitment to the study of climate change and the promotion of sustainable practices in food production.



Through an interdisciplinary and collaborative approach, the AGA works with universities, government institutions, and productive sectors to implement innovative solutions that promote environmental resilience and sustainable development. Its work ranges from technical advice and specialized training to the integration of new technologies in production processes, guaranteeing a positive impact on the well-being of communities and the ecological balance of the country. It also works, in conjunction with public universities, on issues of sustainable energy transition through international projects linked to the European Union and other Latin American countries.



Development Goal

To disseminate and empower society in the economic, social, and environmental fields on climate change, clean energy, productive chains, and added value of products, by developing technical assistance processes that territorially impact innovation projects, technology, and entrepreneurship for the productive development of Costa Rica.

Enforced Values

- Human team care
- Support to the food industry and productive support in continuous improvement
- Collaborative management in the projects that are undertaken
- Socialization of scientific information to society

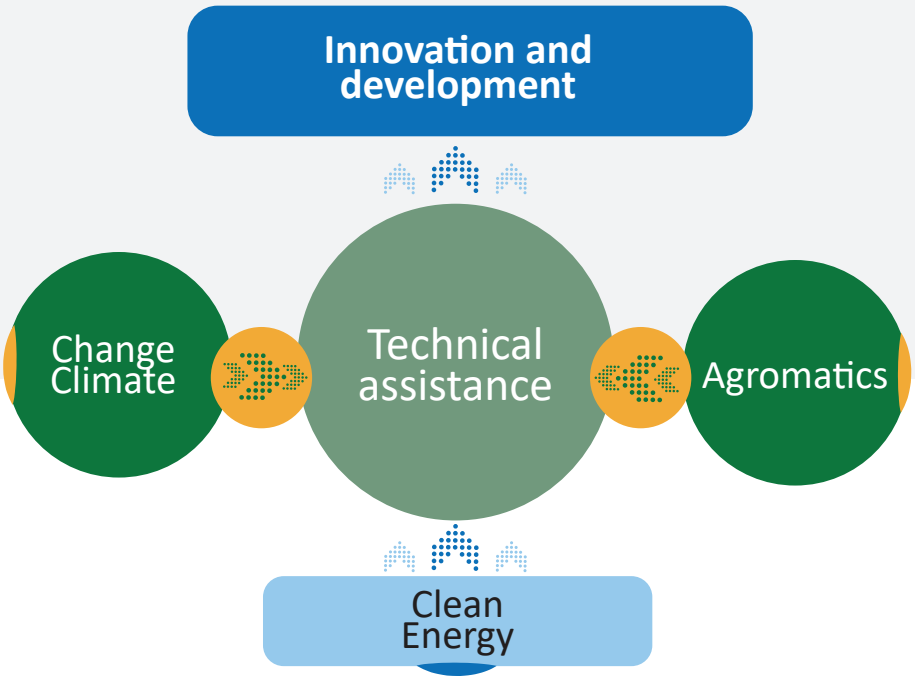
Principles

- Efficient use of time
- Accountable administrative management of research projects
- Willingness for constant improvement of the projects that are undertaken
- Knowledge and skills empowerment



Environmental Management

Strategic Development Area



Environmental Management
Programs

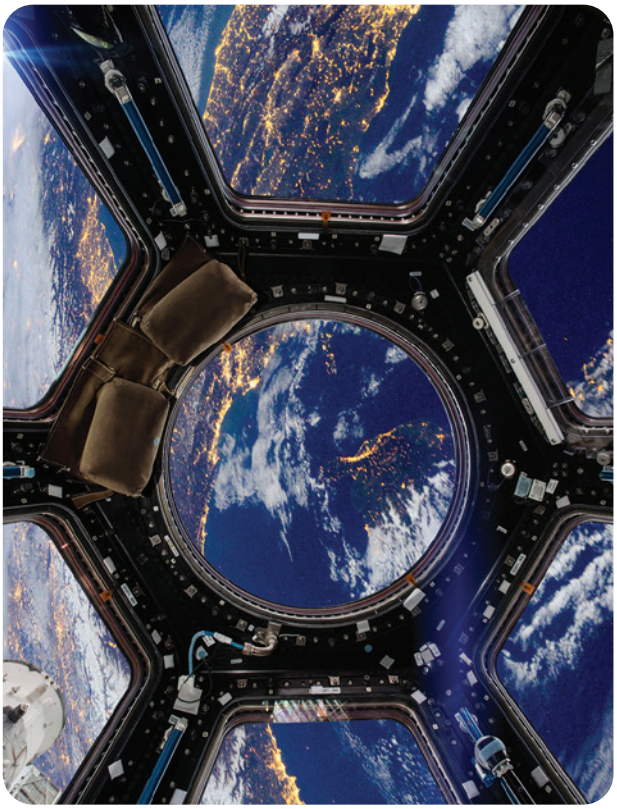


1 Directorate of Environmental Management

The Directorate of the area supports and aligns the strategic actions of the different programs that make up the area.

In addition, it promotes business innovation actions and projects with European and American linkage projects, focusing on SMEs and high-tech ventures. This is done in association with the Ministry of Science, Technology, and Telecommunications (MICITT) and the Ministry of Economy, Industry, and Commerce (MEIC).

Furthermore, in accordance with the instructions issued by the General Directorate of CeNAT, the Director of Environmental Management is responsible for coordinating the CeNAT-CONARE Annual Scholarship Program. This program is aimed at undergraduate and graduate students from public universities, so that they can develop their graduation works or research projects in CeNAT laboratories and/or programs.



2 Climate Observatory

The Climate Observatory Program of the Environmental Management Area responds to the need to strengthen the capacity to adapt to the variability and climate change that extreme variations in weather and climate generate on the productivity of the agricultural sector.

The Climate Observatory is dedicated to researching past and current situations, as well as climate perspectives with the aim of benefiting society in the face of climatic adversities.

The Observatory continuously and innovatively provides services to the agricultural sector through research and training, with customized assistance via a technological platform on issues of adaptation and resilience to variability and climate change. This support is aimed at farming communities in order to sustain productivity and increase crop and livestock yields, thereby helping in decision-making and planning activities.

3 Agromatics

The Agromatics program is dedicated to working with the support of alliances and high technologies (with universities, institutions, ministries, companies, regulatory bodies, and CeNAT's own laboratories), in publicizing local resources and products.

Both products and their gene expression are typified to detect genes for adaptation to the environment and resistance to diseases and pests, which are linked to quality and hardness, according to the variability of the existing species. Characterization is based on knowledge of the organoleptic and culinary quality of local products, many of which are little known. In addition, morpho-agronomic, physicochemical, organoleptic, and biochemical characterizations are carried out to identify and assess both nutritional and anti-nutritional contents of products and, through high technologies, the technical specifications that may indicate that a product deserves a distinctive sign of quality are endorsed. The aim is to determine the origins and uses of the different products and the good use of agro-industrial by-products. These comprehensive studies make it possible to address natural disasters, climate variability and change, deforestation, and loss of harvests that cause higher prices of products and food insecurity.



Through the alliance with Slow Food, activities are developed to promote quality, clean products (innocuous and with clean technologies that minimize damage to human, animal, and environmental health), and fair pricing. This is done by reducing intermediation chains so that both producers and their families have earnings. This also includes co-producers, who are conscious consumers and understand the problems of producers and their families and consider the great effort they make to provide more sustainable and healthy products.

Impact
Indicators

Publications



2
TOTAL

Classification	Public	Private	Total
Specialized	2	-	2
Total	**2**	**-**	**2**

Knowledge **Transfers**



30
TOTAL

Lectures, Workshops, Presentations

Type	National	International	Total
Public	19	2	21
Private	8	1	9
Total	27	3	30

People benefited by knowledge transfers:

20 050

- 17,000 people received climate information through chats, the PIACT platform, and its Facebook page.
- Approximately 752 people participated in local workshops and training events.
- At the international level, 320 people attended presentations and discussions.
- Activities carried out in communities such as Matambú, the Republic of Honduras School, and the Francisco Valerio Center impacted nearly 300 people.
- 51 CONARE staff members participated in training on waste, fossil fuels, and climate strategies.



7
TOTAL

Public

2 CONARE-Funded Projects

2
TOTAL

Private

5 Private Funds

5
TOTAL

Research **projects**





Summary of **Projects**

Projects	Goal

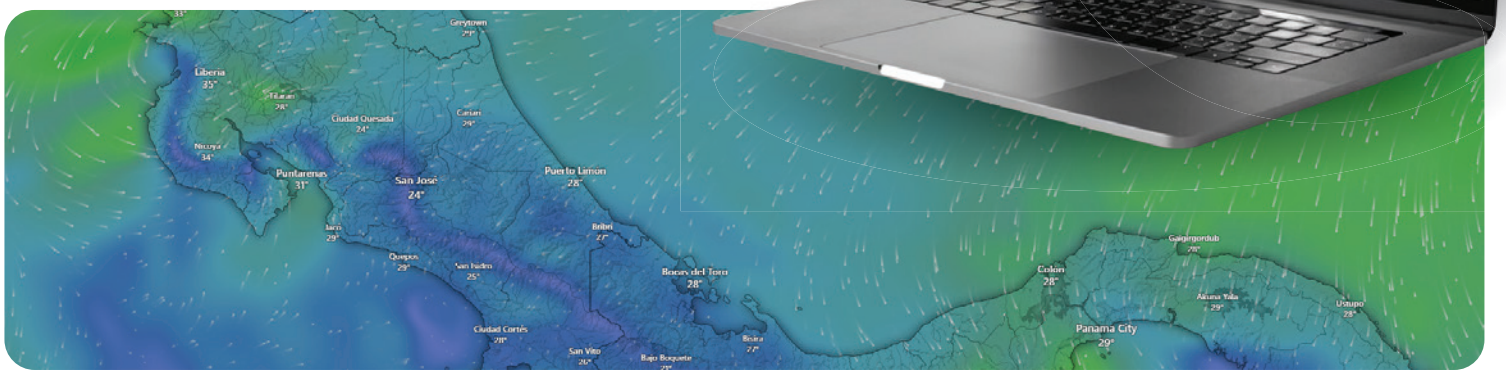
CONARE-Funded Projects

1	Environmental Management Project	This project promotes sustainable development through technical assistance, workshops, innovation and collaboration on climate change, clean energy and productive linkages, strengthening competitiveness, and decision-making.
2	Costa Rica - Antarctica Project	This project seeks for Costa Rica to lead the designation of Antarctica as a protected area, promoting its conservation. It includes a scientific expedition and the journey of a Costa Rican electric vehicle to the South Pole.

Private-Funded Projects

3	Project "Generation of Agro-Industrial Capacities and Creation of a Comprehensive Unit (Physical-Chemical, Organoleptic, and Microbiological Characterization) to Improve the Production Process of Turrialba Cheese with Designation of Origin (PINN- ASOPROA)"	This project seeks to strengthen ASOPROA's technological capacity to benefit Turrialba Cheese producers by developing sustainable processes and research capacity. It focuses on ensuring the quality, safety, and differentiation of cheese to comply with national and international regulations, and on the research and use of by-products to generate new products.
4	Earth Market Project	The project promotes healthy, clean, and fair food, encouraging sustainable agricultural practices and the direct market of agrifood products. In addition, it seeks to preserve local food culture and establish strategic alliances with institutions to support agrifood routes and fair markets.

The Climate Observatory's PIACT platform highlights its impact on data collection and analysis for decision-making on environmental and climate issues.





Projects	Goal
5 UPS Environmental Management Project	The project promotes the services of the Climate Observatory - CeNAT in adaptation to climate change, offering training and consultancy to affected sectors and improving customer service through various channels.
6 CSUCA Project: “Strengthening Environmental Capacity in Communities Through Technological and Methodological Innovation to Promote Resilience in Disaster Risk Management and Climate Change in the Canton of Heredia, Costa Rica, the District of Almirante, Bocas Del Toro, Panama, and the Indigenous Achí Community of Rabinal in the Department of Baja Verapaz, Guatemala.”	It seeks to strengthen environmental skills through technological and methodological innovation to improve resilience to the risk of disasters and climate change. It involves vulnerable communities in Heredia (Costa Rica), Almirante (Panama), and Achí (Guatemala). Work is being done on training trainers, creating risk perception maps, designing mobile applications, and sustainable community planning, with the aim of empowering communities and promoting environmental education.
7 OEI Project - "ENERGYTRAN. EULAC for Energy Transition: Research Infrastructures Cooperation for Energy Transition between Europe and Latin American and the Caribbean Countries"	It promotes knowledge exchange, public policy development, and the implementation of renewable technologies. It includes training of researchers, hybrid workshops, and design of strategies for a clean and fair transition towards climate neutrality. It is a joint effort with international institutions of the EU and LAC, such as the OEI.



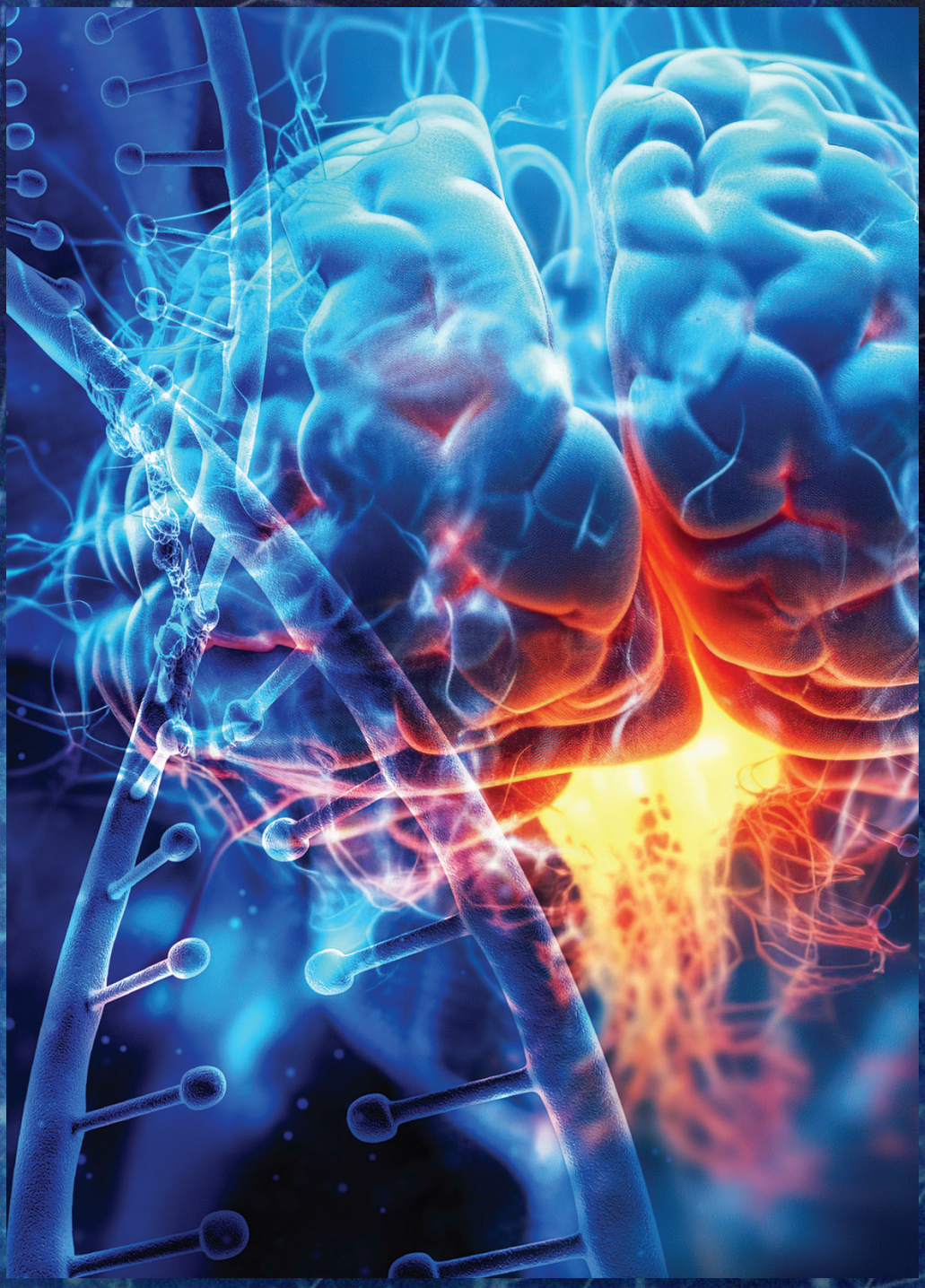




Student Support

15
TOTAL

	Public	Private	Total
Scholarships	7	-	7
Interns and final graduation projects	1	3	4
Assistant students	4	-	4
Total	**12**	**3**	**15**



INSTITUTIONAL **RESULTS**

Support in **Knowledge Transfer**



In addition to its focus on research development, LANOTEC's primary goal is to maximize work in the area of extension and teaching. We are particularly concerned with fostering and strengthening scientific vocations from an early age, seeking to connect with educational centers to involve children from elementary schools in the process.

