



Universidad de Chile

Centers for
Excellence in
Research



RAKIDUAM Knowledge

Centers for Excellence in Research



RAKIDUAM Knowledge



Nge Nge
Eyes to the soul



Pillán
Good spirit



Cruz Andina
Eternity



Anumka
Medicinal plant

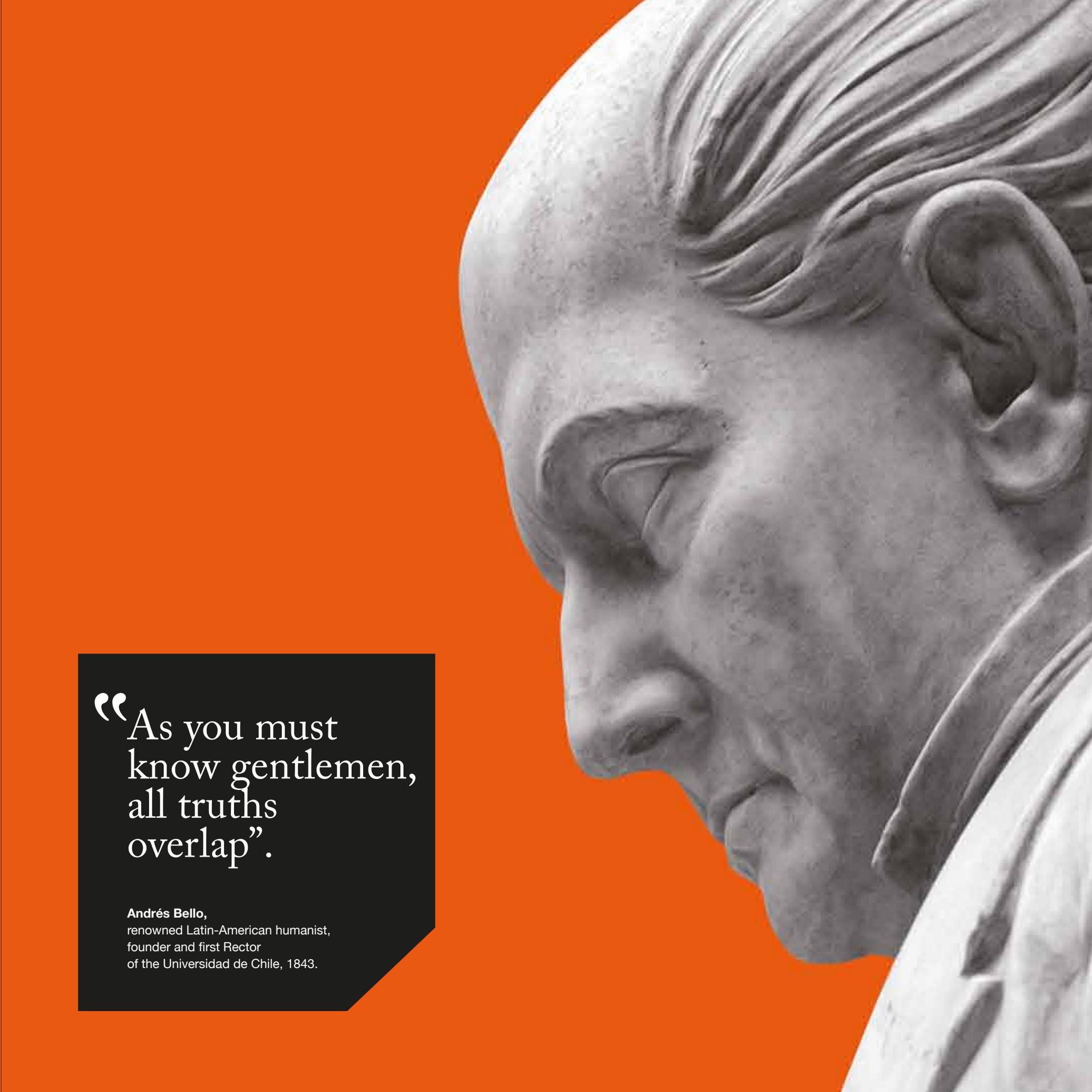


Kultrun
Cosmology

*** Rakiduum (Knowledge),**

Word from the Mapudungun: oral tradition language of the Mapuche people,
the most numerous and predominant indigenous ethnic group in Chile.

This translation is taken from the “Diccionario araucanomapuche-español/español-mapuche”,
by fray Félix José de Augusta.



“As you must
know gentlemen,
all truths
overlap”.

Andrés Bello,
renowned Latin-American humanist,
founder and first Rector
of the Universidad de Chile, 1843.

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 Universidad de Chile Milestones

Words of our Authorities



174 years ago, in the recently created Republic of Chile, La Casa de Bello took on the responsibility for helping to form the identity of a nation from the public and state vocation that gave rise to it. The Universidad de Chile has met the challenges it has been presented, during essential historical events during history. A few examples of meeting challenges are organizing the national education system; contributing to the creation of the public healthcare system; progress towards overcoming child malnutrition; promoting the construction of productive infrastructure, and developing the country's anti-seismic engineering. These examples are only a few of the contributions made and that have become important cornerstones of the national development.

The quality of our commitment is manifest in the awards and senior positions obtained by its graduates and academics: two Nobel Prizes in Literature, 20 Presidents of the Republic and over 170 National Awards in all areas of knowledge. Today, our responsibility is the same: to cultivate science with a marked sense of what is public, orientating scientific research towards the paradigm of sustainable development, based on the excellence of its researchers and the relevance of their projects.

Our objective is a state university that conducts research projects with a transdisciplinary focus, in frank collaboration with other regional public institutions, addressing global problems from a local perspective.

Prof. Ennio Vivaldi Véjar
Rector of the Universidad de Chile





Chile is going through a historic moment in the discussion of the development model necessary to reposition itself as an emerging country in the society of knowledge. The progressive depletion of the exporting matrix focused on the extraction of natural resources and the strong weight of services in the internal economy, make it necessary to center attention on innovation based on science generated in the universities, as one of the engines for national development in the future.

The Universidad de Chile is going through a cultural change that demands all of its human and technological capacities to face this new challenge has become a new challenge. With more than over 10 thousand scientific publications in the past 7 years, 20 centers of excellence in areas that are relevant to the country and over 180 current R&D projects, La Casa de Bello is certainly the main Chilean research institution. This critical mass made it possible for 96 patent applications to be submitted between 2014 and 2016 alone, transferring 25 new technologies to society in the areas of engineering, biomedicine, mining, education and the agricultural sector.

Our institution grows day by day, generating transdisciplinary networks to address the complex scenarios faced by mankind today, such as the ageing of the population, the management of socio-natural disasters, the design of intelligent cities, the use of renewable energies, and social cohesion. So, the Universidad de Chile progresses with its vocation of service and excellence, contributing solutions to the serious challenges of the future from local, national and international perspectives.

We invite you to read a sample of the commitment of our institution to the search for knowledge for the development of Chile.

Prof. Flavio Salazar Onfray
Vice-Rector of Research and Development

Pablo Neruda

describes Chile as a petal of the sea

Where the spring comes from North to South with its fragrance. From the arid septentrional desert, descending down the Pacific Ocean that faces the peaks of the Los Andes mountain range, to the candid places in the Antarctic that are the end of existence, this is a land of incommensurable contrasts.

Explorers such as Magallanes, Darwin and Gay journeyed along these areas in search of answers and looking to open new worlds. Others have been born in these lands to germinate knowledge in all of its facets. Today, Chile continues to provide unique possibilities to expand knowledge, being a natural laboratory for studies in astronomy, Antarctic, ethnic, climatological and geological, which add up to a tradition of research in all scientific, artistic and cultural areas.

The Universidad de Chile continues the adventure of the pioneers, and invites you to be part of the search for answers to the new global challenges, taking the opportunities that this land gifts us to develop top-quality and applicable science.

Universidad de Chile,

a superior quality space for the country's significant issues

The Universidad de Chile, founded in 1842, is the oldest higher education institution in the country and one of the most prestigious and traditional in Latin America. With a top-quality academic body and a high productivity in the fields of science and artistic and cultural research, the University has been continuously linked to reflection and action with respect to the country's and the world's large issues, given its national and public nature.

Since it was founded, this institution has assumed the commitment and endeavor to provide top quality training of professionals in addition to contribute to the development of critical thinking in Chile as well as building leadership in science and technology, humanities, arts and culture. Hoping to achieve all this through teaching, creation and outreach and, emphasizing on research and graduate degrees.



40%

of the world's astronomical observations are made with infrastructure installed in Chile.



2 Nobel Prize laureates

20 Chilean Presidents and more than 170 National Prize winners in all areas of knowledge.



Chile has natural laboratories for scientific research, which result in significant contributions to knowledge and their social and productive use.