Part of the commitment in this area is reflected in the support of the student delegations that participate in the various international Science and Chemistry Olympiads. This support begins with the process at the national level, with the selection of the representatives who will compete in the events at the international level.

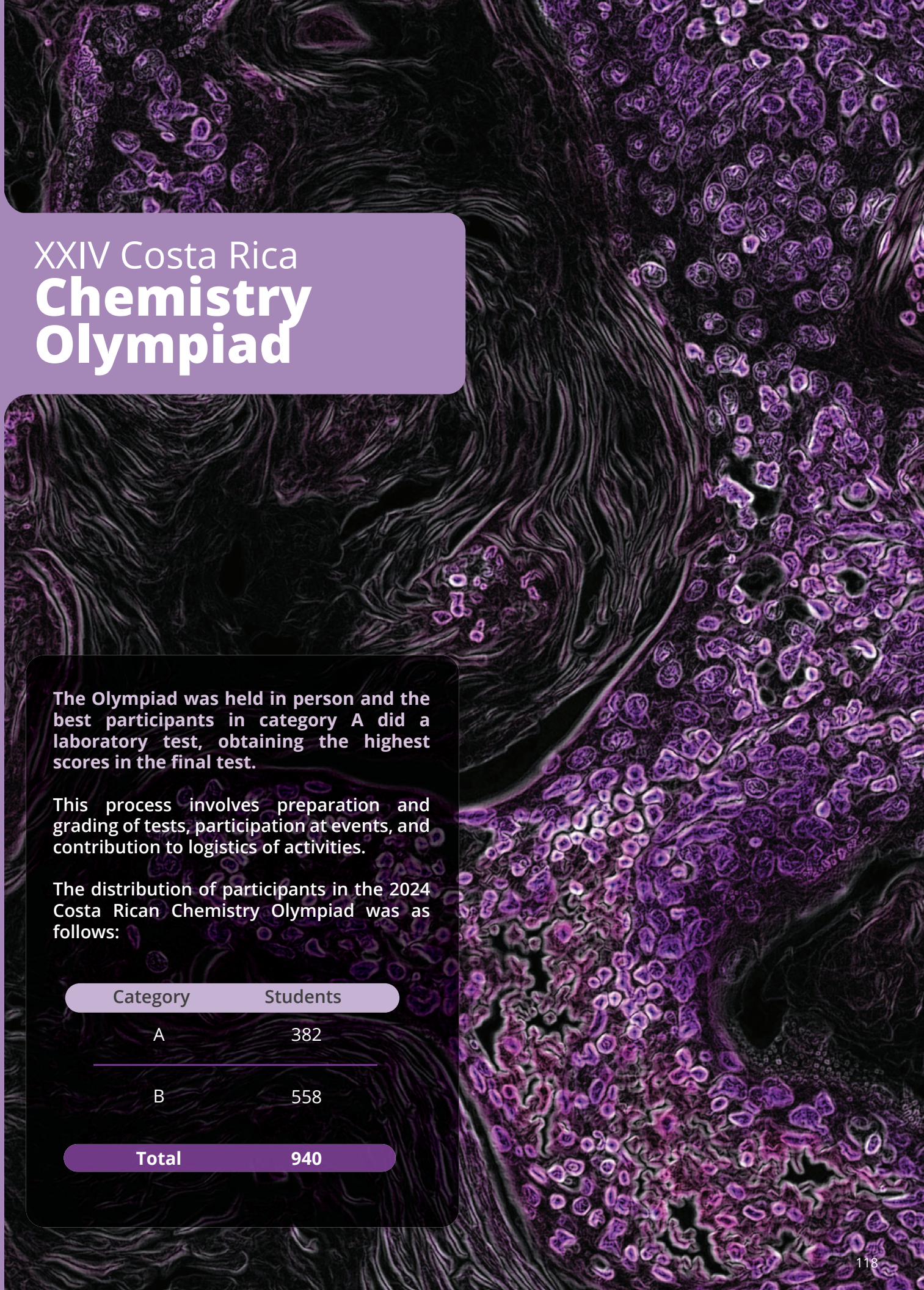
At the national level, LANOTEC took place in the organization of these activities:

- XXIV Costa Rica Chemistry Olympiad
- VI Costa Rica Science Olympiad
- IX Camp for the Promotion of Scientific Vocations, especially Chemistry

In 2024, the following activities were carried out at the international level:

- XVII Central American and XV Caribbean Chemistry Olympiad
- XXVIII Iberoamerican Chemistry Olympiad
- 56th International Chemistry Olympiad
- 21th International Junior Science Olympiad

This year, three Olympiads were held in person: the Ibero-American Chemistry Olympiad, the International Chemistry Olympiad, and the International Youth Science Olympiad. In addition, the Central American and Caribbean Chemistry Olympiad was held virtually.



XXIV Costa Rica **Chemistry Olympiad**

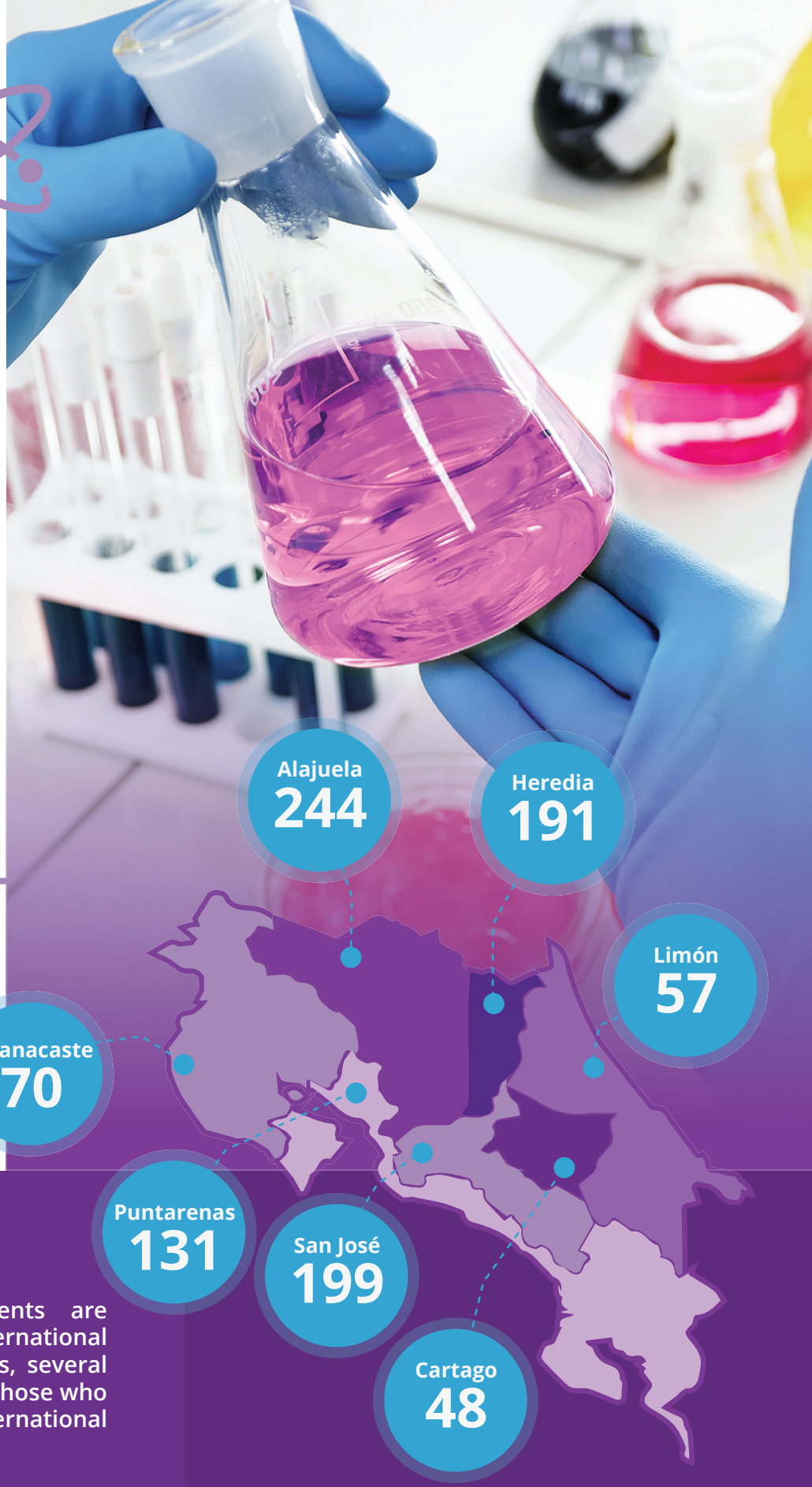
The Olympiad was held in person and the best participants in category A did a laboratory test, obtaining the highest scores in the final test.

This process involves preparation and grading of tests, participation at events, and contribution to logistics of activities.

The distribution of participants in the 2024 Costa Rican Chemistry Olympiad was as follows:

Category	Students
A	382
B	558
Total	**940**

Province	Students
Alajuela	244
Cartago	48
Guanacaste	70
Heredia	191
Limón	57
Puntarenas	131
San José	199
Total	**940**



940
Students

In addition, preselected students are trained to prepare for international competitions. During this process, several "super finals" are made to select those who will participate in the international Chemistry Olympiad.

VI Costa Rica **Science Olympiad**



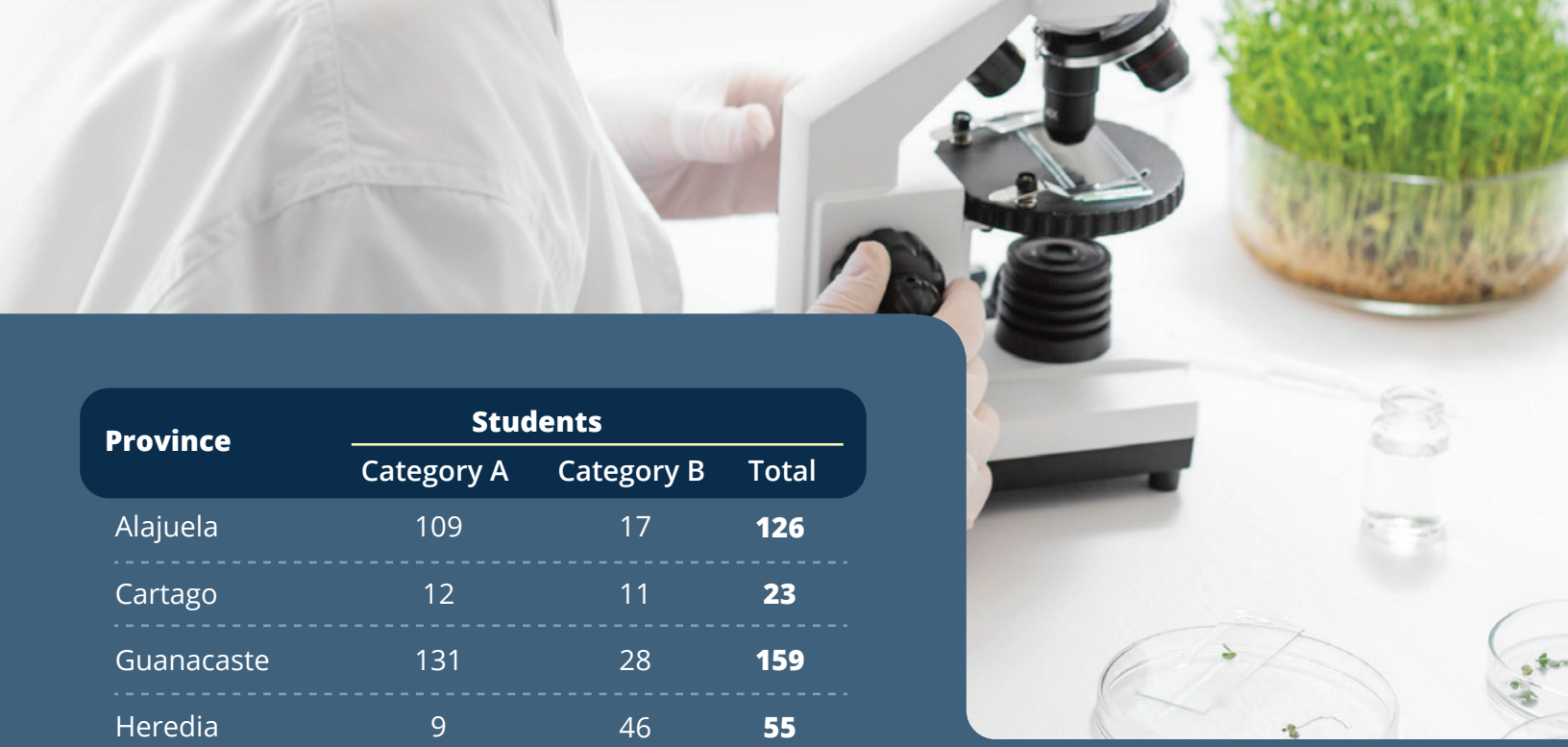
This Olympiad was held in person. This year, a category B was opened, aimed at students in the second cycle of Secondary Education, and was made available to all educational centers in the country.

In category A, a 'Lab Internship' was held for students who obtained the highest grades in the final exam. This internship takes place at CeNAT, where students participate in laboratory practice and subsequently visit other laboratories to learn about the work carried out in each one and their scope.

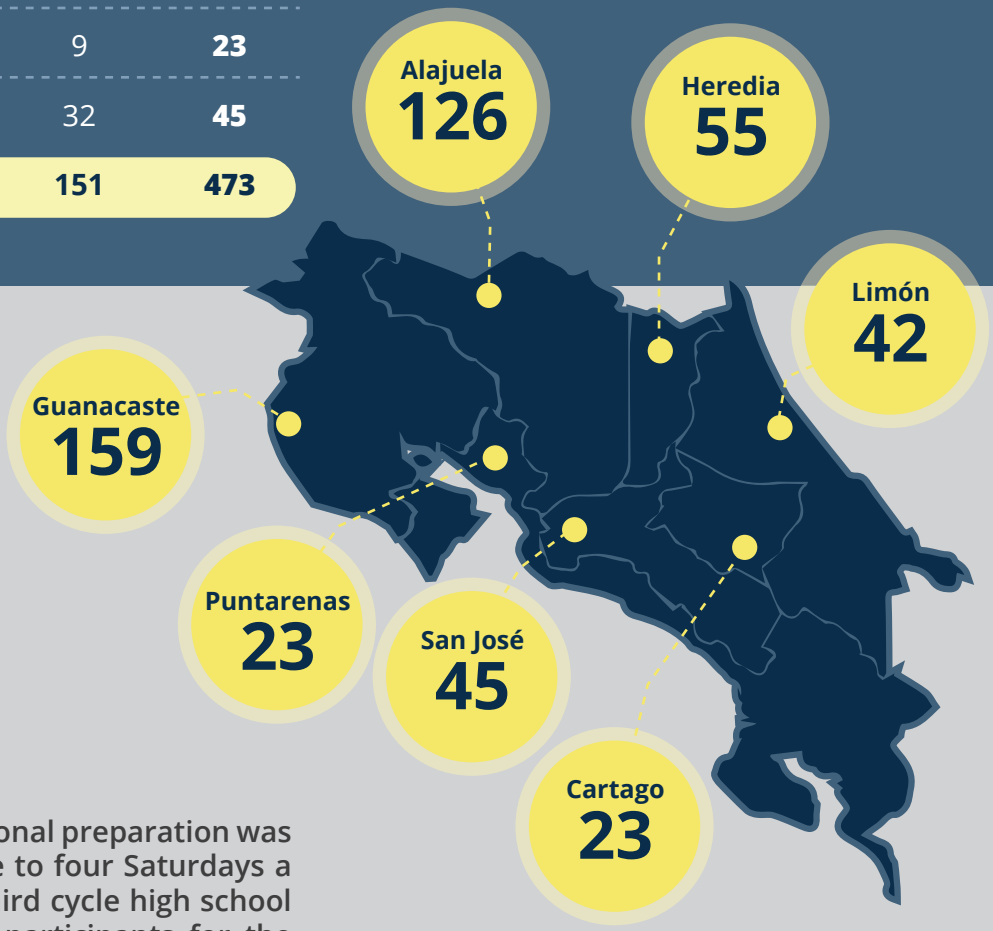
During this process, the exams -including contents from -three biology, physics and chemistry areas- are prepared and reviewed, in addition to participating in the activities and managing the logistics of the entire contest.

In 2024, the Costa Rican Science Olympiad had the following distribution of participants:

Gender	Students	
	Category A	Category B
	184	79
	138	72
	322	**151**



Province	Students		
	Category A	Category B	Total
Alajuela	109	17	**126**
Cartago	12	11	**23**
Guanacaste	131	28	**159**
Heredia	9	46	**55**
Limón	34	8	**42**
Puntarenas	14	9	**23**
San José	13	32	**45**
Total	**322**	**151**	**473**



The Science Olympiad organizes an annual international preparation program, covering biology, chemistry, physics, and mathematical skills, with the goal of preparing students to compete in the International Junior Science Olympiad.

This year, all training for international preparation was carried out at CeNAT. From three to four Saturdays a month, we trained second and third cycle high school students and then selected the participants for the International Junior Science Olympiad. The process began with 18 students at the beginning of the year. By mid-year, the six students who participated in the international Olympiad were selected.

IX Camp for

Promotion of Scientific Vocations, mainly Chemistry

This camp was carried out with the finalist students from the Costa Rican Science and Chemistry Olympiads. After conducting an analysis of the candidates, a group of students from all over the country was selected.

During the three days, there were lectures, laboratories, experiments, and recreational activities focused on chemistry, physics, and biology, in addition to working on critical thinking and problem solving.

This year, the event took place at the Tropical Studies Organization's La Selva Biological Station in Puerto Viejo, Sarapiquí. The camp participants were distributed as follows:

Gender	Students
	10
	20
Total	**30**

Olympiad	Students
Sciences	10
Chemistry	20
Total	**30**



International Participation of **Delegations from Costa Rica**

21° International Chemistry Olympiad



This Olympiad was designed to be held in person. The discussions, translations, and judgments were conducted by the mentoring professors of the delegation. During this period, the questions of each test are approved by all the participating countries, then they are translated, and subsequently the grades obtained by the students are discussed.

The students must complete three exams - a single selection exam, a written exam, and a laboratory exam. Each exam lasts 4 hours. During these tests, students solve questions from the 3 areas - chemistry, physics, and biology.

The event was held in Romania, from December 02 to 12, 2024. The Costa Rican delegation was made up of:

- Andrea Rivera Álvarez, Head of Delegation Physics Mentor
- Ricardo Ulate Molina, Mentor
- Kenneth Castillo Rodríguez, Mentor
- Alexander Sancho Dive, Student
- Sebastian Sanchez Vargas, Student
- Matías Andino Castellano, Student
- Ariana Espinosa Clavera, Student
- Sofia Arguello Herrera, Student

Achievements:



Sebastián
Sánchez Vargas





Central American and Caribbean Chemistry Olympiad

The Olympiad was held virtually, organized by the University of San Carlos in Guatemala, from November 11 to 15. The members of the Costa Rican delegation were:



- Wendy Villalobos González, Head of Delegation
- Edwin Salas Gonzalez, Mentor
- Laura Nicole Moya Bolaños, Student
- Juan Jose Varela Castillo, Student
- Randall Syedd Leon, Supervisor
- Sergio Alvarez McInerney, Supervisor

Achievements:



Juan José
Varela Castillo



Iberoamerican **Chemistry Olympiad**

The Olympiad was held in person in Costa Rica, with the participation of 14 delegations from the following countries: Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Honduras, Spain, Mexico, Panama, Peru, Uruguay, and Venezuela. The activity was carried out at the La Selva Biological Station of the Organization for Tropical Studies, located in Puerto Viejo, Sarapiquí, from October 9 to 14, 2024. The Costa Rican delegation was made up of:

- Eduard Ríos Badilla, Head of Delegation
- Fabio Araya Carvajal, Mentor
- Saúl Rodriguez Víquez, Student
- Santiago Jara Vargas, Student
- Josué Chacón Barrantes, Student
- Marcelo Villalobos López, Student

Achievements:

SILVER

Saul Rodríguez Víquez

BRONZE

Josué Chacón Barrantes



International **Chemistry Olympiad**

The event was held in Saudi Arabia, on July 21-25, 2024. The Costa Rican delegation was made up of:

- José Roberto Vega Baudrit, Head of Delegation
- Cristian Campos Fernández, Mentor
- Nicolás Molina Arango, Student
- Josué Chacón Barrantes, Student
- Saúl Rodríguez Víquez, Student
- Jimena Chacon Castro, Student



Achievements:



Saúl
Rodríguez
Víquez



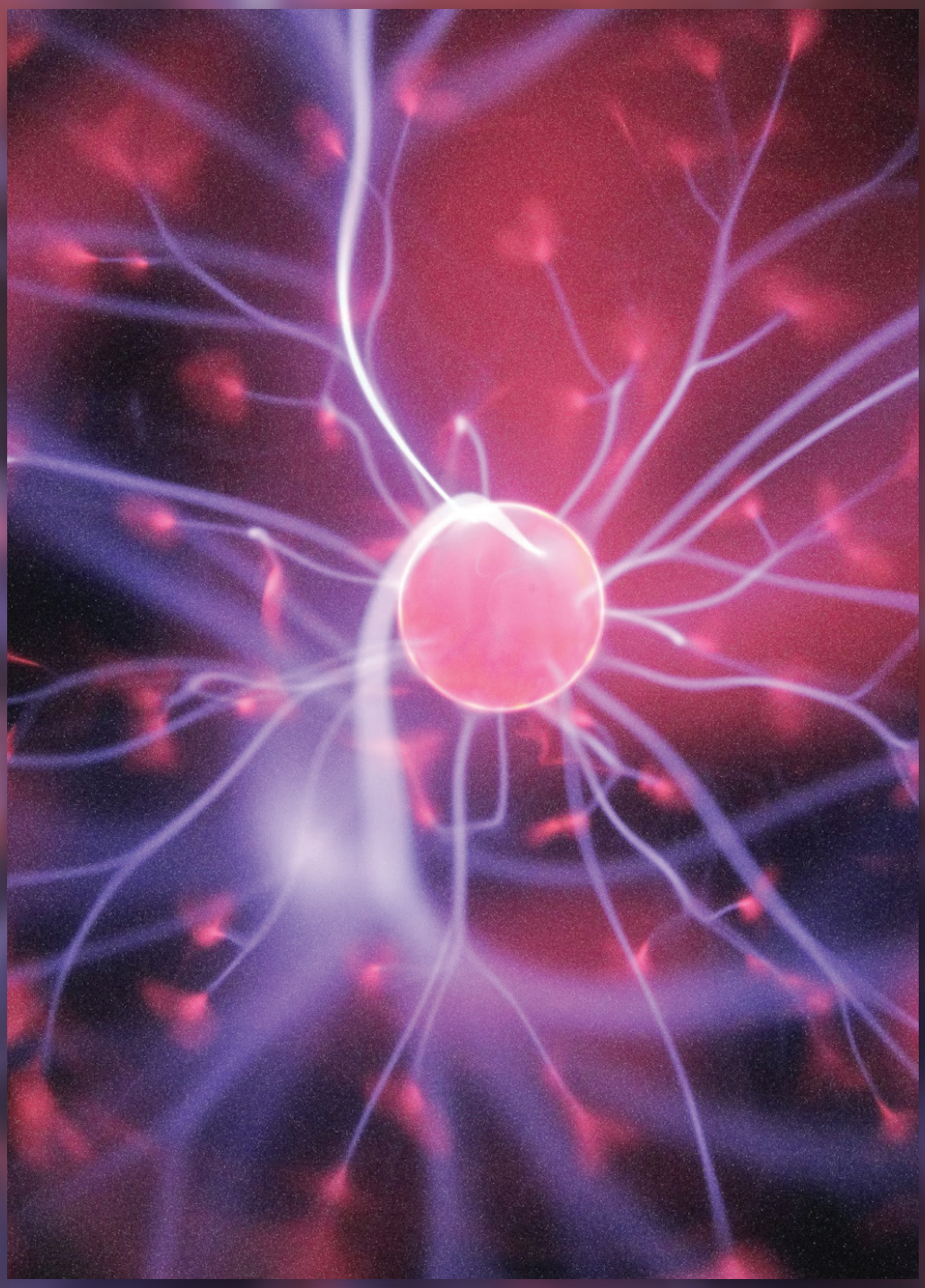
Summary of International Participation in Olcoci and Olcoquim 2024

Compiled by Nathalie Valencia Chacón, MSc.

Table1 International participations of Olcoci and Olcoquim

Olympiad	International competition	Place and date of the international event	Costa Rican student delegation	Awards Received
Olcoci	International Junior Science Olympiad (IJSO)	**Bucharest, Romania.** December 2-12, 2024	Sebastián Sánchez Vargas, Rafael Sancho Dive, Ariana Espinosa Clavera, Leonor Obando Umaña, Sofía Argüello Herrera, Matías Andino Castellanos	1 Bronze medal
Olcoquim	International Chemistry Olympiad (ICHO)	**Riyadh, Saudi Arabia.** July 21-30, 2024	Nicolás Molina Arango, Josué Chacón Barrantes, Saúl Rodríguez Víquez, Jimena Chacón Castro	1 Honorable mention
	Central American and Caribbean Chemistry Olympiad (OCACQ)	**Virtual Edition organized by Guatemala.** November 11 to 15	Laura Nicole Moya Bolaños, Juan José Vargas Castillo	1 Special mention
	Ibero-American Chemistry Olympiad (OIAQ)	**La Selva Biological Station, Sarapiquí, Costa Rica.** October 9-14, 2024	Saúl Rodríguez Víquez, Santiago Jara Vargas, Marcelo Villalobos López, Josué Chacón Barrantes	1 Silver medal and 1 Bronze medal

Source: Internally produced, based on information from Olcoci and Olcoquim



INNOVATION

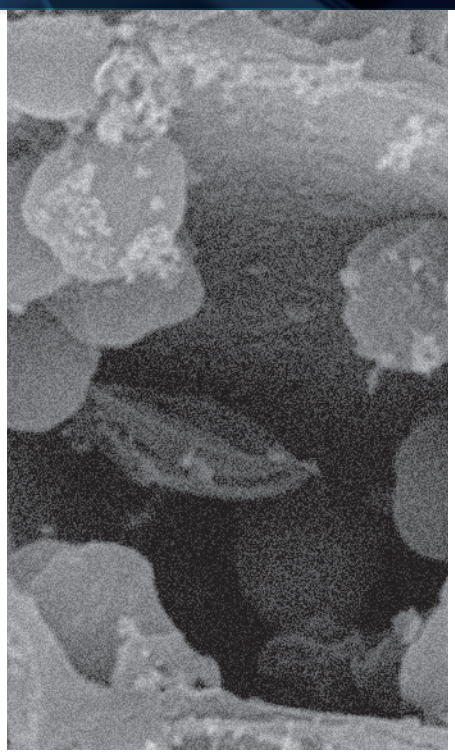


Entrepreneurships:

Support to Applied Research Companies

LANOTEC

Company	Support and Research
Confluent Medical	Material characterization analysis
Smith Interconnect	Material characterization analysis
Proquinal	Scientific paper drafting
CooperVisión	Material characterization analysis
Establishment Lab	Material characterization analysis
Ilsi Mesoamerica	Event co-organization
AbbVie	Material characterization analysis
MicroVention Terumo	Material characterization analysis
Nevro	Material characterization analysis
Stein Laboratories	Material characterization analysis
Calox Laboratories	Material characterization analysis
TE Connectivity	Material characterization analysis
Sauber INN	Material characterization analysis
UPL Costa Rica	Material characterization analysis
Ecogreen Organics	Material characterization analysis
Funda UCR	Material characterization analysis
Plásticos Modernos S.A.	Material characterization analysis
CMI Corporación Multi Inversiones	Material characterization analysis
Auto Mercado	Material characterization analysis
Panduit	Material characterization analysis
Odontoweb	Material characterization analysis
Mayca Distribuidores S.A.	Material characterization analysis



CENIBiot

Company	Support and Research
CORBANA, S.A.	Growth kinetics
Cenahce Operacional S.A.	Various laboratory services
Establishment Labs S.A.	Various laboratory services
Granja Avícola Santa Marta S.A.	Various laboratory services
La Garra del Norte RQS S.A.	Molecular identification of living organisms Strain identification.
Pelón de la Bajura	Various laboratory services
Tirimbina Biological Reserve	Nucleic acid extraction
Speratum	Various laboratory services
Solidarity Employee Association of Hologic Surgical Productos SRL	Cytotoxicity assay
Laboratorios Saval Costa Rica S.A	Various laboratory services
AMVAC de Costa Rica	Nucleic acid extraction
CoopeAgri R.L.	Various laboratory services
Costa Rica Institute of Technology	DNA sequencing using the Sanger method
FUNDAUNA	Nucleic acid extraction
University of Costa Rica	DNA sequencing using the Sanger method
La Cotinga	Nucleic acid extraction



Environmental Management

Company	Support and Research
CINDE	Collaboration on biodevelopment and biomaterials projects and presentation of initiatives related to innovation and sustainability.
ICE Electronics FESTO	Development of proposals for collaboration in technological innovation.
Chamber of Industries of Costa Rica	Participation in the Innovation Commission to strengthen the relationship between academia and industry.
National Bank of Costa Rica	Development of a Proof of Concept to analyze customer churn and a proposal to measure investments in biodiversity and impact in critical credit analysis areas.