Therefore, regarding renewable energies, as well as oceanography, seismology and volcanism, the study of forests or population, among others, Chile has natural laboratories for scientific research, which result in significant contributions to knowledge and its social and productive uses.



This institution has assumed the formation of professionals and making a contribution to the development of critical thinking in Chile, building leadership in science and technology, the humanities, the arts and culture.



“The history of the progress and development of science teaches us that all great ideas such as the planetary system, steam power, celestial attraction, etc. have been anticipated by men who had at the same time intelligence, sensibility and poetic imagination”.

Ignacio Domeyko,

Scientist and explorer, pioneer in mineralogy, successor of Andrés Bello as Rector of Universidad de Chile, 1866.

Nº 1

In scientific production in Chile in Scopus (SCImago Ranking)*.

*SCImago Journal & Country Rank is a ranking developed by the Scomago group, which takes into account scientific publications listed on the Scopus database since 1996. It is the most prestigious ranking in this subject.

Top 7

In Latin America according to the Academic Ranking of World Universities (ARWU) 2015.

11.447

Articles published in magazines indexed in ISI-WOS, between 2007-2014 (Institute for Scientific Information, +Web of Science). Source: Conicyt

1.000

Over 1,000 research projects with national and international financing conducted annually.



Universidad de Chile, national reference in research and innovation

20

Centers of excellence,
16 as the principal institution
and 4 as an associated
institution.

87

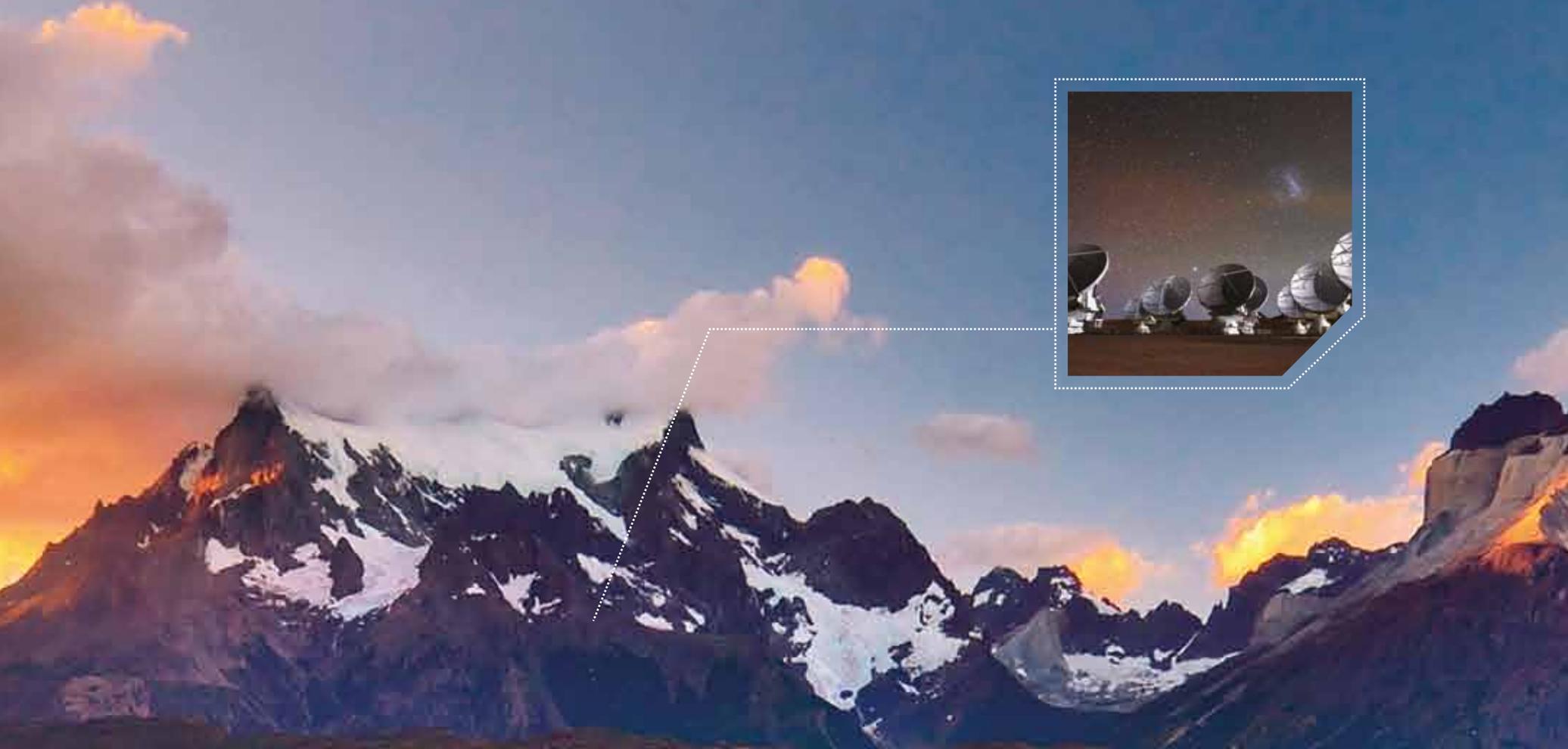
Patent applications
submitted between 2014
and 2016.

25

Technologies transferred to
society through intellectual
property rights.



Centers of excellence:
the adventure
of knowledge in
an open world



In 1914, exactly one century ago, an advertisement in the British press requested volunteers for an expedition to the Antarctic: “Men wanted for a perilous voyage. Low salary. Extreme cold. Long months in complete darkness. Constant danger. No assurance you will return alive. Honor and recognition in the case of success.” A handful of courageous men answered this call, and led by the explorer Ernest Shackleton, began an audacious journey through unknown regions, eager to discover unexplored places.

Thanks to the courageous action of the Chilean sailor Luis Alberto Pardo, they were rescued safe and sound. The adventure of knowledge has been in the center of human behavior since its origins, allowing borders to be to be moved and talents displayed.

This tireless energy, passed on from generation to generation and has left an impression in the structure of our country. Since the dawn of the Republic, science has been a fundamental part of the country’s cultural, social and economic structures. It has drawn the boundaries of the nation we inhabit, with indelible strokes that today configure its identity.

Shortly after independence, at the beginning of the XIXth century, visionary presidents and statesmen in our country understood the ineludible need to know the territory under the new leadership and agreed to the noble task of hiring experts from other lands to examine our territory up to its borders, the natural resources, and the people who inhabited it.



When Charles Darwin began his historical journey on board the brigantine HMS Beagle, the French naturalist Claudio Gay carried out the first studies of Chilean flora, fauna, geography and geology, which would be enriched by a pleiad of scientists such as Ignacio Domeyko, polish born, who emphasized the singular mineral richness of Chile; Rodolfo A. Philippi, a medical with a German background who travelled several areas of the country, which made it possible for him to make a significant scientific contribution, or Pedro Pissis, a geographer and geologist born in France, who was requested to provide a geological, topographic and mineralogical study of Chile. The work done by these naturalists, added to that by other personalities, such as Eloísa Díaz, the first woman to graduate in medicine in Chile and Latin America; Justicia Espada Acuña, the first Chilean and South American woman to graduate as an engineer; Amanda Labarca, teacher, feminist pioneer,

or Juan Gómez Millas, a humanist and promoter of scientific and research work, made it possible to forge a nation that, thanks to the knowledge generated early, was aware of its natural reality, but also of its economic, cultural, social and political challenges.

Heirs of this long and fertile tradition, the centers of excellence of the Universidad de Chile constitute an essential space for scientific and technological research, and place teams of researchers in a variety of disciplines, whose work is oriented towards issues of national importance. Hence, sustainable development, climate change, the study of the Universe, medicine for the XXIst century, clean energy, and the dilemmas of contemporary Chilean society today, constitute the unexplored confines towards which the thirst for knowledge navigates.



At the peak of the scientific-technological development

The centers of excellence (Institutos Milenio, Fondo de Financiamiento de Centros de Investigación en Áreas Prioritarias -Fondap- and Fondos Basales) have the purpose of carrying out high-impact scientific research and educating young scientists on topics that are a priority for the country, which have been previously defined by the government. Through the competitive tender system, tenders are subjected to a strict assessment process carried out by a panel of world-renowned experts from prestigious foreign academic institutions. Numerous researchers in different fields of knowledge attend these centers for between 5 and 10 years, and receive public financing that fluctuates between US\$ 1.6 million and US\$ 2.6 million per year, so becoming the pinnacle of the country's scientific-technological development.



“I have benefitted more than anyone else from the work done at the Universidad de Chile. My discovery along with other researchers on the acceleration of the universe is entirely based on studies carried out in the 1990s by José Maza, Mario Hamuy and their colleagues at Cerro Tololo. They provided the instrument we used to discover that the universe is accelerating: the type 1-A Supernova.”