Support to Applied Scientific Research Organizations or Institutions

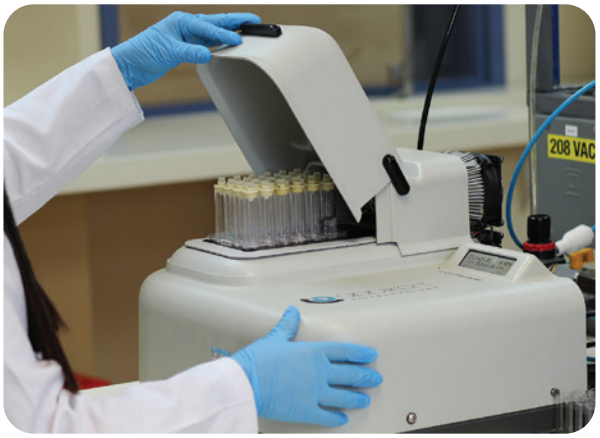
LANOTEC

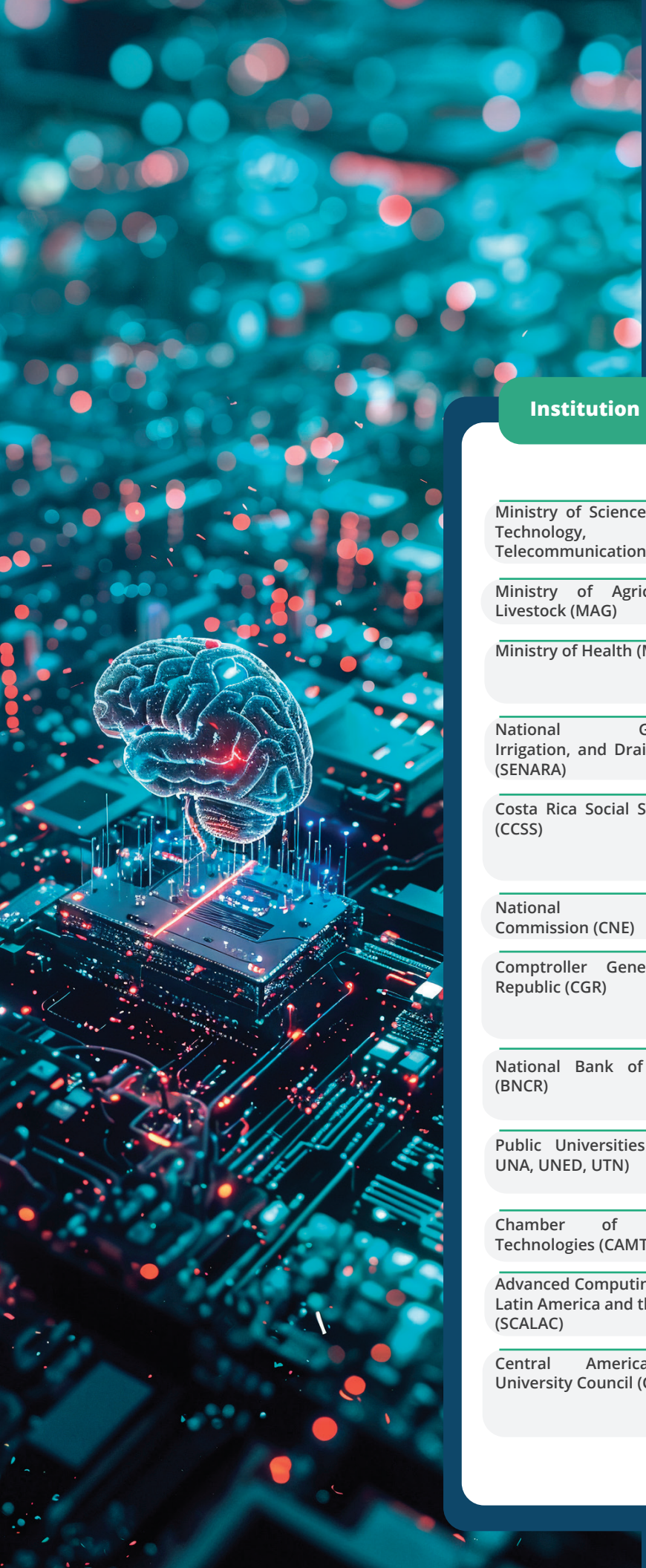


Entity or Institution	Support
Office of Naval Research Global	Alternatives for interface-modified and 2D/3D perovskite absorbers for perovskite solar cell application.
H2020 - EU - University of Belgrade, Serbia	Automated functional screening of IgGs for diagnostics of neurodegenerative diseases (AUTOIgG).
Fertinyc	Prototype of Biopolymers obtained from pineapple biomass waste. (BIO TAG).
Private Northern University, Peru	Biosynthesized metal nanoparticles from agro-industrial waste, applied in functionalization of bioplastics for use in the industrial chain of berries.
University of the Republic of Uruguay	Proposal drafting within the framework of South-South Cooperation
Private Northern University, Peru	Projects in the area of nanoparticle biosynthesis
Max Planck Institute, Germany	Research project on properties and mechanisms of non-stick coatings
University of Belgrade, Serbia	Project in the area of neurodegenerative diseases
University of Costa Rica	Internal project in the study of snake venoms
National University	Scientific paper drafting
Costa Rica Institute of Technology	Internal projects in areas of biogas systems, solar cells, biosensors, and semiconductors
Invenio	Attention to students, support in internships, and supervised practice processes

CENIBiot

Company	Support
University of Bordeaux, France	Attention to Students
UCR-CIPRONA	Agreements and projects
Monterrey Institute of Technology	Attention to Students
WAITRO	Participation in lectures
National Higher School of Agronomy and Food Industries (France)	Attention to Students



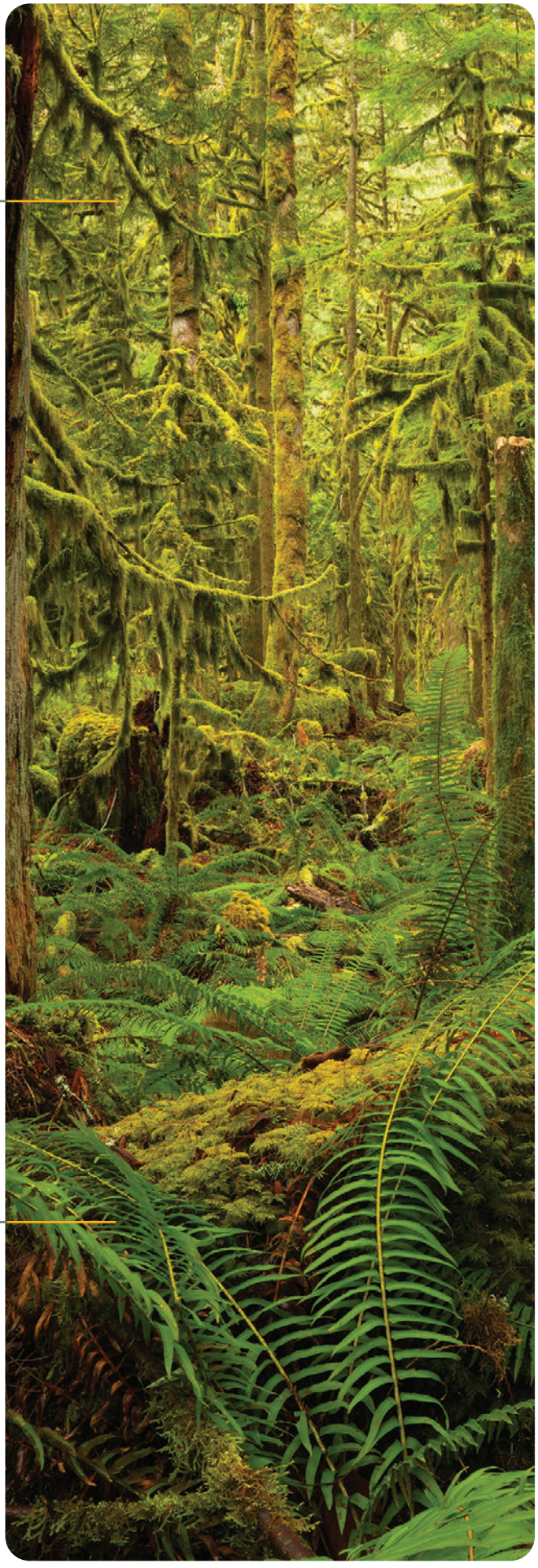


CNCA

Institution	Support
Ministry of Science, Innovation, Technology, and Telecommunications (MICITT)	Collaboration for developing artificial intelligence in the country.
Ministry of Agriculture and Livestock (MAG)	Computing infrastructure support for SENASA data analysis.
Ministry of Health (MS)	Development of artificial intelligence tools for analysis of electrocardiographic data and a potential agreement.
National Groundwater, Irrigation, and Drainage Service (SENARA)	Support in the implementation of computer simulations of rivers.
Costa Rica Social Security Fund (CCSS)	Process of agreement and collaborations on health issues and the project titled “Development of artificial intelligence tools for analysis of electrocardiographic data”
National Emergency Commission (CNE)	Development of collaborative projects for an early warning system for the Cañas River.
Comptroller General of the Republic (CGR)	Support in the development of data science platforms for the detection of irregularities in the SICOP platform. In addition, an agreement was established for the use of the platform's data.
National Bank of Costa Rica (BNCR)	Support in the development of a prediction model using video images to identify customer wait times at the bank’s branches.
Public Universities (UCR, TEC, UNA, UNED, UTN)	Execution of the laboratory's internal research projects, as well as various collaborations on scientific computing topics.
Chamber of Information Technologies (CAMTIC)	Collaboration in the artificial intelligence chapter and in the development of data science research.
Advanced Computing System for Latin America and the Caribbean (SCALAC)	Support in organization of the structure of the society and collaborations on High Performance Computing (HPC) matters.
Central American Higher University Council (CSUCA)	Advanced computing platform for the development of research and training projects. The CoCeCAR project is currently being developed and executed.

PRIAS

Entity or Institution	Support and Research
RSTAG	Member of the Science and Technology Advisory Group for the Americas and the Caribbean.
National University for Distance Education (UNED)	Joint execution of the project titled “The forest fire regime in Costa Rica: possible strategies for mitigating its impact on the tropical dry forest”.
Costa Rica Institute of Technology (TEC)	In conjunction with the School of Forestry Engineering, the project proposal "Evaluation of forest structure using remote sensing and field validation in the North Pacific of Costa Rica" is being developed.
GreenXpoLab	Joint teaching of the Pix4D Mapper course with the company GreenXpoLab.
La Libertad Park	Joint development of the project "Evaluation of Positioning Correction Methods to Improve the Accuracy of Orthophotographs Generated with RPAS”.
National Monitoring System for Land Cover and Use and Ecosystems (SIMOCUTE)	Support in the development of the second stage of the SIMOCUTE system.
UN Biodiversity Lab / University of British Columbia	Member of the advisory committee for the development of the second stage of the ELSA project.
Copernicus LAC	Member of the Copernicus LAC national committee.



PRIAS

Entity or Institution	Support and Research
NASA Space Apps Challenge	Participation as judges in the NASA Space Apps Challenge activity.
University of Costa Rica	Joint execution with the Aerospace Engineering Group of the UCR of the project "Reforestation from the air": Methodologies to evaluate the effectiveness of reforestation using rocketry as a dispersion mechanism
General Directorate of Civil Aviation	Liaison for a scientific airborne mission for NASA.
Legislative Assembly	Analysis of bill 24,489 "Urban Tree Law".
National Museum	Joint execution of project "Spatialization of the tree flora of Costa Rica. A pilot study for the Greater Metropolitan Area".
State of the Nation Program (PEN)	Project development "Analysis of the Exposure of Agricultural Hotspots and Multi-productive Zones in Costa Rica to the Natural Threat of Flooding".
FAO	Project development "Pilot of Digital System for Monitoring Illegal Logging, Golfo Dulce Forest Reserve and AMISTOSA Biological Corridor".



Gestión Ambiental

Entity or Institution	Support and Research
La Salle University	Management of a collaboration agreement and development of joint initiatives in education and technology.
University of Costa Rica	Development of research on emerging contaminants in freshwater. Development of the Environmental Health Observatory project, which works on the research and monitoring of environmental factors that impact public health in the Desamparados area.
State Distance Education University	Collaboration in the proposal "Aquaponics for Food Security and Development of the Environmental Health Observatory project", which works on research and monitoring of environmental factors that impact public health in the Desamparados area.
CATIE	Collaboration with the PIACT platform and participation in sustainability and environmental impact projects.
EDUNAMICA	Coordination and logistics of educational visits with ninth and tenth grade students.
University of Southern California	Development of a project proposal on water use, management, and quality, addressing its management and sustainable use.
Texas Tech University	Participation in the presentation of the FutureFeed initiative.
OEI	Collaboration in thematic events related to energy and sustainability.
NASA	Collaboration on the SABRE Project with Vidal Salazar.



Environmental **Management**

Organization or Institution	Support and Research
UAEM Tenancingo University Center LifeWatcha ERIC	Participation in presentations on the importance of the indigenous trilogy.
National Museum of Costa Rica	Collaboration in the presentation of results of the flora spatialization project.
Costa Rican Institute of Electricity	Collaboration in decarbonization and biogas studies and participation in the energy development project.
Costa Rican Coffee Institute	Participation in technical visits and collaboration with PRIAS on biodiversity issues.
Desamparados Committee	Development of the Environmental Health Observatory project, which works on research and monitoring of environmental factors that impact public health in the Desamparados area.
REDIES	Participation in sustainability activities and environmental education networks.
DINADECO	Development of the Environmental Health Observatory project, which works on research and monitoring of environmental factors that impact public health in the Desamparados area.
Environmental Management Area, CONARE	The Environmental Management area actively participates in CONARE's Environmental Management Commission, consistently contributing to the development and implementation of environmental strategies and actions.



SOCIALIZATION
OF SCIENCE

Work of CeNAT on Media

Through the media

The Centro Nacional de Alta Tecnología (CeNAT-CONARE) plays a fundamental role in scientific and technological dissemination, using the media as a key tool to bring knowledge to society. Through various platforms, CeNAT not only reports on its research and progress, but also promotes interest in science and technology, fostering scientific careers and raising public awareness about the relevance of these fields.

Through media and social networks, CeNAT disseminates the work it performs in nanotechnology, biotechnology, environmental research, engineering, and computer science. In addition, it produces scientific papers on innovative projects and international collaborations, allowing both experts and the general public to stay informed about the latest developments.







Work of CeNAT **on Media**

CeNAT's Social Networks

Currently, the presence in social networks is fundamental within the dissemination strategy, since it offers a permanent communication channel, which has the advantage of the immediacy of the information to the audiences of the institution.

CeNAT has various institutional channels, such as YouTube account, SoundCloud, Facebook page, and website, which provide relevant and up-to-date information to different target audiences of the community.
Through these platforms, CeNAT provides valuable informative, educational content that promotes scientific careers. The most popular posts are announcements of virtual courses or workshops, institutional news, CeNAT-CONARE scholarship programs, knowledge transfer activities, research projects, and digital media campaigns covering different topics.

As for the digital ecosystem, CeNAT's Facebook page continues to grow its follower base. The audience is almost evenly split, with 53.70% women and 46.30% men, reflecting a diverse interaction with the posted content.



In 2024, three campaigns were developed:

CeNAT-CONARE Scholarships Information on Division Services and CeNAT's Anniversary.

In addition, announcements were made on various topics.







Social Media



Opening of new social network accounts.

Instagram | Tiktok

CeNAT's reach on **Facebook**

Number of **followers**	Over **16 thousand**
Average monthly **reach of posts**	**30 thousand** people
Total page **likes**	Over **14 thousand**
Number of countries that **follow the page**	**49**



49

activities posted by **CeNAT on Facebook**

Main **Countries**

Costa Rica	**Spain**
Mexico	**Guatemala**
Peru	**Colombia**
United States	**Germany**
Ecuador	**Argentina**

Germany
Argentina
Australia
Austria
Bolivia
Brazil
Belgium
Canada
Chile
Colombia
South Korea
Costa Rica
Cuba
Denmark
Ecuador
Egypt
El Salvador
Spain
United States
Philippines
France
Guatemala
Honduras
Iraq
Israel
Italy
Japan
Mexico
Nicaragua
Nigeria
Norway
New Zealand
Panama
Paraguay
Netherlands
Peru
Portugal
Puerto Rico
United Kingdom
Czech
Republic Dominican
Republic Russia
Syria
Sweden
Switzerland
Turkey
Uruguay
Venezuela
Vietnam



Source: information on the year 2024 provided by CeNAT

2024 Facebook Figures

Facebook
Views

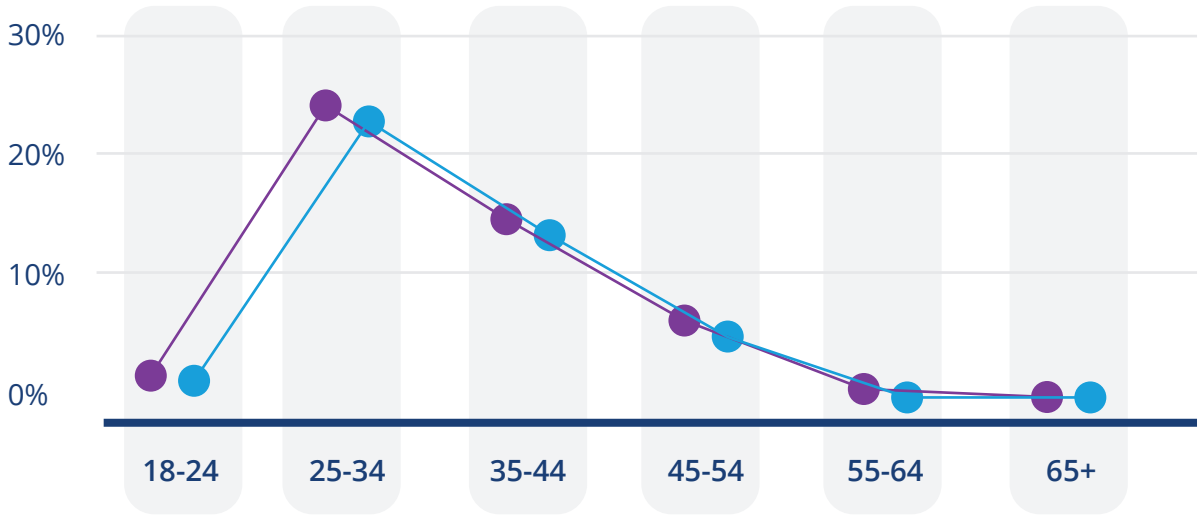
Over
157
thousand

User reach
through
Facebook

Over
81
thousand



Facebook reach
by age and sex



Women **54%**

Men **46%**



PIACT

Interactive Platform of the Tropical Climate Application



FACEBOOK SOCIAL NETWORK
2024 Figures

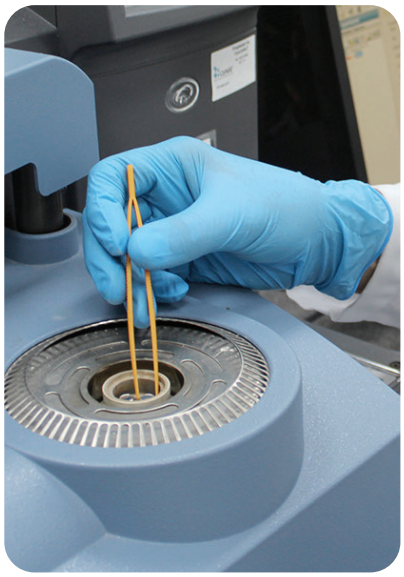
Number of **followers**	Over **15 thousand**
Number of **page likes**	Over **9 thousand**
User **reach**	**2,410,756** people
Annual **reach of posts**	**1,260,195** people

WEBSITE **PIACT**

Visits	**14,384**
New users	**1,644**
Active users at December 2024	**58,948**



Human Resources **at CeNAT**

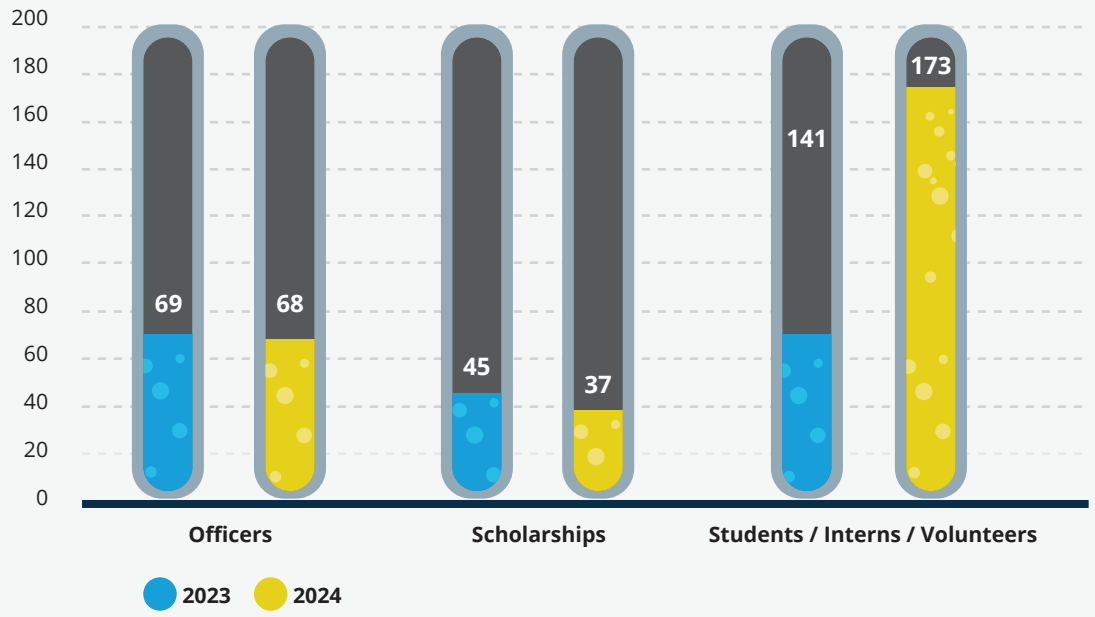


R & D Human Resources 2024

Laboratory	Officers	Collaborators	Scholarships	Total
CNCA	11	13	6	**30**
PRIAS	7	13	3	**23**
Env. Management	1	8	7	**16**
LANOTEC	15	71	12	**98**
CENIBiot	21	68	9	**98**
CeNAT	6	-	-	**6**
PEN	7	-	-	**7**
Total	**68**	**173**	**37**	**278**



Comparison of Officials, Workers, and Scholarships
2023 and 2024



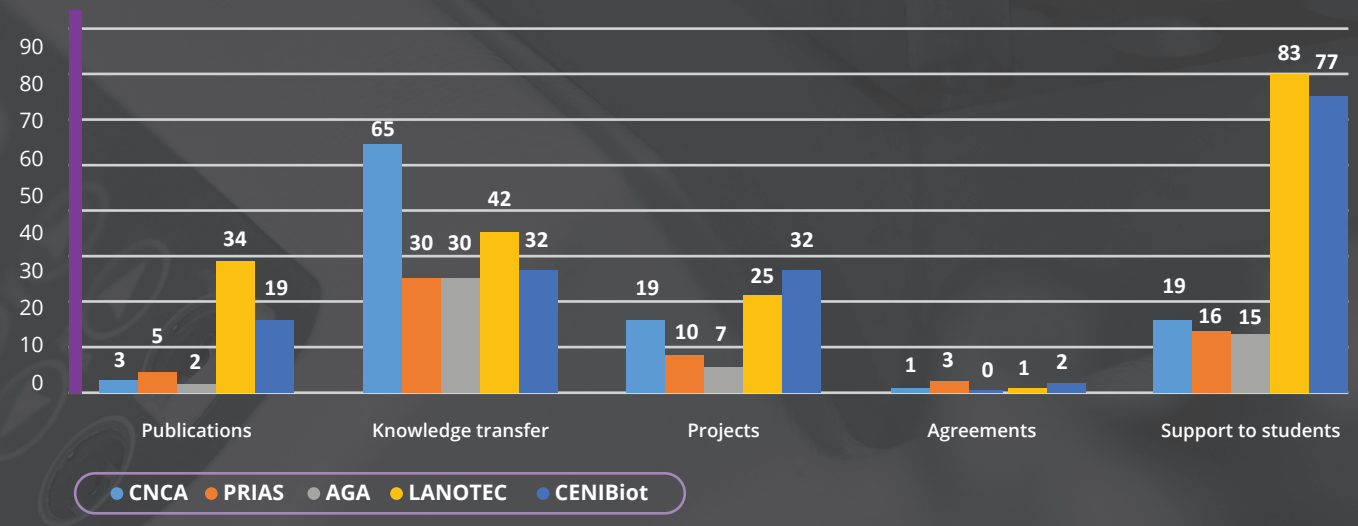


2024 Indicators, **According to CeNAT Laboratories and Areas**

Public and Private Indicators 2024

Indicator	CNCA	PRIAS	GA	LANOTEC	CENIBiot	Total
Publications	3	5	2	34	19	**63**
Knowledge transfer	65	30	30	42	32	**199**
Projects	19	10	7	25	32	**93**
Agreements	1	3	0	1	2	**7**
Student support	19	16	15	83	77	**210**
Cluster Performance Days	347	-	-	-	-	**347**
Cluster usage hours	138,139	-	-	-	-	**138,139**

Public and Private Indicators 2024





Sectors linked to CeNAT in the Past Years

Identication of sectors related to CeNAT as of December, 2024

- Education 2018
- Social 2018
- Health 2018
- Energy 2018
- Agriculture 2018
- Local-Municipalities 2018
- Aerospace 2018
- Tourism 2018
- Environmental 2018
- Food 2018
- Technology 2018
- National Security 2018
- Medical Physics 2018
- Biodiversity 2018
- Drug development 2018
- Biorefinery/Bioeconomy 2018
- Medical Devices 2018
- Aeronautics 2018

- 2019 Quality/Accreditation
- 2019 Art and Culture
- 2019 Sports
- 2019 Textile
- 2020 Transportation
- 2021 Ministry of Treasury
- 2021 Regulation
- 2021 Marine-fishing
- 2021 Forest
- 2021 Innovation
- 2022 Banking and Finance
- 2023 Economy
- 2024 Foreign Trade
- 2024 Emergencies





Institutions, Organizations, and **Companies linked to CeNAT in 2024**

AMEXCID
ENAPROC
Red Educadores Ambientales
CoopeAgri
Coope-Victoria
Liberty
Ministry of Culture and Youth
National Emergency Commission - CNE
Legislative Assembly
Comptroller General of the Republic (CGR)
British Columbia University
UCIMED
Meryland University
NASA Servir
NATGEO
JUPEMA
CANAPEP
Chamber of Tourism
Banco Popular
CNFL
Ministry of Treasury
US Naval
Inst. Nat. Innovation and Technology Transfer. Agriculture
Procomer
CINDE
COMEX
Ministry of Housing and Human Settlements (MIVAH)
CANAPALMA
Chamber of Industries
CORFOGA
ICAFE
Meteorologi-cal Institute
CSUCA
Association of Agronomists
SCALAC
SENASA
MEP
Professional Guilds
Ministerio de Justicia
ICT Chamber
INEC
MEIC
CCSS
ECA-LACOMET
Civil Aviation
MAG
Ministry of Health
ICE
INA
Public universities
MICITT CONICIT
BCCR
MINAE
CeNAT

- Present in 2024
- Incorporated in 2023
- Incorporated in 2022
- Incorporated in 2021
- Incorporated in 2020
- Incorporated in 2019
- Incorporated in 2018



CeNAT worldwide **linkage map in 2024**

CONARE
CONSEJO NACIONAL DE RECTORES

CeNAT
Centro Nacional de Alta Tecnología



INDICATORS OF
INSTITUTIONAL WORK

Impact of the CeNAT program of the Consejo Nacional de Rectores (CONARE) in 2024



MORE THAN 81 THOUSAND
Mayor of Users via Facebook

49
Nationalities of Facebook followers

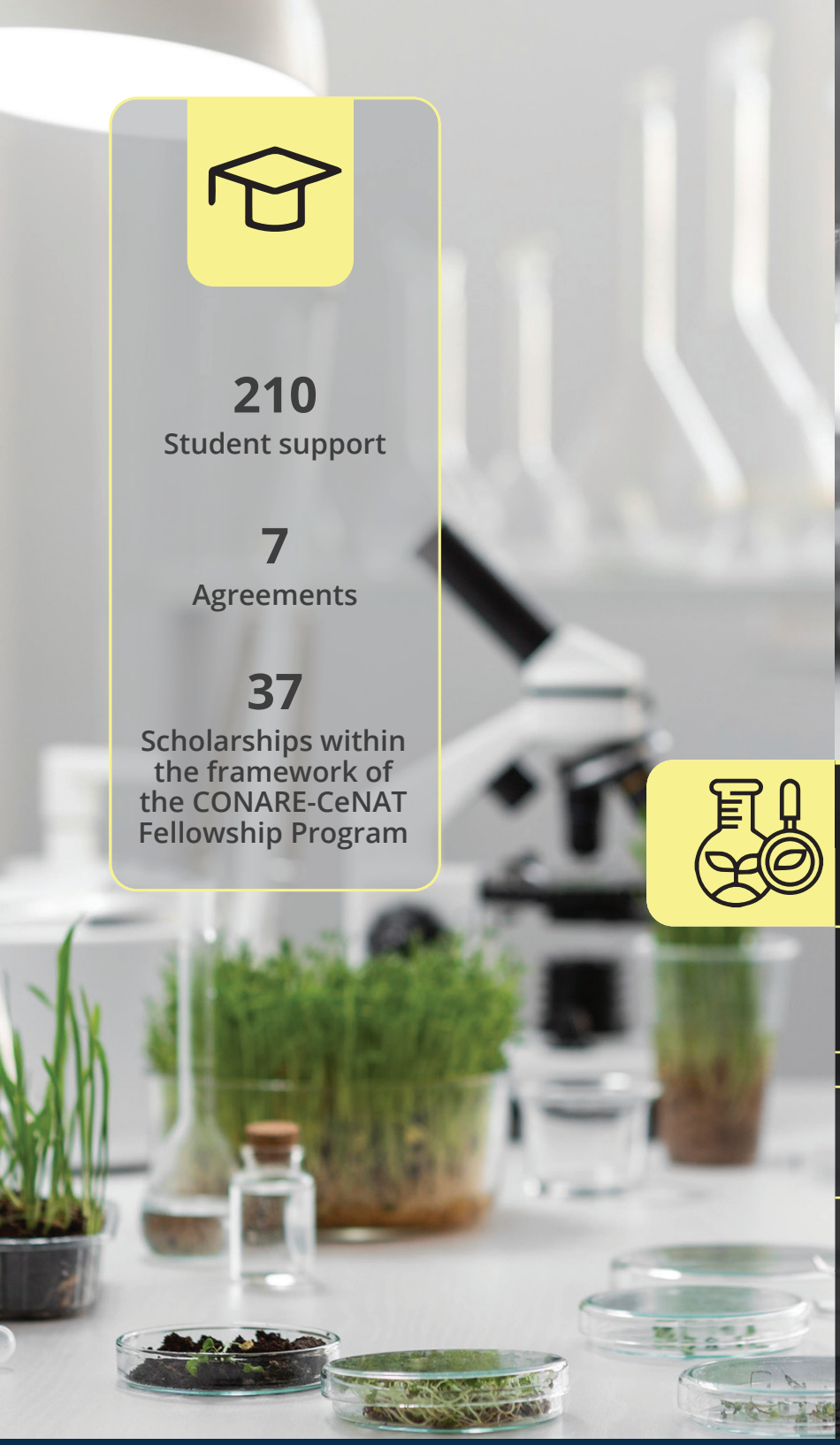
50
Presence in the media

MORE THAN 16 THOUSAND
Facebook Followers

3
Registered patents

7
Registration processes

2
Researchers in the United States Invention Registration





210
Student support

7
Agreements

37
Scholarships within the framework of the CONARE-CeNAT Fellowship Program

63
Scientific Publications

93
Projects



138,139
Cluster usage hours

347
Cluster performance days

752
Accounts with access to computing infrastructure services

138,139
Science hours in simulations and data processing



KNOWLEDGE

199	25,641	8
Knowledge Transfer	Benefited Population	Olympiad and Fairs Supported



10,000

technical assistance to producers in Variability and Climate Change

59

support to applied scientific research organizations or institutions

46

support to applied scientific research companies

5

Eduroam deployed in the headquarters and campuses of the 5 Public Universities

164,000

network services available to students, staff, and teachers

4 million

Logins to the Eduroam Network from national territories

106

Countries with Eduroam





FunCeNAT
AND FINANCIAL
RESULTS

FunCeNAT and Financial Results

FunCeNAT was created on November 4, 1997, with the purpose of managing the resources and overseeing the attainment of institutional goals of the Centro de Alta Tecnología (CeNAT). Law No. 7806, of May 25, 1998.

Article 3.- The State and its institutions are hereby authorized to transfer resources to the Centro Nacional de Alta Tecnología, whose administration and management will be handled by the Fundación Centro Alta Tecnología.



FunCeNAT is under continuous supervision by the Comptroller General of the Republic, with regard to the proper management and administration of the resources received under the Act 7386. In the same way, it is audited continuously by CONARE Audit Department, in addition to third-party annual audits.

Furthermore, the Foundation has a Board, comprised by representatives of the State Institutions of University Higher Education (IESUE), the local city government (Municipality), and of the Government of the Republic. The Board appoints an Executive Director in charge of FunCeNAT.

It is worth mentioning that at the time of creating CeNAT, within the legal context, the chancellors of the member universities of CONARE also created the Centro de Alta Tecnología Foundation (FunCeNAT). This foundation addresses the special characteristics of CENAT in aspects related to its structure and the legal regime provided. Law No. 7806 of May 25, 1998, expressly recognized FunCeNAT as the entity that would hold the legal duty to administer the resources required for the execution of the projects developed through CeNAT.

The Foundation acts as a service platform that meets the needs of CeNAT, as well as the public and private projects it manages. For this reason, FunCeNAT actively collaborates in the work of the areas, laboratories, programs and projects, providing support in administrative management in an efficient and transparent way, in sound financial management, in the organizational development at national and internationals, as well as legal support in the actions that the Laboratories, Programs, and Projects undertake. Through its work, it strengthens the link with CONARE, in addition to supporting communication and inter-sectoral articulation.