Brian Schmidt,
Nobel Prize in Physics 2011.

Open skies: a look at the universe

Chile, with some of the most transparent and clear skies in the world, has over 160 years of tradition in astronomical research, since the first astronomical instruments to arrive in the country were installed on the summit of Cerro Santa Lucia in Santiago. Since then, Chile has become an astronomical power, thanks to its natural conditions and a policy of incentives to install top-quality astronomical observatories. In fact, in the present day, 40% of the world's astronomical observations are done using infrastructure installed in the country, and this is expected to reach 70% in 2018.

The Parque Astronómico Atacama is currently being built through scientific collaboration agreements with the world's most prestigious institutions. The European E-ELT telescope will be installed in this park which will generate significant progress at a global level. The Atacama Large Millimeter Array (ALMA) Radio Observatory is also part of this park, which began operations in 2011 and is operated by Associated Universities Inc. (AUI), a network that groups the Universidad de Chile and important universities in the United States and Japan. This alliance will also operate with the sub-millimeter CCAT observatory to be inaugurated in 2017.



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INSTITUTO
DE VALPARAÍSO DE
ASTROFÍSICA

Millenium Institute of Astrophysics (MAS)



The *Big Data* era, an avalanche of data from synoptic research generated by the large-scale exploration that dominates modern astronomy, opens new scientific opportunities linked to the development of efficient techniques and technological tools for the pertinent extraction of information through a synergy between astronomy, statistics and IT.

In this context, the Millenium Institute of Astrophysics (MAS) develops the algorithms necessary to carry out the automatic classification of variable objects from a time series coming from our present and future samples. It's main objective is being the exploitation of a new dimension in the exploration of the Universe: the Domain of Time.

Along with the foregoing, the MAS intends to leave a legacy that is beyond astrophysics, in infrastructure (hardware), algorithms (software), as well as people who are highly qualified to handle the Big Data in other areas of the country's endeavor, making use of the Chilean skies, a renewable natural resource, in order to contribute to global knowledge, new technologies, innovation and advanced human capital.

Hosting Institutions: Universidad de Chile, Pontificia Universidad Católica de Chile, Universidad de Valparaíso, Universidad Andrés Bello and Universidad de Concepción.

Lines of Research

- Discovery and characterization of supernova and their use as distance indicators.
- Origin, structure and evolution of the Milky Way and the galaxies in the Local Group.
- Description and characterization of transient and exoplanetary astrophysical phenomena.
- Astrostatistics and astroinformatics in order to develop algorithms that make it possible to detect and classify variable astrophysical phenomena.



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Center of Excellence in Astrophysics and Associated Technologies (CATA)



At the Center of Excellence in Astrophysics and Associated Technologies (CATA), research is done on the formation and study of the structure of the Universe at a large scale, the evolution of galaxies and the formation of stars and extrasolar planets, with the objective of seeking Earth-like planets that could sustain life as we know it.

This project makes use of 10% of the time available to Chilean astronomers on the most powerful and modern astronomical instruments in the world; to this we add “intelligence”, a natural resource, like the country’s skies.

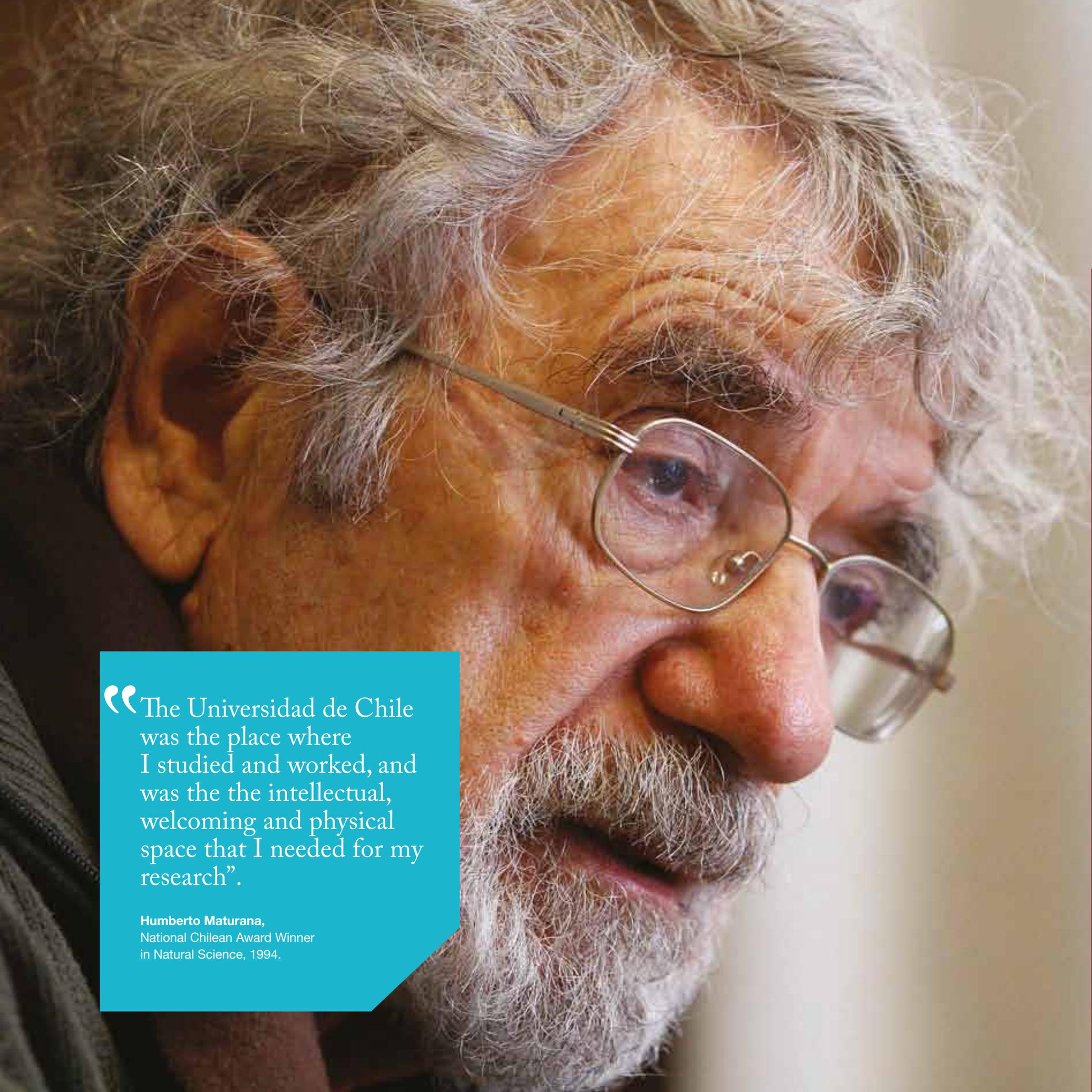
Radiofrequency technology is developed as part of this project, building Band 1 for the ALMA radio telescope, important technology for communications in the future.

Principal Institution: Universidad de Chile.

Associated Institutions: Universidad Católica de Chile and Universidad de Concepción.

Lines of Research

- Birth and evolution of structures in the Universe.
- Stellar populations in the local universe.
- The extra-galactic scale of distance.
- Star Formation.
- Study of brown dwarfs and planetary systems.
- Supernovas and dark energy.

A close-up, profile view of an elderly man with thick, wavy grey hair and a full grey beard. He is wearing glasses and looking slightly to the right. The background is a plain, light-colored wall.

“The Universidad de Chile was the place where I studied and worked, and was the the intellectual, welcoming and physical space that I needed for my research”.

Humberto Maturana,
National Chilean Award Winner
in Natural Science, 1994.

Biomedicine:

A tree with an infinite number of branches

“Illnesses of modern times”, such as obesity, diabetes, several types of cancer, cardiovascular illnesses, etc., along with the increasing aging of the world’s population, pose new challenges for biomedical science and neuroscience.

Therefore into the brain, nervous system, and chronic illnesses are of crucial importance in developing the medicine of the future, studies that the Universidad de Chile is carrying out at the Institute of Biomedical Neuroscience, the Center of Advanced Studies on Chronic Diseases, the Geroscience Center for Brain Health and Metabolism, and the Millennium Institute on Immunology and Immunotherapy.