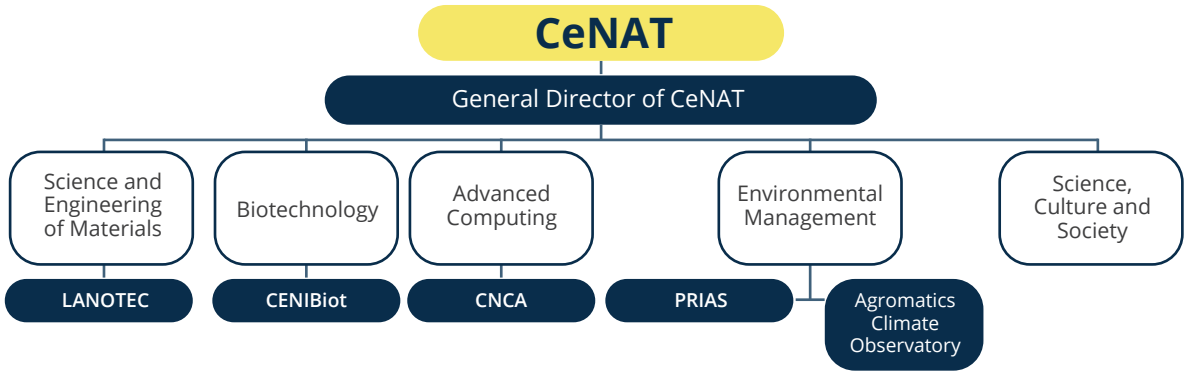
It aligns all its activities with the guidelines issued by CONARE, its Board of Directors, the Comptroller General of the Republic, and the audit department of CONARE, as well as the External Audit, so that its activities and actions comply with all the applicable laws and regulations.

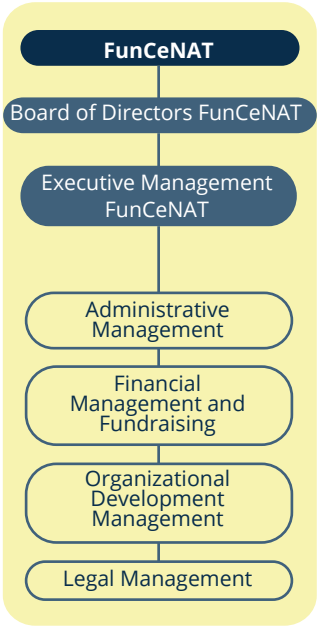


FunCeNAT is the foundation that provides permanent support to CeNAT laboratories and programs in four pillars for organizational development, namely:

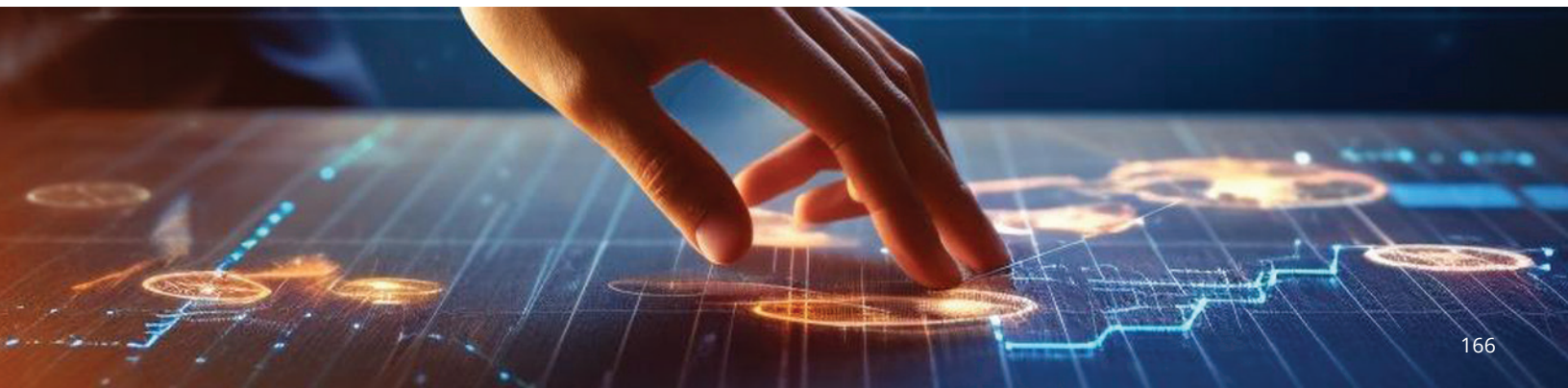
- Administrative Management
- Legal Management
- Human Talent Management
- Financial Management and Fundraising

The operational structure that sets out how CeNAT works is presented below











FINANCIAL **STATEMENTS**

DC-ALLIANCE
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+506-88391469.
+506-88359996.

REPORT OF THE INDEPENDENT AUDITORS ON THE SUMMARY FINANCIAL STATEMENTS

To the Managing Board of Fundación Centro de Alta Tecnología (FunCeNAT).

The summary financial statements, which comprise the summary statement of financial position as of December 31, 2024 and 2023, and the summary income statement for the year then ended, as well as the corresponding explanatory notes, are derived from the audited financial statements of the Centro de Alta Tecnología Foundation - FunCeNAT ("the Foundation") for the year ended on December 31, 2024 and 2023. In our report dated March 17, 2025, we expressed an unmodified audit opinion on these financial statements. Those financial statements, and the summary financial statements, do not reflect any effects of events that occurred subsequent to the date of our report on those financial statements.

The summary financial statements do not contain all the disclosures required by the International Financial Reporting Standards for Small and Medium Enterprises for the preparation of the audited financial statements of the Centro de Alta Tecnología Foundation (FunCeNAT). Consequently, reading the summarized financial statements is not a substitute for reading the audited financial statements of the Centro de Alta Tecnología Foundation (FunCeNAT).

Management's responsibility for the summary financial statements

Management is responsible for the preparation and reasonable presentation of the financial statements, in accordance with the International Financial Reporting Standards for Small and Medium-sized Enterprises and for any internal control that Management may deem necessary to allow for the preparation of financial statements that are free from material errors, both due to fraud and mistakes not related to fraud.

Auditor's responsability

Our responsibility is to express an opinion on whether the summary financial statements, based on our procedures performed in accordance with the International Standard on Auditing (ISA) 810 "Engagements to report on Summary Financial Statements."

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Opinion

In our opinion, the summary financial statements derived from the audited financial statements of the Centro de Alta Tecnología Foundation (FunCeNAT) for the year ended December 31, 2024 and 2023, are consistent, in all material respects with those financial statements, in accordance with International Financial Reporting Standards for Small and Medium Enterprises.

Nombre del CPA: ZORAIDA VARGAS VALERIO
Carné: 4204
Cédula: 106600626
Nombre del Cliente: Fundación Centro de Alta Tecnología (FUNCENAT)
Identificación del cliente: 300621377
Dirigido a: Junta Administrativa
Fecha: 17-03-2025 06:06:23 PM
Tipo de trabajo: Informe de Auditoría

Timbre de ¢1000 de la Ley 6663 adherido y cancelado en el original.

ZORAIDA VARGAS VALERIO
Contador Público Autorizado No. 4204
COSTA RICA

COSTA RICA TIMBRE
1000 COLONES 1000

Código de Timbre: CPA-1000-18875

ZORAIDA MARIA VARGAS VALERIO (FIRMA)

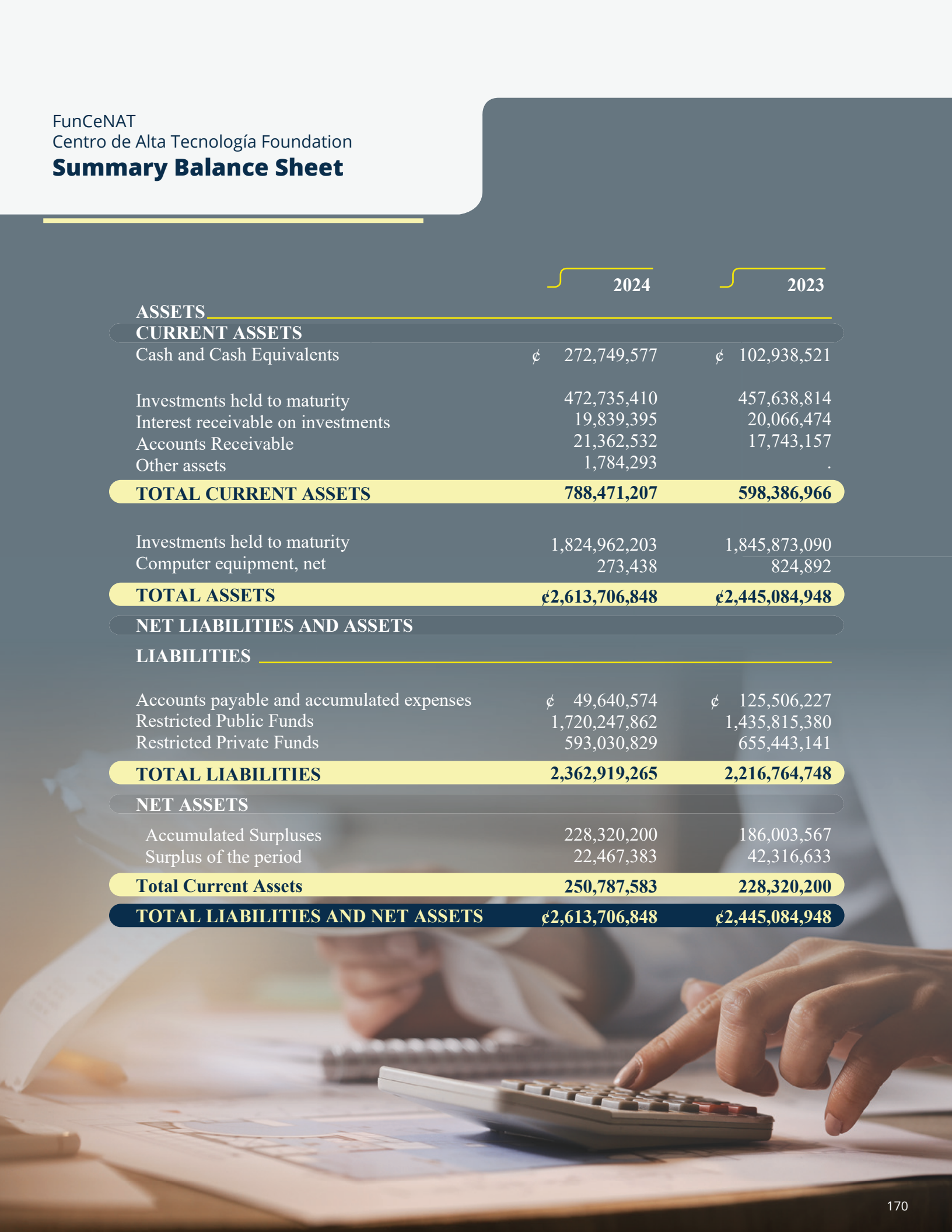
Digitally signed by ZORAIDA MARIA VARGAS VALERIO (FIRMA)
Date: 2025.03.17 19:07:46 -06'00'

Licda. Zorahyda Vargas V.- C.P.A. No. 4204
DC ALLIANCE, SA.
17 de marzo de 2025

FunCeNAT
Centro de Alta Tecnología Foundation

Summary Balance Sheet

	2024	2023
ASSETS		
CURRENT ASSETS		
Cash and Cash Equivalents	¢ 272,749,577	¢ 102,938,521
Investments held to maturity	472,735,410	457,638,814
Interest receivable on investments	19,839,395	20,066,474
Accounts Receivable	21,362,532	17,743,157
Other assets	1,784,293	.
TOTAL CURRENT ASSETS	**788,471,207**	**598,386,966**
Investments held to maturity	1,824,962,203	1,845,873,090
Computer equipment, net	273,438	824,892
TOTAL ASSETS	**¢2,613,706,848**	**¢2,445,084,948**
NET LIABILITIES AND ASSETS		
LIABILITIES		
Accounts payable and accumulated expenses	¢ 49,640,574	¢ 125,506,227
Restricted Public Funds	1,720,247,862	1,435,815,380
Restricted Private Funds	593,030,829	655,443,141
TOTAL LIABILITIES	**2,362,919,265**	**2,216,764,748**
NET ASSETS		
Accumulated Surpluses	228,320,200	186,003,567
Surplus of the period	22,467,383	42,316,633
Total Current Assets	**250,787,583**	**228,320,200**
TOTAL LIABILITIES AND NET ASSETS	**¢2,613,706,848**	**¢2,445,084,948**





FunCeNAT
Centro de Alta Tecnología Foundation

Accumulated Income Statement

		2024		2023
REVENUE:				
Interest on investments	¢	74,149,684	¢	74,466,899
Project Management income		131,530,581		146,502,142
Total Revenue		**205,680,265**		**220,969,041**
EXPENSES:				
General and administration expenses		180,835,823		159,185,419
Foreign exchange differences, net		2,528,427		19,548,373
Other income		(151,368)		(81,384)
Subtotal		183,212,882		178,652,408
SURPLUS OF THE PERIOD	¢	**22,467,383**	¢	**42,316,633**



INSTITUTIONAL
LEADERSHIP



Consejo Nacional de Rectores

Dr. Gustavo Gutiérrez Espeleta
Chancellor, University of Costa Rica

María Estrada Sánchez MSc.
Costa Rica Institute of Tecnology

Francisco González Alvarado, M.Ed.
National University

Rodrigo Arias Camacho, M.B.A.
State University for Distance Education

Dr. Emmanuel González Alvarado
National Technical University

Luis Restrepo Gutiérrez, M.B.A.
National Technical University

William Rojas Meléndez, M.B.A.
National Technical University

Consejo Científico

Dr. María Laura Arias Echandi
| UCR Coordinator

Dr. José Luis León Salazar
| TEC

Dr. Jorge Herrera Murillo
| UNA

Rosibel Víquez Abarca, PhD.
| UNED

Laura Vargas Badilla MEng.
| UNED

Lilliana Rodríguez Barquero, M.Sc.
| UTN

Eric Alvarado Barrantes MGAS
| UTN

Strategic Partners

University of Costa Rica

Costa Rica Institute of Technology

National University

State Distance Education University

National Technical University

Costa Rican Promoter of Innovation and Research

MICITT



Directorate of CeNAT

Dr. José Vega Baudrit
Acting Director, CeNAT

Karol Palma Odio
Administrative Assistant to the Directorate

Laboratory Directors

Dr. José Vega Baudrit
Director, National Nanotechnology Laboratory

Dr. Randall Loaiza Montoya
Director, CENIBiot Laboratory

Dr. Max Chavarría Vargas
Acting Director, CENIBiot Laboratory

Dr. Esteban Meneses Rojas
Director, National Collaboratory of Advanced Computing

Ing. Allan Campos Gallo, MBA
Environmental Management Area

Ing. Cornelia Miller Granados, MBA
PRIAS Laboratory Director

Officers



Mirsa Domínguez Alvarado	CeNAT- Environmental Management
Rubén Padilla Hernandez	CeNAT
Sugey Rivera Obando	CeNAT
Andreina Leal Sánchez	CeNAT
José Andrés Valerín Pérez	CeNAT-PRIAS
Armando Rojas Esquivel	Observatory of Scientific Diplomacy

LANOTEC

Anthony Mayorga Hernández
Fabiola Rodríguez Ulloa
Andrea Araya Sibaja
Diego Batista Menezes
Juan Miguel Zúñiga Umaña
Reinaldo Pereira Reyes
Rebeca Corrales Brenes
Sergio Paniagua Barrantes
Yendry Corrales Ureña
Susana Mesén Porras
Claudia Chaves Villarreal
Daniela Zúñiga Rivera
Andrea Rivera Álvarez
Tamara Quesada Soto
María José López Brenes



CNCA

Melissa Hernández Sánchez	CNCA
Christian Asch Burgos	CNCA
Melany Calderón Osorno	CNCA-CENIBiot
Carlos Gamboa Venegas	CNCA-CONARE NETWORK
Herson Mena Mora	CNCA
Fabricio Quirós Corella	CNCA
Edward Soto Castro	CNCA
Isaí Ugalde Araya	CNCA
Johansell Villalobos Cubillo	CNCA
Jonathan Cortés Oviedo	CNCA
Crista Ureña Chanto	CNCA

PRIAS

Heileen Aguilar Arias
José Andrés Umaña Ortiz
Esteban Montenegro Hernández
Stephanie Leitón Ramírez
Vanessa Morales Cerdas
Eleana Rodríguez Alvarado
Milagro Jiménez Rodríguez
Iván Ávila Pérez



CENIBiot

Max Chavarría Vargas
Emanuel Araya Valverde
Pamela Alfaro Vargas
Jonathan Parra Villalobos
Vanessa María Rivera Mora
Rachel Ardón Rivera
Erika Barrantes Murillo
Melissa González Sanabria
Valeria Leandro Arce
Gabriel Bogantes
Stephanie Mata Bonilla
Natalin Picado Canales
Douglas Alberto Venegas González
Daniela Wicki Emmenegger
Andrea Calvo Obando
Alina Gamboa Villalobos
Esteve Mesén Porras
Luis Diego Hidalgo Badilla
Darling Mora Rojas
Isaac Hidalgo Quirós
Fernando Briceño Sandí

State of the Nation Project

Gustavo Rojas Godínez
Erick Rojas Zuñiga
Maria Camila Aguilar Gómez
Sebastián González Rosales
Ileana Jiménez Ardón
Suyen Miranda López
José Mario Achoy Sánchez

Environmental Management

Patricia Sánchez Trejos
Jazmín Calderón Quirós





FunCeNAT

Cynthia Cordero Solís, MBA
Executive Director
Mauricio Segura Chacón
Jeannette Vargas Arce
Yakelyn Bejarano López
Margarita Quan Zepeda
María Fernanda Hernández Jiménez
Carolina Morales Cerdas
Paula Valverde Mora

Managing Board of Fundación Centro de Alta Tecnología



President:
Dr. Emmanuel González Alvarado

President:
M.B.A. Luis Restrepo Gutiérrez

President:
William Rojas Meléndez, MBA

Secretary:
Dr. Gustavo Gutiérrez Espeleta

Treasurer:
Ing. María Estrada Sánchez

Board Member 1:
Marielos Aldi Villalobos

Board Member 2:
Rose Marie Ruiz Bravo

First Comptroller:
Francisco González Alvarado, MBA

Second Comptroller:
Rodrigo Arias Camacho, MBA

Guest:

OPES-CONARE Legal Advisor:
Lic. Gastón Baudrit Ruiz



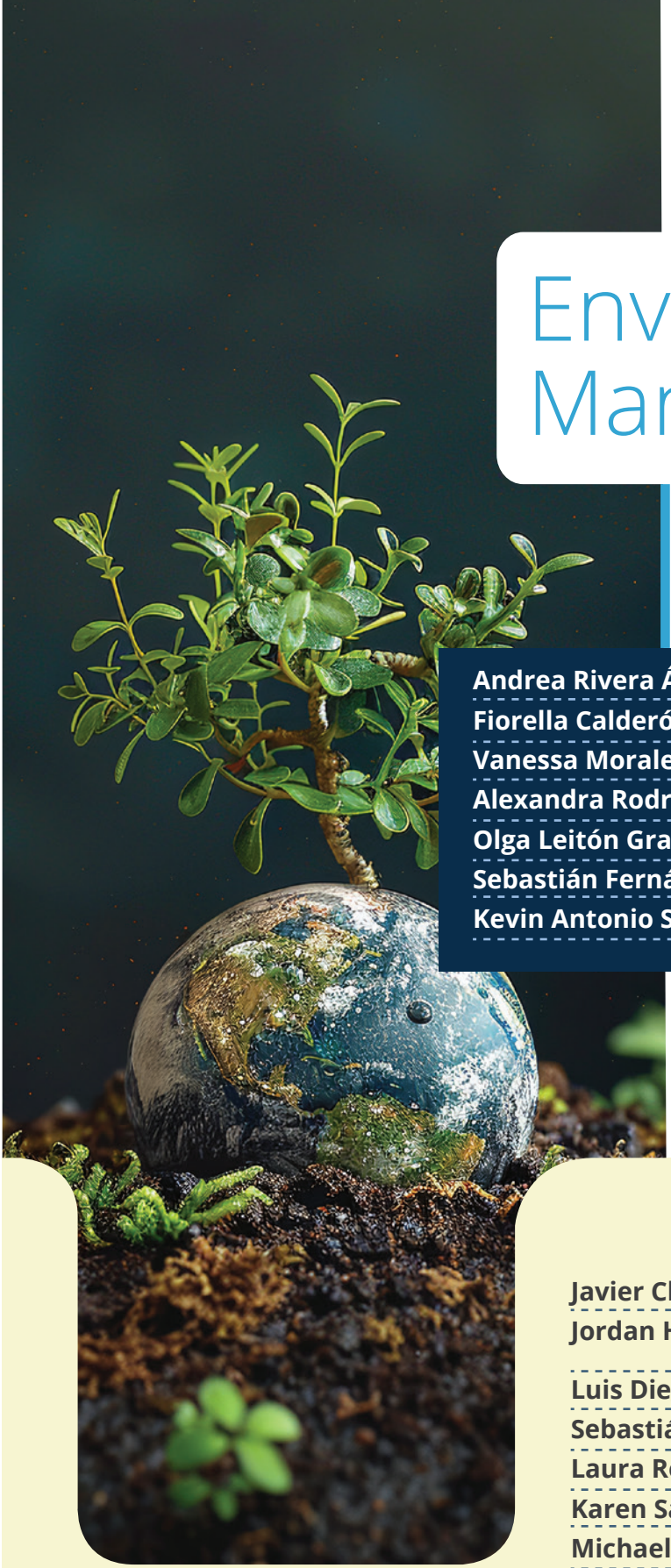
Scholars and **Collaborators**

CENIBiot

David Araya Gutiérrez	Costa Rica Institute of Technology (TEC)
Dilan Rojas Saborío	National University (UNA)
Geisel Cabrera Lazo	National University (UNA)
Johana Valera Rangel	University of Costa Rica (UCR)
Lucía Noboa Jiménez	University of Costa Rica (UCR)
Randall Hidalgo Sánchez	University of Costa Rica (UCR)
Jorge Sánchez Fonseca	University of Costa Rica (UCR)
Laura Vega Fernández	University of Costa Rica (UCR)
Gustavo Solano Gutiérrez	University of Costa Rica (UCR)

CNCA

Dorian Rojas Villalta	Costa Rica Institute of Technology (TEC)
Esteban Bertsch Aguilar	University of Costa Rica (UCR)
Isaura Gutiérrez Vargas	University of Costa Rica (UCR)
Julián Sánchez Castro	Costa Rica Institute of Technology (TEC)
Danny Lie Xie	Costa Rica Institute of Technology (TEC)
Daniel Mora Romero	University of Costa Rica (UCR)



Environmental Management

Andrea Rivera Álvarez	University of Costa Rica (UCR)
Fiorella Calderón Jiménez	Costa Rica Institute of Technology (TEC)
Vanessa Morales Cerdas	University of Costa Rica (UCR)
Alexandra Rodríguez Blanco	University of Costa Rica (UCR)
Olga Leitón Gradovich	University of Costa Rica (UCR)
Sebastián Fernández Martínez	National University (UNA)
Kevin Antonio Sánchez Chinchilla	University of Costa Rica (UCR)

LANOTEC

Javier Chinchilla Orrego	University of Costa Rica (UCR)
Jordan Hernández Ledezma	National University for Distance Education (UNED)
Luis Diego Mora Araya	University of Costa Rica (UCR)
Sebastián Moya Salas	University of Costa Rica (UCR)
Laura Rojas Artavia	University of Costa Rica (UCR)
Karen Salazar Barrantes	University of Costa Rica (UCR)
Michael Solano Rojas	University of Costa Rica (UCR)
Juan Diego Chacón Vargas	University of Costa Rica (UCR)
Valeria Leandro Aguilar	University of Costa Rica (UCR)
Esteban Ulate Rodríguez	University of Costa Rica (UCR)
Frandy Arroyo Vargas	University of Costa Rica (UCR)
Christopher Espinoza Araya	University of Costa Rica (UCR)

Adolfo Piedra Mora University of Costa Rica (UCR)
Brayan Rodríguez Delgado National University for Distance Education (UNED)
José David Umaña Monge University of Costa Rica (UCR)

STUDENTS-INTERNS-VOLUNTEERS

CENIBiot

Jennifer Calvo Alemán
María Gómez Bogantes
Esteban Escalante Campos
Juliana Blanco Rodríguez
María Torres Hidalgo
Andrés González Vega
Andrea Calvo Obando
Shelsey Lanzas López
Karol Aguilar Guerrero
Andrés Hernández León
Sofía Trejos Valverde
María Henríquez Granados
Natalie Meza Gutiérrez
Sharon Chacón Vargas
David Ramos Serrano
Mónica Delgado Hernández
Mariel Chavarría Jiménez
Daniel Corea Morales
Isaac Quirós Fallas
Darling Mora Rojas
Mónica Valerio Villalobos
Ariela Alfaro Valverde
Jeremy Montero Gálvez
Rebeca Sánchez Rivera
Evelyn Pérez Rodríguez
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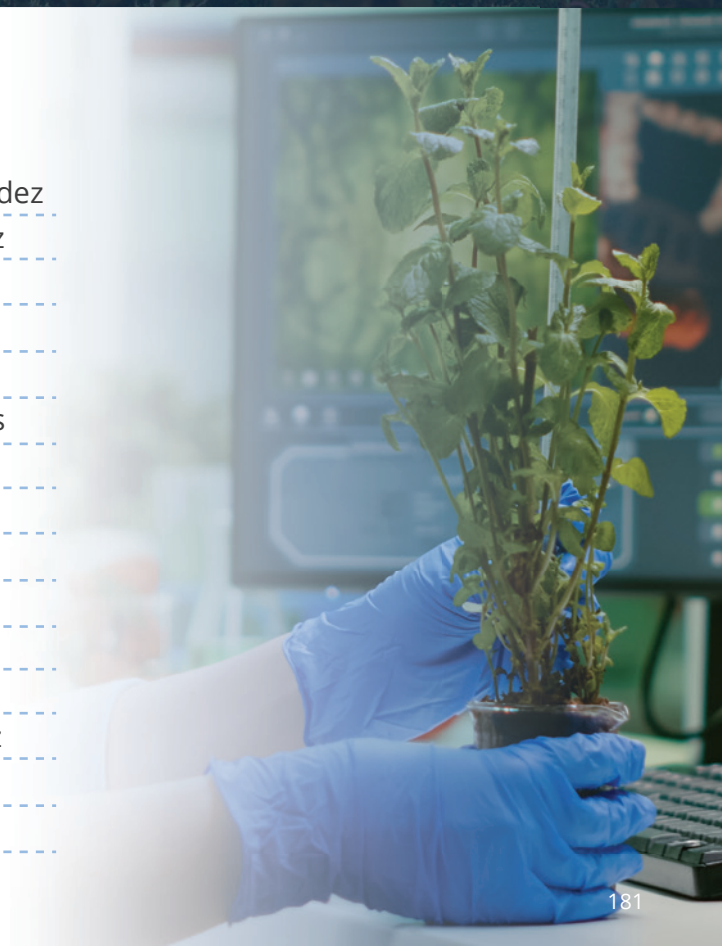
Adrián González Jiménez
Lucia Marín Barboza
Víctor Víquez Muñoz





CENIBiot

Marisol Chacón Rodríguez
Yummy Granados Salas
Irene Alfaro Ulate
Mauricio Vallejo Azofeifa
Daniel Rojas Pérez
Nazareth Espinoza Silva
Angélica Araya Castro
Belkys Nicaragua Ramírez
Daniel Jiménez Madrigal
Clemence Pensec Louise
Bérénice Annick, Marie Verdelet
Karina Montero Mena
Joel Castro Salazar
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Luz González Salazar
Sofía Bianchi Barrantes
Sharon Venegas González
Sebastián Suñer Sánchez
Diana Bravo Estupiñan
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Valeria Herrera Alfaro
Carolina Sevilla Obando
Andrea Hernández Flores
Mariana Cerdas Pérez
Tomás López Soto
Jimena Sisa Álvarez
Sharlize Badilla Soto
Leandro Villalobos Bravo
Juan Hernández Vásquez
Jocelyn Ugalde Ruiz
Jeshua Acuña Matamoros
Angélica Vargas Rojas



CNCA

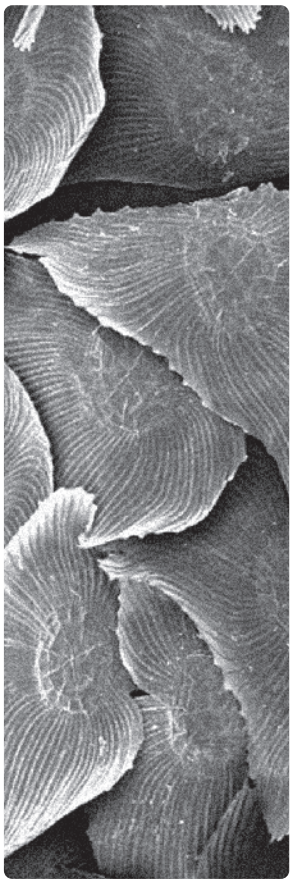
Mariel Chacón
Nicole Ramírez
Sebastián Gamboa
Josef Ruzicka
Tracy Leitón Barquero
Roger Calderón Urbina
Adrián González Jiménez
Isaac Palma Medina
Antonio Piedra Pacheco
Juan Pablo Ureña Madrigal
Julián Sánchez Castro
Jailine González
Yader Barahona



Environmental Management

Mirsa Domínguez Alvarado
Jazel Domínguez Alvarado
Roberto Salazar Madriz
Valeria Oviedo Juárez
Andrés Alvarado Ramírez

LANOTEC



Catalina Alvarado Jiménez
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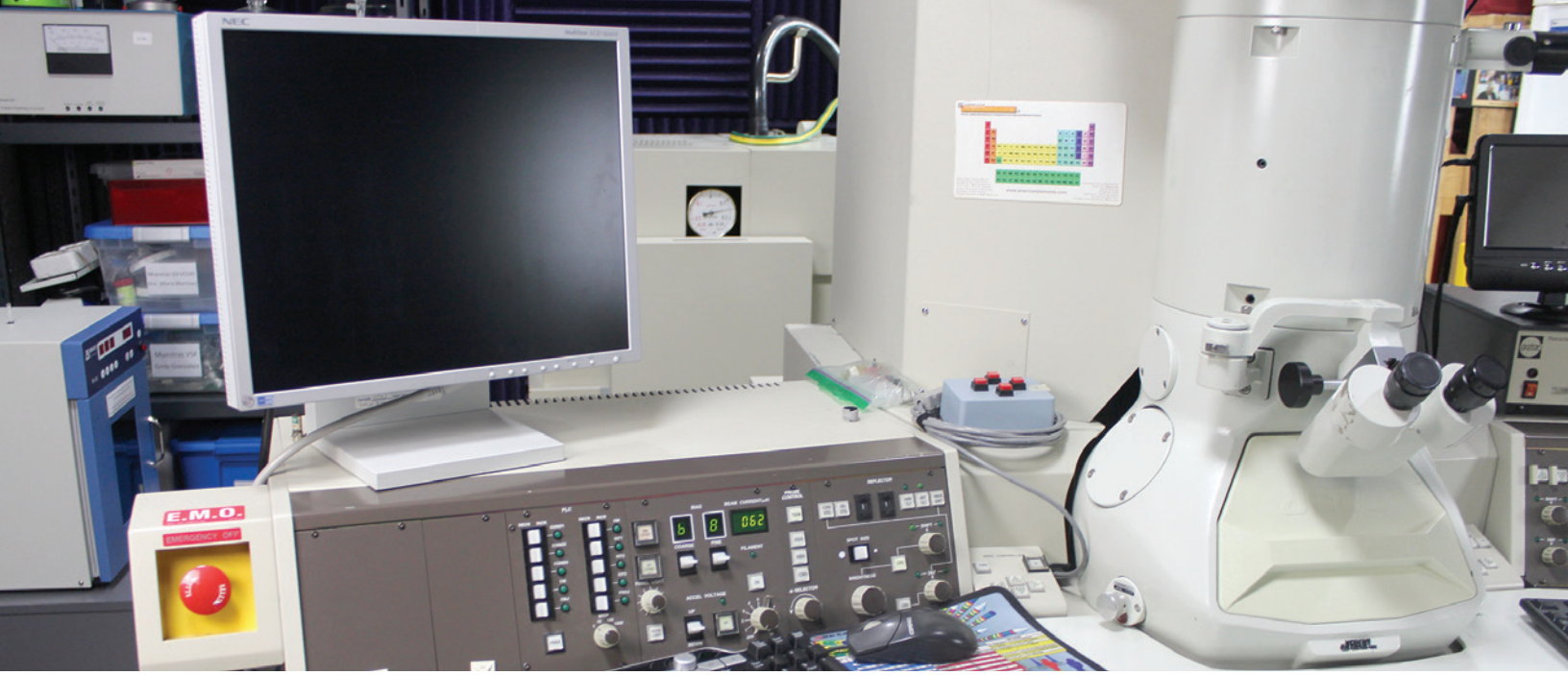
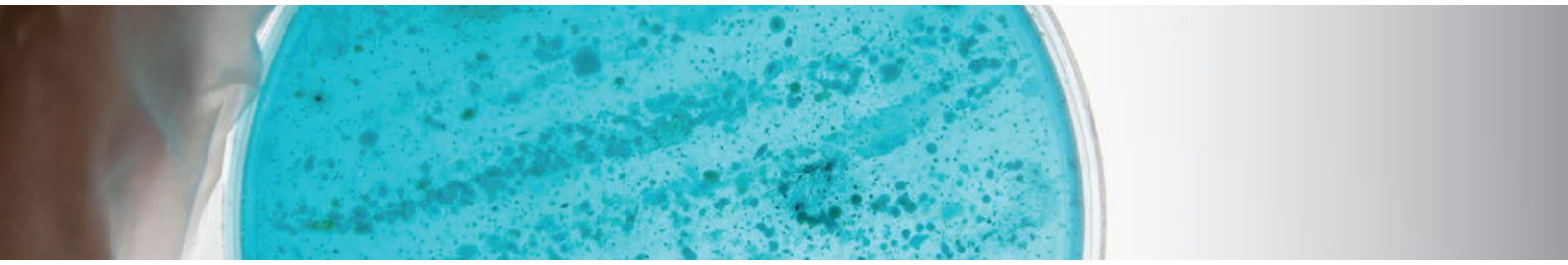
José Pablo Chaves Pérez
Ernesto Villegas Villegas
Annaby Contreras Alemán
Esteban Mena Porras
María Guevara Hidalgo
Julián Morales Monge
José Pablo Alvarado Espinoza
Ricardo Quesada Grosso
Jean Guerrero Piña
Justin Benavides Arce
Alesandro Franco Morales Jara
Luis Corea Bolaños
Daniel Alpízar Esquivel
Stephanie Chavarría Hernández
Juan Diego Chacón Vargas
Valeria Leandro Aguilar
Paola Céspedes Ajún
Mery Alfaro Fernández
José Alejandro Rojas Hidalgo
Valery Dianne Torres Garita
Andrés Chinchilla Velhagen
Fernando Urias Rojas Elizondo
José Andrés Granados Morales
Pablo Agüero Hidalgo
Sharon Estefanie Chacón Vargas
Shaslyn Yarcari Araya Tames
Merylin Dayanna Seas Jiménez
Alfredo Alessandro Villafuerte Mena
Josué Meza Araya
Edgar Andrés Picado Troz