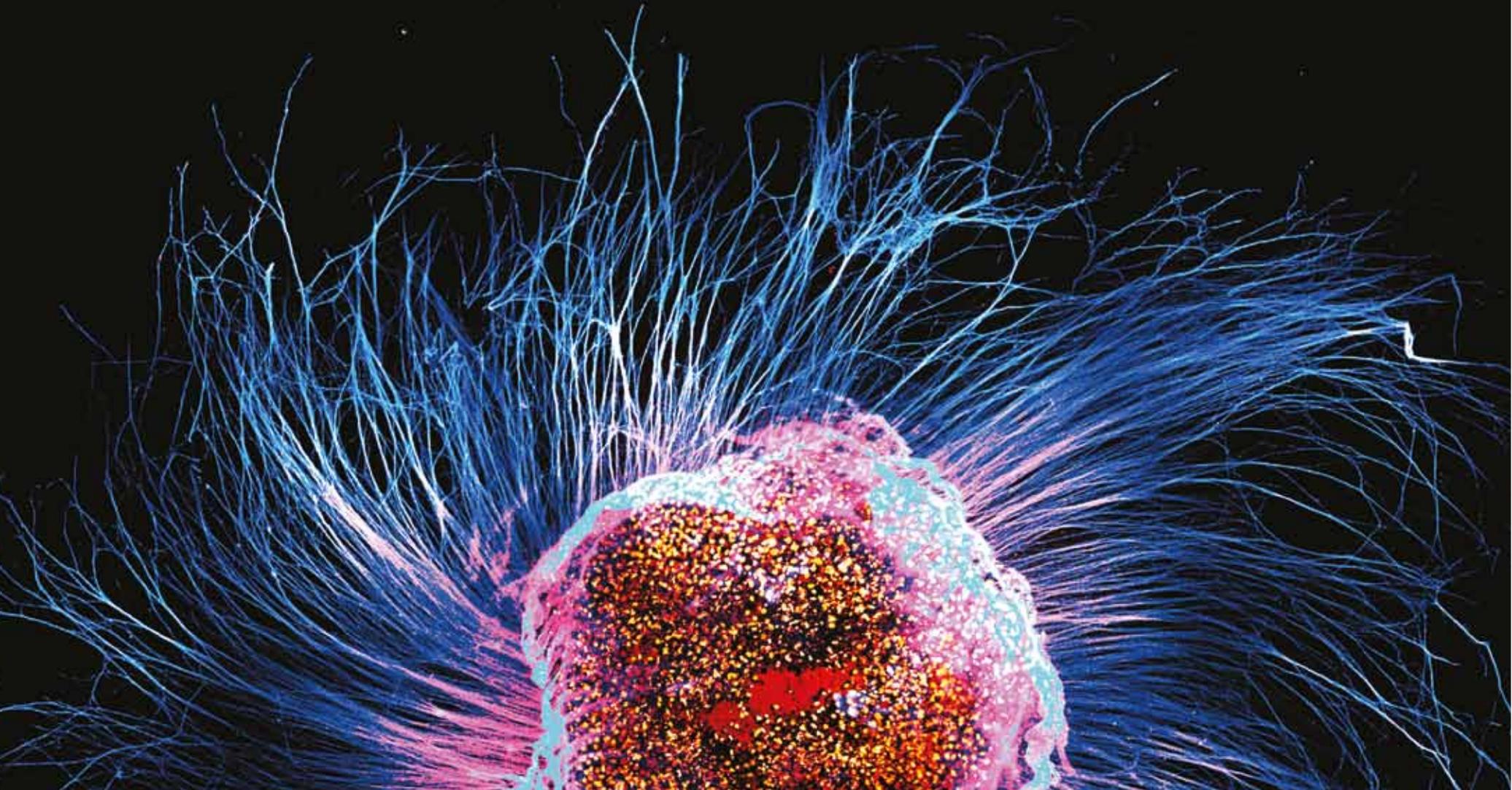




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Institute of Biomedical Neuroscience (BNI)



The Institute of Biomedical Neuroscience (BNI) is part of a node of cutting-edge research that is of global interest. It studies the entire nervous system, from molecules to organisms in multiple animal models. For this reason, it uses a combination of biological and mathematical approximations to maximize the collection of information from living beings. In addition, the research focuses on neurological and psychiatric pathologies.

Its studies seek to understand the contribution of components of the cytoskeleton and subcellular traffic in the nervous system in order to know how these determine neuronal function or dysfunction; how the expression of genes conditions the morphofunctional characteristics throughout the development and useful life of the neurons. Also, in what way the activity of the genes translates into the morphogenesis of the brain; how genetic interactions and signaling pathways control lasting memories; how the neuronal activity associated with cognitive functions is organized during “ecological” functions and how the genes associated with illnesses affect common cellular and physiological processes, such as for example the synaptic function, developing technological and therapeutic approaches.

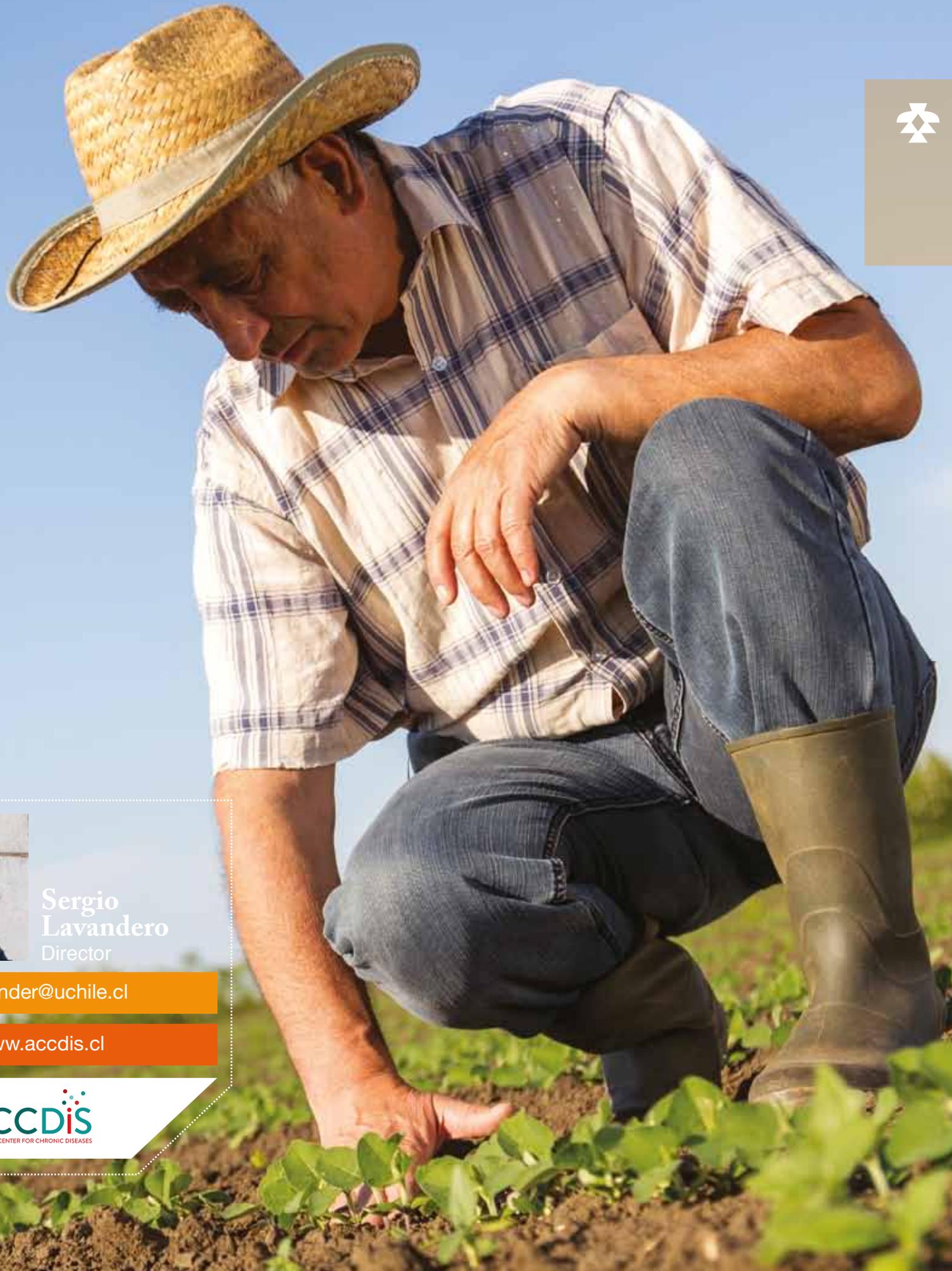
We are interested in learning about the nervous system and its functioning in depth, which will contribute towards showing who human beings are and towards understanding the causes of the neurological and psychiatric illnesses that affect them. Also, we seek to share this enthusiasm and its impact on society.

Principal Institution: Universidad de Chile.

Associated Institutions: none.

Lines of Research

- Functional sub-cellular dynamics.
- Cellular identity and morphology.
- Supra-cellular circuit development.
- Plasticity and behavior.
- Systems Neuroscience.
- Applied mathematics and biomedical IT.
- Neural dysfunction and pharmacological targets.
- Clinical research and creation of new skills.



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ACCDiS
ADVANCED CENTER FOR CHRONIC DISEASES

Center of Advanced Studies on Chronic Diseases (ACCDiS)



The Center of Advanced Studies on Chronic Diseases (ACCDiS) focuses its research on cardiovascular illnesses and cancer, with the objective of identifying their common elements, in order to offer solutions to the country's health problems by collaborating in the diagnosis, prognosis, treatment and generation of public prevention policies. ACCDIS gathers over 220 members including academics, postdoctorate students, postgraduate students and undergraduate students, professionals and technicians, who carry out transdisciplinary research on issues such as molecules all the way through to public health.

A significant contribution is the MAUCO Project, where 10,000 adults residing in the Region of Maule are assessed and followed for 10 years, and this is the first epidemiological cohort in Chile.

In its third year of execution, the Center surpassed the productivity and quality targets proposed: with 145 publications in ISI-indexed magazines (average impact factor of 4.8; 24 of them in magazines of the upper 10% of the discipline and 61 in magazines of the 25%). ACCDiS is a benchmark in the formation of human resources with 25 postdoctorate students and 74 students doing their doctorate dissertations. The diffusion and extension of the Center is done for the scientific world as well as for the community in general, and carries out a variety of activities, in which more than 8,600 people have participated. ACCDiS also has a permanent and active presence in the national communication media.

Hosting Institutions: Universidad de Chile and Pontificia Universidad Católica.

Lines of Research

- Metabolism and cardiovascular signaling.
- Emerging Biomarkers in cardiac insufficiency.
- Inflammation in angiogenesis, cellular migration and metastasis.
- Biomarkers for the early detection of gastric tumors.
- Natural history of gallbladder cancer.
- Nanomedicine and nanotheranostics.



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Geroscience Center for Brain Health and Metabolism (GERO)



The Geroscience Center for Brain Health and Metabolism (GERO) is a national initiative led by the Universidad de Chile and the Universidad Mayor, which involves the participation of the Universidad Diego Portales, the Instituto de Neurociencias Biomédicas, and the Fundación Neurounion Foundation as associated institutions. The Center has established a direct alliance with the Buck Institute (USA), pioneers in research on aging.

The group of researchers is comprised of renowned basic and clinical scientists, who through cooperative strategies will establish interdisciplinary research programs focused on:

- Improving diagnosis skills in neurodegenerative illnesses, whose main risk factor is aging.
- Understanding the local risk factors and the contribution of genetic variants in a cohort of Chilean patients.
- Studying the molecular mechanisms associated with aging and how these promote neurodegeneration.
- Exploring new markers to prematurely assess the appearance and progression of pathologies in the nervous system.
- Develop a program of interventions to delay aging processes.

Principal Institution: Universidad de Chile and Universidad Mayor.

Associated Institutions: Institute of Biomedical Neuroscience and the Neurounion Foundation.

Lines of Research

- Longitudinal study with patients that considers Geotypical, Phenotypical, Metabolic and Psychosocial aspects.
- Proteostasis and adaptation to cellular stress.
- Reactive species of oxygen as signaling molecules.
- Inducible Pluripotential Stem Cells (iPSCs) and modeling of illnesses.
- Metabolism in the nervous system and endoplasmic mitochondrial-reticulum interaction.
- Axonal Degeneration and regeneration during aging.



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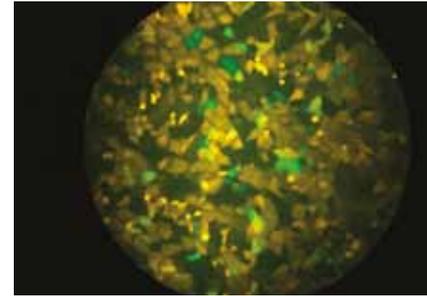
www.imii.cl



Millennium Institute
**IMMUNOLOGY &
IMMUNOTHERAPY**



Millennium Institute on Immunology and Immunotherapy (IMII)



The mission of the IMII is the integrated study of the immune system in order to generate new high impact knowledge, which can be transferred to therapy, prophylactic strategies such as vaccinations and methods to diagnose illnesses with an immune and inflammatory component that affect the human population. The illnesses studied by the IMII include cancer, autoimmunity, hypertension and infections.

The investigation carried out at the Center is done in a multidisciplinary manner, through the collaboration of biochemists, doctors, medical technologists, nurses and veterinarians, among others. In turn, the IMII has around 150 young researchers (undergraduate, masters, doctorate, post doctorate), housed in over 15 independent research laboratories, which are well-known due to their scientific productivity.

Some notable achievements of the IMII include neural therapies for treating melanoma and prostate cancer; the development of a vaccine against the respiratory syncytial virus, and new diagnostic methods to investigate infections and pathological endocrinological and inflammatory infections and conditions. These technologies are being assessed in different phases of clinical studies, for transfer to the population in the medium term.

Since 2016, the IMII is the only member of the Southern Cone that belongs to the International Network of Centers of Excellence of the Federation of Clinical Immunology Societies (FOCIS; <http://focisnet.org>), an initiative that provides tools for conducting clinical studies.

Hosting Institutions: Pontificia Universidad Católica de Chile, Universidad de Chile and Universidad Andrés Bello.

Lines of Research

- Immunology of Tumors.
- Infectious diseases.
- Endocrinological and Inflammatory Illnesses.
- Autoimmune illnesses.



“I have had many opportunities to visit the Universidad de Chile to conduct research under the auspices of the Complex Engineering Systems Institute (ISCI). I am very thankful for the opportunity to interact with a high-quality research center that addresses critical sectors such as energy, transportation and mining. I believe that it is a very good idea to involve researchers from different departments and universities. I would like this to be done more frequently in the USA.”

Monique Guignard-Spielberg,
Pennsylvania University, USA.

Engineering and technology for sustainable development

The nine billion inhabitants of the planet projected for the year 2050 represent a great challenge, since this implies a transformation in the way we connect, changes in public policy, business, research, etc. This research has the objective of promoting development in harmony with the environment, the economy, agriculture, urban planning and the exploitation of natural resources. In this context, technological and engineering advances play a key role in the service of the new requirements.

In Chile, growing demands regarding education, the economy, energy and the environment show a shift in the paradigm, to which the Universidad de Chile responds with thought and long-term research.





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Advanced Center for Mining Technologies (AMTC)



At the Advanced Center for Mining Technologies (AMTC), world-class multidisciplinary research is done in all stages of the mining production chain: research into exploration, identification of new mineral resources and modeling of deposits. The latter is a key area of research for the development of new mining projects, since it enables the generation of computer modeling tools to improve the estimates of ore grades and with this, promote Chile as a relevant player in the global mining industry.

The AMTC focuses its research on robotics and automation, ore processing and extractive metallurgy, which enable new processes to be implemented, such as continuous mining and bioleaching in situ, among others, with the development of new technologies that support mining operations under increasingly demanding conditions from the financial, productive and safety points of view, as well as regarding the use of resources (water and power) in a sustainable manner.

The technologies developed at the AMTC are transferred to the domestic mining industry, which benefits from improvements in productive efficiency, increased safety, and the reduction of negative impacts on the environment and on human health.

Principal Institution: Universidad de Chile.

Associated Institutions: none.

Areas and Lines of Research

- Exploration and modeling of deposits.
- Mine design and planning.
- Ore processing and extractive metallurgy.
- Automation in mining.
- Water and environmental sustainability.



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ISCI
INSTITUTO
SISTEMAS COMPLEJOS DE INGENIERÍA



Complex Engineering Systems Institute (ISCI)



The work of the Complex Engineering Systems Institute (ISCI) has been considered as a continuum that goes from cutting-edge research to specific application to relevant problems, in subjects that involve an interaction between infrastructure, human behavior and management that require new approaches and methodologies for their resolution. The ISCI research seeks to provide solutions to the problems of companies and institutions through sophisticated analysis and optimization techniques, which include studies of behavior, use of soils, complex transportation systems, on-line elements, optimization of strategic decisions regarding the location of infrastructure and design of supply chains, as well as the interaction between companies, public institutions, markets with few agents, economies of scale and efficiency of markets.

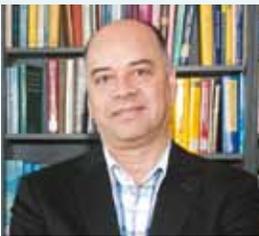
The work of this center has a positive impact on society, through projects such as that of the Junta Nacional de Auxilio Escolar y Becas (Junaeb), which signified savings of 20% of the cost of distribution of 1.5 million daily servings of food; mining projects, which has meant improvements in the planning of extraction; the Compañía Sudamericana de Vapores (CSAV) project, of management of fleet of containers, and that of forestry companies, and improvements to transportation and harvesting.

Principal Institution: Universidad de Chile.