Melanny Bonilla Soto
Jostin Cordero Madrigal
Mayron Martínez Lopez
Juliana Guillén Alfaro
Gerardo Ramírez Madrid
Alejandro Vargas Vargas
Juan Carlos Sánchez Barboza
Fabián Bachmann Cantallops
Alexa Webb Sancho
Steven Ceciliano Castro
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Marvine REGNAULT
Diana Monge Salazar
Tatiana Meléndez Aguilar
Laura Solano Picado
José Andrés Granados Morales
Raquel Chacón Mora
Michelle Gutiérrez Campos
Tamara Quesada Soto

Kenia Blandón Bolaños
Austin Esquivel Castro
Melany Castillo Morales
Génesis Melissa Guevara Fallas
Nicolle Ujueta Alvarado
Kevin Alvarado Murillo
Sergio Solano Calderón
Christopher Murillo Bolaños
Carlos Valenciano Elizondo
Daniel Esteban Pérez Rojas
Daniel Portuguez Molina
Nicole Vílchez Mejías
José Andrés Garro Garita
Kevin Jiménez Molina
Julián Ruiz Hidalgo
Yanice Segura Álvarez
José Daniel Hernández Castro
Fabricio Calderón Jiménez



PRIAS

Andrés Aguilar Carboni
Natalia Martínez Rojas
Wilberth Corrales Torres
Ignacio Mora Cordero
Ariana Arguello Cordero
Tracy Rivera Benavides
Gabriela Chaves Soto
Naittan Lugo Rodríguez
Walter Pereira Vargas
José Pablo Castro Martínez
Luis Gamboa Calvo
William Alfaro Quirós
Byron Ramírez Jiménez

State of the Nation Project

Stephanie Castro Jiménez
Susana Viales Cubillo
Samantha Brenes Mora
Gabriela Azofeifa Fonseca
Dariel Amador Pérez
Bradley Jiménez Camacho
María Jiménez Cordero
Diego Amey Fonseca
Nicole González Ureña
Roldán Aguirre Murillo
Jeefry Gutiérrez Chaves
Ericka Rojas Valerio
Erickson Molina Rodríguez
Jean Franco Montiel Carrillo
Priscilla Retana Cordero



RESEARCHERS WHO RECEIVED

Scholarships or Awards

Stephanie
Leitón Ramírez

She was selected as an **Emergent Space Leader (ESL) 2024** by the International Astronautical Federation (IAF), in Milan, Italy.



Heileen
Aguilar Arias

She was recognized for her outstanding contribution in the field of **Environmental Sustainability** in the fourth edition of the **"25 Women in Science"** recognition program, organized by 3M.

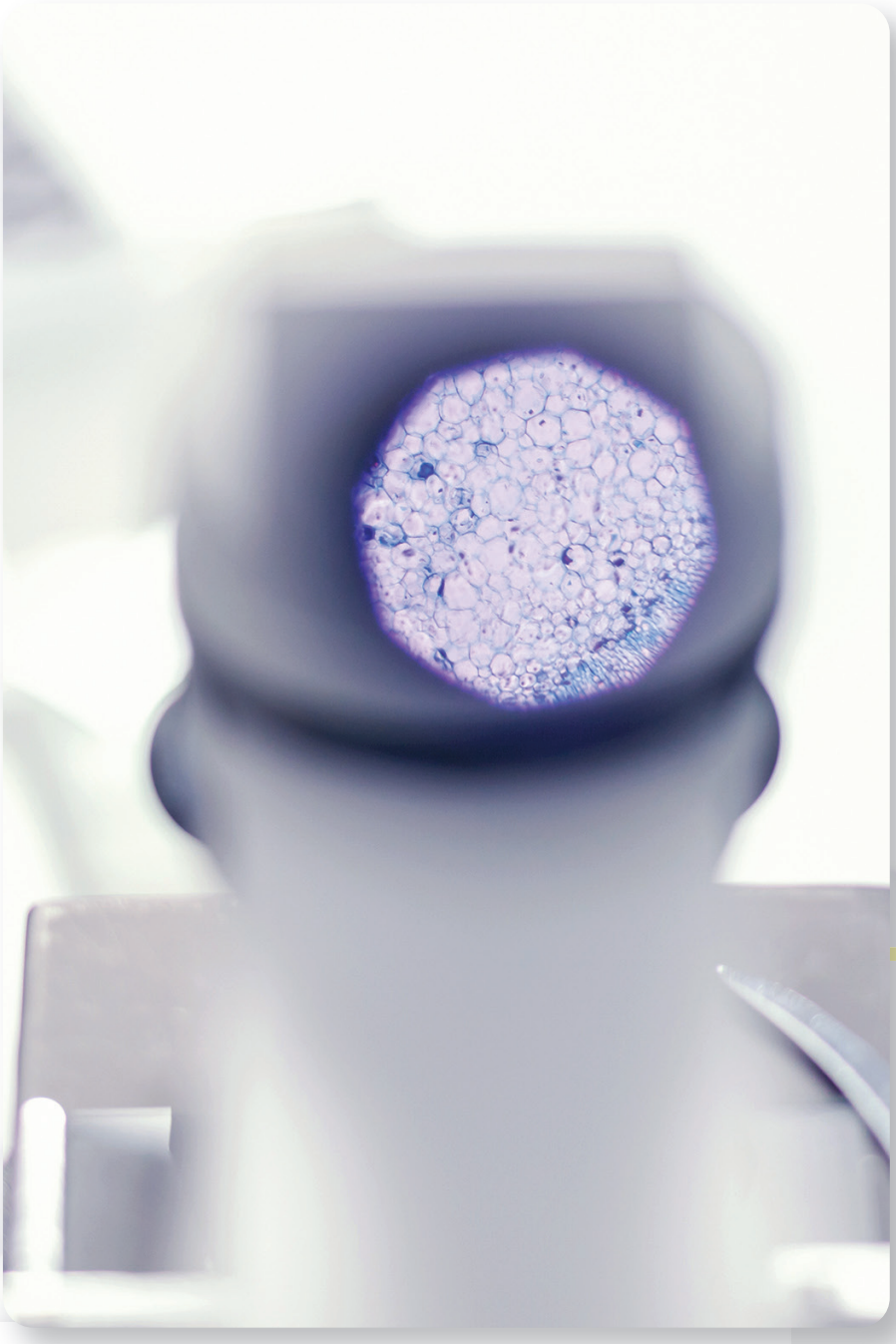
She was selected for a scholarship to participate in the **Seminar on Satellite Remote Sensing for Belt and Road Countries,** held in the People's Republic of China.

José Andrés
Umaña Ortiz

He was selected for a scholarship to participate in the **International Seminar on Beidou Navigation Satellite System and GNSS,** held in the People's Republic of China.

Herson
Mena Mora

He was selected for a scholarship to participate in the **DevOps** school, held in Chile during the **CLARA 2024** event.



Christian
Asch Burgos

He was selected for a scholarship to participate in the **Seminar on International Navigation Satellite System & GNSS,** held in Wuhan, China.

He was selected for a scholarship to participate in the **Argonne Training Program on Extreme-Scale Computing 2024,** one of the most important training and capacity building events on HPC topics.

Pamela
Alfaro Vargas

She was selected to participate in the international forum **LAC Connections Symposium – Colombia** (Universidad del Norte, Barranquilla), which promotes the exchange of knowledge among scientists and academics from Latin America and the Caribbean.

She was selected to participate in a scientific collaboration with INIA, focused on agricultural research, with the **National Institute of Agricultural Research (INIA)** – Uruguay.

Carlos
Gamboa Venegas

He was selected for a scholarship to participate in the **TICAL 2024** conference, entitled "Connecting Knowledge: "AI and Data as Catalysts for Academic and Social transformation", held in Brazil, RedCLARA.



Esteban
Meneses Rojas

He was invited with a full scholarship to participate in the **IESTEC 2024** event, the most important engineering conference in the Central American region.



Max
Chavarría Vargas

He was selected to participate in the international project "Collaboration on Communication and Climate Change – Chile", which focuses on scientific dissemination as a key tool for education and awareness-raising on climate change.

Emmanuel
Araya Valverde

He was selected to participate in the **LAC Connections Symposium – Colombia** (Universidad del Norte, Barranquilla), which brings together researchers from different countries to strengthen cooperation in science and innovation.

He was selected as a researcher in the international project **Adelante2**, for international collaboration in biofactories and bioinputs, at the event held in **Medellín, Colombia.**

He was selected to represent the institution, invited by the **World Association of Industrial and Technological Research Organizations (WAITRO)** to the WAITRO 2024 Summit in **Nanjing, China,** where advances in applied research were discussed.

Valeria
Leandro Arce

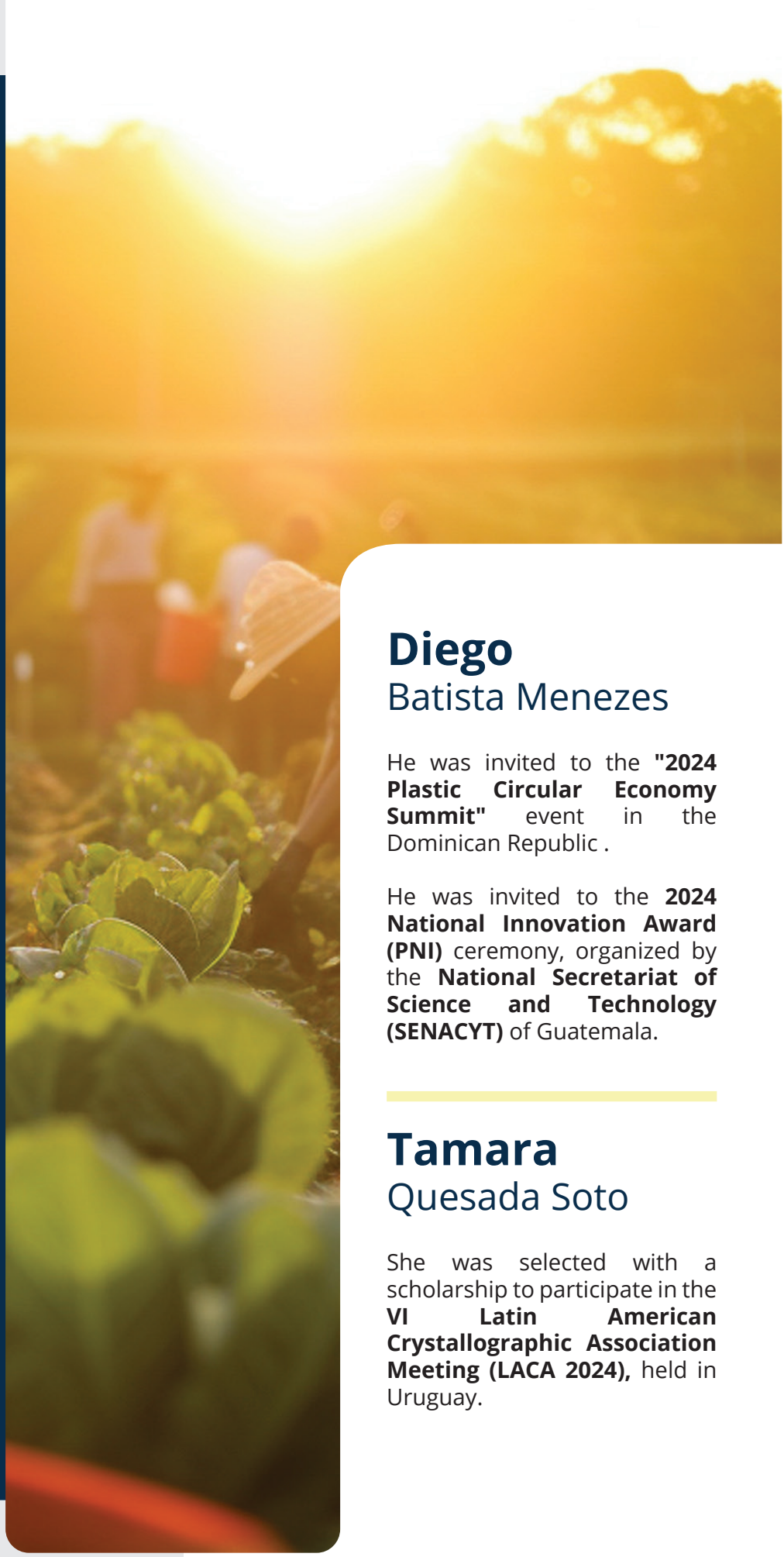
She was selected to participate in the **9th Pacific Alliance-Chile Meeting** , held at the **Nestlé Research Center in Santiago** , where topics of innovation and sustainability in the agri-food sector were addressed.

Rachel
Ardón Rivera

She was selected to carry out a research stay at **UNAM – Mexico** (National Autonomous University of Mexico), with the goal of evaluating the growth of the **Rhizopus oryzae** filamentous fungus, a microorganism with high-industrial potential for the production of valuable compounds in biotechnology.

Douglas
Venegas González

He was selected to participate in the **Fifth Meeting of the Latin American Society of Metabolic Profiling 2024** in Uruguay, a conference specialized in metabolomics, where advances in metabolic profiling and its applications in various scientific fields were discussed.



Diego
Batista Menezes

He was invited to the **"2024 Plastic Circular Economy Summit"** event in the Dominican Republic .

He was invited to the **2024 National Innovation Award (PNI)** ceremony, organized by the **National Secretariat of Science and Technology (SENACYT)** of Guatemala.

Tamara
Quesada Soto

She was selected with a scholarship to participate in the **VI Latin American Crystallographic Association Meeting (LACA 2024),** held in Uruguay.

Andrea
Araya Sibaja

She was selected for a study visit to the **Instruct-Eric Centre France 2** (IBSISBG), in **France**, organized by the European Union (EU) and the Community of Latin American and Caribbean States (CELAC).



Jazmín
Calderón Quirós

She was selected for a scholarship to participate in the **Seminar on Satellite Remote Sensing for Belt and Road Countries**, held in the People's Republic of China.



Allan
Campos Gallo

He was selected for a scholarship to participate at the Third Inter-American Conference on Disaster Risk Reduction and Adaptation to Climate Change, held in Manizales, Colombia.

He was invited to the Latin American and Caribbean Open Science Forum, held in San Andrés, Colombia.

He was invited to the ITSI Government Leaders Forum event at Arizona State University, held in Arizona, United States .

Annual REPORT 2024

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