Associated Institutions: Pontificia Universidad Católica de Chile, Universidad de Santiago de Chile, Universidad de los Andes, Universidad de Talca and Universidad de Concepción, Universidad Diego Portales and Universidad Adolfo Ibáñez.

Lines of Research

- Natural resources: applied models and operations management optimization.
- Analysis of transportation systems: networks, circulation and user behavior.
- Intelligent networks, distributed generation and tools for decision-making associated with energy.
- Industrial organization: theory and structure of companies and markets.
- Logistics, localization and use of soils.



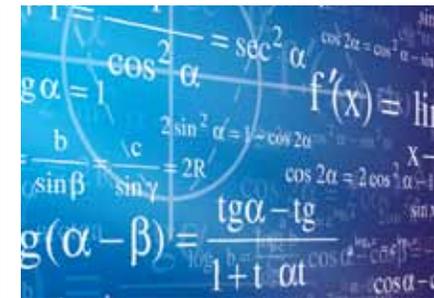
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CMM
Center for
Mathematical
Modeling

Center for Mathematical Modeling (CMM)



The Center for Mathematical Modeling (CMM) is a leader in the creation of state of the art mathematics to resolve problems arising in the industry, public policies and other sciences. It seeks to develop a high standard of science that also guides their activities in industrial research and education. Through alliances with international centers, the CMM has created a network that enables it to be at the forefront at world level. Locally, it works in connection with a set of companies and public institutions.

In the present day, the CMM projects are focused on mining, education, bioinformatics, resource management and data analysis. The use of mathematical tools enables problems to be solved, processes optimized, making use of opportunities, and supporting decision-making in the main productive sectors with scientific tools as well as the challenges that the country needs to address in order to reach development. In particular, there are genome sequencing projects such as that of salmon or sultanas, bioleaching, astroinformatics, support of the initial and continuous education of mathematics teachers, energy efficiency, mining in real time –which support on-line decisions with data from the worksites– , logistics and others.

The Center has the High Performance Computer Science National Laboratory (NLHPC) and the most powerful supercomputer in Chile, a machine that provides tools used to process large volumes of data that serve the various sectors where the CMM produces solutions.

Its strategic areas of applied research are: education in mathematics, modeling of biological and bioinformatics systems, resource management, energy, astroinformatics, mathematical modeling in marketing and finance, mathematical modeling in safety, data analysis and calculation of high performance.

Principal Institution: Universidad de Chile.

Associated Institutions: Centre National de la Recherche Scientifique (France) and Universidad de Concepción.

Lines of Research

- Non-linear analysis.
- Numerical analysis.
- Stochastic processes, ergodic theory and stochastic modeling.
- Discrete mathematics.
- Mathematical mechanics.
- Optimization and equilibrium.



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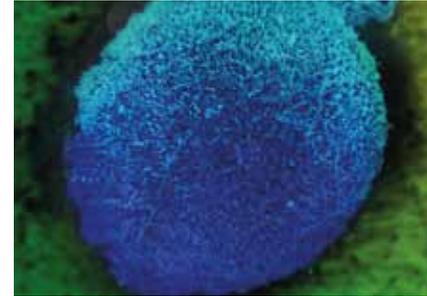
www.nanonegocios.cl



CEDENNA

Centro para el Desarrollo de la
Nanociencia y la Nanotecnología

Center for the Development of Nanoscience and Nanotechnology (CEDENNA)



The study and manipulation of structures with nanometric dimensions has revolutionized science, generating significant contributions in various areas. The Center for the Development of Nanoscience and Nanotechnology (CEDENNA), focuses on the study of the fundamental properties of nanostructures and their incorporation into applied projects in order to deliver innovative and patentable solutions, through multidisciplinary work.

Applications such as the decontamination of water and soil using filters with nanostructures especially designed for this; the preparation of active containers that improve and extend the shelf life of food; the production of nanoparticles with traditional and ecological methods and the fabrication of magnetic and chemical sensors are part of the research conducted by the Center in alliance with companies.

The Cedenna has specialized equipment that enables it to offer services in its associated laboratories for Physics, Chemistry, Biology and Technology; and since its creation in 2009, it has generated networks of collaboration with institutions and researchers in Europe, North America, Asia and Latin America.

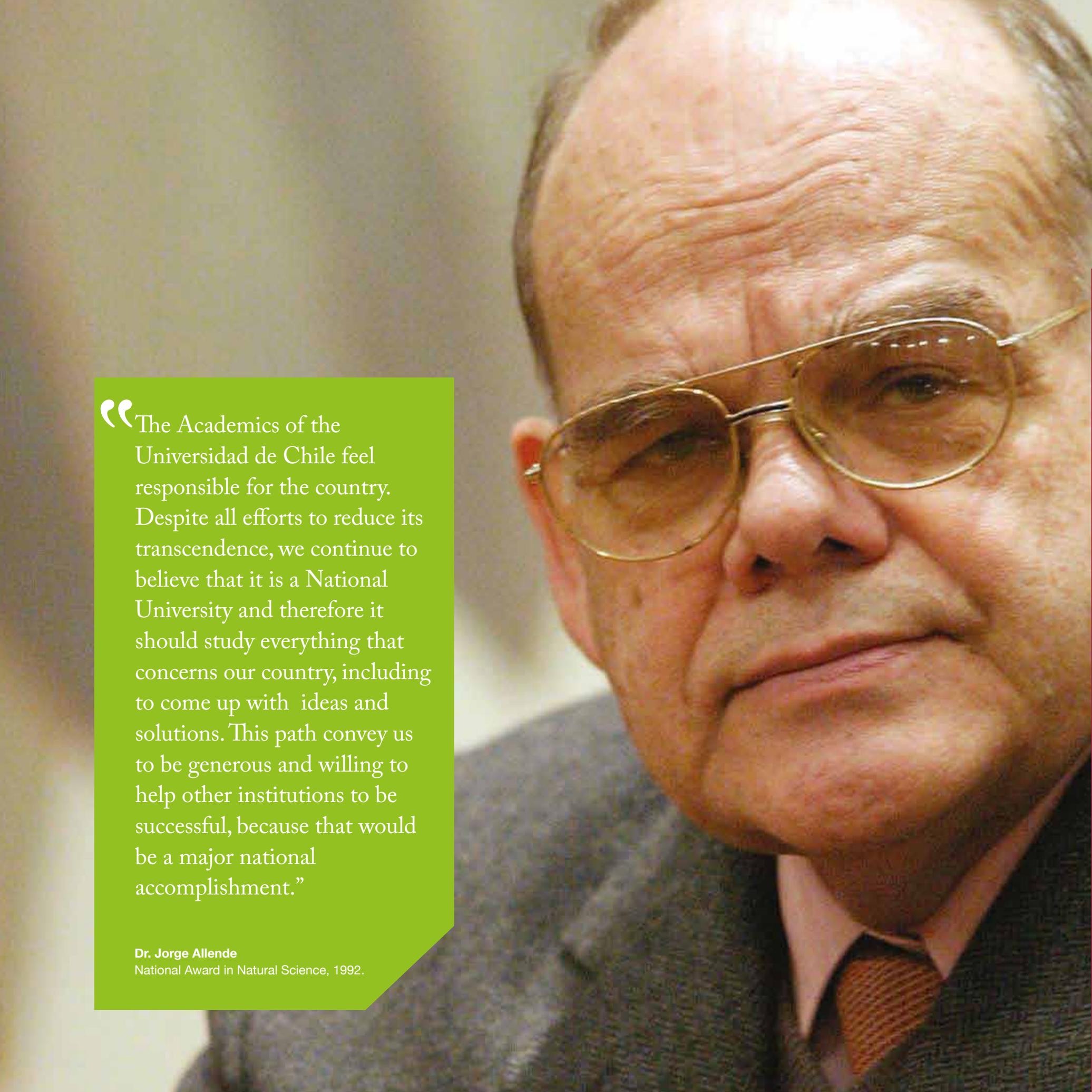
Along with promoting the generation of new knowledge in nanoscience and nanotechnology, the Center contributes to the formation of specialized and top-quality human capital, integrating undergraduate and postgraduate students. It also promotes scientific disclosure, bringing these areas closer to schoolchildren and their teachers, who are key agents in the early formation of scientists.

Principal Institution: Universidad de Santiago de Chile.

Associated Institution: Universidad de Chile.

Lines of Research

- Numerical Simulations.
- Magnetic Nanostructures.
- Nanostructure Chemistry.
- Chemical Physics.
- Container Technology.
- Nanobiomedicine.



“The Academics of the Universidad de Chile feel responsible for the country. Despite all efforts to reduce its transcendence, we continue to believe that it is a National University and therefore it should study everything that concerns our country, including to come up with ideas and solutions. This path convey us to be generous and willing to help other institutions to be successful, because that would be a major national accomplishment.”

Dr. Jorge Allende

National Award in Natural Science, 1992.

Education, social conflict and mental health: the challenges of contemporary Chile

Chile has been undergoing rapid and continuous socioeconomic changes over the last decades, which has led to the growth of the national product, an increase in income levels and the decrease of national poverty levels. However, these improvements have been asymmetric. Proliferating social conflicts have been reflecting this asymmetry over the last few years. Among these conflicts were the student movements. They have had a special resonance, namely seeking equitable qualitative education, and pursuing a hold to the profits gained out of the educational system in Chile.

As a key player in these processes of change, the Universidad de Chile addresses the challenges coming with this growing social complexity, by firstly promoting research that contributes to the improvement of education and secondly, through understanding the origin and unfolding developments of social conflicts. The University wishes is to support public policies and bestow scenarios for social dialog in the country.





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Center for Advanced Research in Education (CIAE)



The urgent necessity for all children in our country to learn the fundamentals during their school years, has led the Center for Advanced Research in Education (CIAE) to study the acquisition and development of skills in mathematics, language, science and technology, considering the advances in research in the area of neuro-cognition. A better understanding of these processes enables teaching strategies to be developed that make it possible to overcome learning problems existing in the school system. This is the case in the use of cutting-edge technologies based on online games for learning science and mathematics for primary and middle school children, or in the development of assessment instruments, and teaching reading and writing for primary school education, with the participation of classroom teachers.

At the same time the Center has researched the factors that affect the trajectories of improvement at the schools, delivering important keys for the management of the school boards and leaders, and has developed a territorial intelligence platform to support public policies in the area.

In the field of pedagogy, its researchers have developed the first standards for the initial education of teachers in the areas of language and mathematics and for nursery school education. Contributions have also been made in the Center to knowledge about the teaching profession, through a national representative study of teachers, which has served as the basis for the preparation of the EFA Global Monitoring Report 2013/2014 and the development of the Regional Strategy for Teachers, led by the Unesco.

Principal Institution: Universidad de Chile.

Associated Institutions: Universidad de Concepción, Pontificia Universidad Católica de Valparaíso.

Lines of Research

- Teaching and learning: language, mathematics, science and technology.
- Education in early childhood.
- Development of teachers and teaching professionalism.
- Academic improvement and educational policy.
- Cognition, learning and information technology.



**Dante
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coes.
Centre for Social Conflict and Cohesion Studies

Center for Social Conflict and Cohesion Studies (COES)



The Center for Social Conflict and Cohesion Studies (COES) gathers more than 40 academics from various areas of the social sciences and humanities, in order to conduct interdisciplinary research into the multiple manifestations of social conflict and cohesion in Chile, its causes, as well as its cultural and historic context, analyzing them from different viewpoints, such as education, urban development, the political system, social movements, and neighborhood policies, among others, enabling the researchers to visualize in what way the public policies affect and/or contribute to understanding these phenomena.

Its main projects include:

1. COES Panel Survey: Longitudinal Panel Survey on Social Conflict and Cohesion in Chile, unique in Latin America. This study investigates the same group of people over several years, in order to understand the manner in which the attitudes and behavior of Chileans change or continue in time, in several areas of individual and social life. So, subjects such as citizenship and democracy, social networks and attributes towards immigrants, legitimacy and social inequality, socioeconomic characterization, neighborhood and territorial social conflict and cohesion and aspects referring to the health and psychosocial wellbeing of Chileans are analyzed. It seeks to generate high-quality information in a national representative sample that illuminates scientific knowledge and the development of public policies in Chile.
2. Annual international COES conference: every year it gathers outstanding national and international speakers, and is an important platform for academic discussion (www.coes-conference.cl).

Principal Institutions: Universidad de Chile y Pontificia Universidad Católica de Chile.

Associated Institutions: Universidad Diego Portales and Universidad Adolfo Ibáñez.

Lines of Research

- Political and social conflict.
- Geographies of the conflict: The spatial dimension of the social conflict and cohesion.
- Group and individual interactions.
- The socioeconomic dimensions of the conflict.



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Millennium Institute
Market Imperfections and Public Policy

Institute for Research in Market Imperfections and Public Policy (MIPP)



The recent wave of regulatory rulings has shown the need to improve our understanding of solutions to market imperfections. These cases reveal the various areas in which the current regulation of the system does not fulfill its objectives.

In this aspect, Chile is not special, since similar cases have been seen in various places in the world (the Lysina cartel, the Enron case and the case of the regulatory rulings that contributed to the 2008 financial crisis).

In addition, in many of these cases, even when the optimal regulation is known, political economy restrictions, such as lobbying and corruption, make its legislation and execution more difficult. Without a suitable understanding of these restrictions, any study of the answer by public policy to the failures of the market will be incomplete.

The Institute for Research in Market Imperfections and Public Policy (MIPP) is an academic center that develops and disseminates knowledge in Economy, Political Science and Management. The MiPP researchers conduct cutting-edge research to address the most challenging and important issues in Economics.

The extensive international network of collaborators and visitors of the Institute make the MiPP a vibrant and stimulating intellectual place. The Institute develops methodological tools that enable information to be generated for decision-making by companies and public and private entities. The MiPP continuously collaborates with its public and private partners on issues such as anti-monopoly and financial regulation.

Principal Institution: Universidad de Chile.

Associated Institutions: Pontificia Universidad Católica de Chile and Universidad Diego Portales.

Lines of Research

- Industrial Organization.
- Macroeconomics.
- Finance.
- Political Economy.



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Millennium Institute for Research in Depression and Personality (MIDAP)



Depression is a universal phenomenon. It is a mental condition characterized by a low mood, loss of energy, low self-esteem and decreased interest in activities that are normally pleasurable. The high global prevalence of depression produces a great social impact, which manifests in high levels of disability and in the generation of significant costs at the individual, family, social and economic levels. In Chile, a nationwide study by the Ministry of Health (2011) revealed that 17.2% of the general population had experienced symptoms of depression the previous year, while 21.67% indicated that they had been diagnosed with depression at least once during their lives.

The Millennium Institute for Research in Depression and Personality (MIDAP) is a scientific center comprised of psychologists, psychiatrists and professionals in various areas of the social sciences and health, who seek to generate knowledge based on a multidimensional understanding of depression in interaction with personality, with the objective of maximizing the effectiveness of interventions by identifying the change agents and mechanisms involved in prevention, psychotherapy and rehabilitation.

In order to obtain a deep understanding of the causes of depression and of the effectiveness of prevention and treatment, MIDAP works on the basis of a multidimensional approach that uses the skills of an experienced group of scientists in order to generate an empirical model of the etiology, prevention, intervention and rehabilitation from depression. This model studies the relationship between depression and personality, along with the various dimensions of human functioning that have been empirically associated with this illness.

Principal Institution: Pontificia Universidad Católica de Chile.

Associated Institutions: Universidad de Chile, Universidad de La Frontera, Universidad de Valparaíso and Universidad del Desarrollo.

Lines of Research

- Basic bio-psycho-social structures and processes.
- Promotion of health and psychosocial prevention.
- Psychotherapeutic interventions and change processes.
- Rehabilitation and reintegration.

A photograph of a person wearing a green jacket, using red-handled shears to harvest a bunch of yellow grapes from a vine. The background is a bright, sunlit vineyard with other people blurred in the distance. A dark red triangle is in the top right corner.

“Building the primary biotechnology and bioengineering center in Latin America in order to find new approaches to many of the biotechnology challenges is of supreme importance, not only because of the scientific impact, but also for the education of a new group of Chilean researchers with experience overseas, who will become a solid team of leading scientists”.

Sir Thomas Blundell,
Research Director of the Biochemistry
Department, University of Cambridge,
United Kingdom.

Life sciences: from molecules to the ecosystem

The various structures that comprise matter, with different sizes and complexities, determine the origins of life. From the atomic, molecular and cellular levels to the pluricellular, populations and ecosystems, life is created in an infinite set of interactions between the various levels. In this universe, the scientists from the Centers of Excellence of the Universidad de Chile associated with life sciences investigate to report on evolutionary changes and the structure of the diversity of ecosystems existing on the planet.





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Center for Biotechnology and Bioengineering (CeBIB)



Infectious diseases are responsible for approximately one quarter of deaths worldwide. Although there have been significant developments in research in the treatment of many contagious illnesses, there is a latent danger, which is the drastic increase in the quantity and worldwide distribution of pathogens that are resistant to antimicrobial drugs. Resistance to antibiotics in infections represents serious damage, not only to health, but also economically, a crisis that is exacerbated by a lack of innovation in generating new antibiotics.

The Center for Biotechnology and Bioengineering (CeBIB) attempts to address this problem through searching for microorganisms in external environments in Chile in order to develop new antibiotics and anti-cancer drugs. This objective has given fruit through the creation of drugs such as Chaxamicina, Chaxalactina and Atacamicina, all from species of *Streptomyces*, prolific producers of antibiotics, which were found in the Atacama desert, the driest in the world. They are also currently analyzing Antarctic strains, isolated by their researchers some years ago. In this way, it is expected to have a significant international impact on health with the discovery of new antibiotics and anti-neoplastics.

Principal Institution: Universidad de Chile.

Associated Institutions: Universidad de Antofagasta, Universidad de Santiago de Chile, Universidad de La Frontera and Universidad de Los Lagos.

Lines of Research

- Metabolomics and metabolic engineering.
- Protein engineering.
- Mathematical modeling.
- Bioinformatics.
- Molecular genetics, extremophiles and ecophysiology.



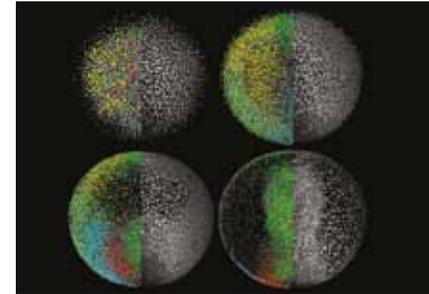
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www.genomacrg.cl

Genome
cgr

Center for Genome Regulation (CGR)



The Center for Genome Regulation (CGR) is interested in discovering how organisms handle the diverse and variable conditions of the media they inhabit, by using the regulation of the expression of their genes. The genome of an organism is invariant, but is capable of handling biotic or abiotic stress situations, modifying the structure of the chromatin (epigenetic) and modulating the regulatory networks that enable it to maintain cellular homeostasis. For this they study the genome-epigenome relationship in isolated cells and in complete organisms under various conditions, particularly those that involve processes of differentiation or adaptation to extreme situations. Their study models are extremophile organisms, which inhabit the world's driest desert in the north of Chile, as well as microorganisms, plants and laboratory animals. They have also conducted the first genomic studies on native Chilean people, in order to contribute towards identifying aspects that are unique to the national genetic heritage.

The CRG is exploring the genetic heritage of Chilean species, which is essential in order to know the country's natural wealth. This will not only provide valuable scientific information, but will also open the door to using this information in benefit of rational and efficient exploitation of the environment.

Principal Institution: Universidad de Chile.

Associated Institutions: Pontificia Universidad Católica de Chile and Universidad Andrés Bello.

Lines of Research

- Genome sequencing of native Chilean species of economic interest and of the country's indigenous people.
- Design of bioinformatics tools for the analysis of large-scale biological data (omics).
- Creation of models that enable us to understand how the genome is regulated and how it can be modified for biotechnical applications.



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Institute of Ecology and Biodiversity (IEB)



Climate change and the conservation of biodiversity are two of the greatest challenges faced by mankind and are the central theme of the cutting-edge research being done at the Institute of Ecology and Biodiversity (IEB), where models are used to determine the effect of large-scale climate change, and also experiments that determine the real effects of temperature increase on the biota and ecosystems with much greater precision. A fundamental aspect being researched is the time needed by the evolutionary lineages to adapt to climate change in the past.

Basic and advanced information is collected at the IEB on the distribution and composition of biodiversity throughout Chile, in order to maximize its protection and find ways to incorporate it into local economies, especially in geopolitically relevant remote areas, and where conventional agriculture and forestry are not feasible due to climatic reasons. It must be noted that Chile has two biodiversity hotspots, with very high levels of endemism.

Principal Institution: Universidad de Chile.

Associated Institutions: Pontificia Universidad Católica de Chile, Universidad de La Serena, Universidad de Concepción, Universidad Austral, Universidad de Magallanes.

Lines of Research

- Paleoecology and paleoclimatology.
- Biogeography.
- Macroecology.
- Ecosystems dynamics.
- Forest ecology and evolutionary ecology.
- Molecular phylogenetics.
- Plant reproductive biology and behavioral biology.
- Microevolution.
- Ecological modeling.
- Conservation biology.
- Environmental ethics and biocultural conservation.



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(CR)²



Center for Climate and Resilience Research (CR)²



The Center for Climate and Resilience Research (CR)² studies natural and anthropic climate change in an interdisciplinary manner in order to better understand the land system and contribute to increasing resilience in Chile. For this it has scientists from the exact and natural areas of science, as well as from the social sciences.

It focuses its research on an integrated approach to problems that are urgent for Chile: scarcity and variability of water resources in the central and northern areas of the country, the increasing urbanization and the change in use of the soil in the central and southern areas of the country.

Some of the notable products of the (CR)² are the report to the nation on the mega-drought in Chile that was delivered to the President of the Republic, Michelle Bachelet, and a proposal containing the minimum content for a potential law on climate change for our country. Its researchers also participate on the United Nations Intergovernmental Panel on Climate Change (IPCC) and the MAPS-Chile project, among other domestic and international initiatives.

In this way, the (CR)² has continuously contributed to the development of the science of the country's land system and the public policies that address climate change in Chile.

Principal Institution: Universidad de Chile.

Associated Institutions: Universidad de Concepción and Universidad Austral.

Lines of Research

- Biogeochemistry.
- Climate dynamics.
- Ecosystem services.
- Human dimension.
- Modeling and monitoring systems.

The background of the entire page is a photograph showing the silhouettes of several wind turbines against a sky filled with soft, white clouds. The turbines are dark against the lighter sky, and their three-bladed structure is clearly visible. The sky transitions from a pale blue near the horizon to a slightly darker blue at the top. The overall mood is serene and clean, representing renewable energy.

“An institution like the Andean Geothermal Center of Excellence (CEGA) offers a good academic and research platform not only for the work of Chilean scientists but also for work by researchers from the Andean countries and any international collaborator. CEGA connects the regulating entities with the geothermal companies, which is an aspect that is fundamental for developing geothermal resources”.

Bridget Lynne,
Auckland University, New Zealand.

Energies of the future

The generation of clean, environmentally friendly energies that are reasonably priced is a great concern for the world in the present day.

The current energy model does not permit sustainable growth to be maintained, since it is based on the consumption of fossil fuels. This means the possibility that these resources may be depleted, as well as a negative impact in terms of climate change, due to the greenhouse effect gases derived from the use of these fuels.

In this context, promoting new sources of energy, such as wind, solar or geothermal, becomes fundamental.





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Andean Geothermal Center of Excellence (CEGA)



The Andean Geothermal Center of Excellence (CEGA) develops research programs that make it possible to understand Andean geothermal systems, and in this way facilitate geothermal exploitation and exploration, so that this is an important component not only for the energy matrix of Chile, but also for the rest of the Andean countries. This is relevant since geothermal energy can be used in almost any productive process that requires cold or heat, which converts it into a high-impact energy, due to its sustainability and efficiency.

In parallel, they are implementing new areas of research fundamentally directed towards the study of the direct use of heat in productive processes and linking geothermics and society, as well as going into more depth in the study of geothermal fluids, the control of magmatic systems in the geothermal fields, the processes of interaction between fluid-heat-rock and the control exerted by the main fault systems on geothermal systems. Also, the CEGA has implemented analytical laboratories that enable new methodologies to be developed to establish a conceptual model of the Andean geothermal systems. This, this center intends to become a worldwide benchmark in the geological aspects of geothermal systems.

Principal Institution: Universidad de Chile.

Associated Institutions: Pontificia Universidad Católica de Chile.

Lines of Research

- Heat sources.
- Geochemistry of fluids and isotopes.
- Interaction between heat, fluid and rock.
- Structural, tectonic and geophysical geology.
- Reservoir modeling and architecture.



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Solar Energy Research Center (SERC Chile)



The potentiality of the Far Northern region of Chile, in terms of the production of electricity, heat and light due to its high levels of irradiation and its high clarity indexes, converts it into an exceptional area for the study, development and testing of new solar technologies and photovoltaic as well as thermal solutions.

To the extent that the new knowledge generated by the Solar Energy Research Center (SERC Chile), along with the seven institutions that comprise it, can be transferred to those who make the decisions and develop the technological solutions, it will be feasible to contribute to the improvement of the country's quality of life through a sustainable energy matrix and lower energy prices.

Principal Institution: Universidad de Chile.

Associated Institutions: Universidad de Tarapacá, Universidad de Antofagasta, Universidad Técnica Federico Santa María, Universidad Adolfo Ibáñez, Universidad de Concepción and Fundación Chile.

Lines of Research

- Solar energy in industry/mining.
- Electrical power systems with high solar energy penetration.
- Solar energy coordination systems for rural and urban communities.
- Solar energy storage.
- Solar water treatment.
- Economic, social and regulatory aspects for the development of solar energy.
- Electrical energy systems with high-penetration solar energy.

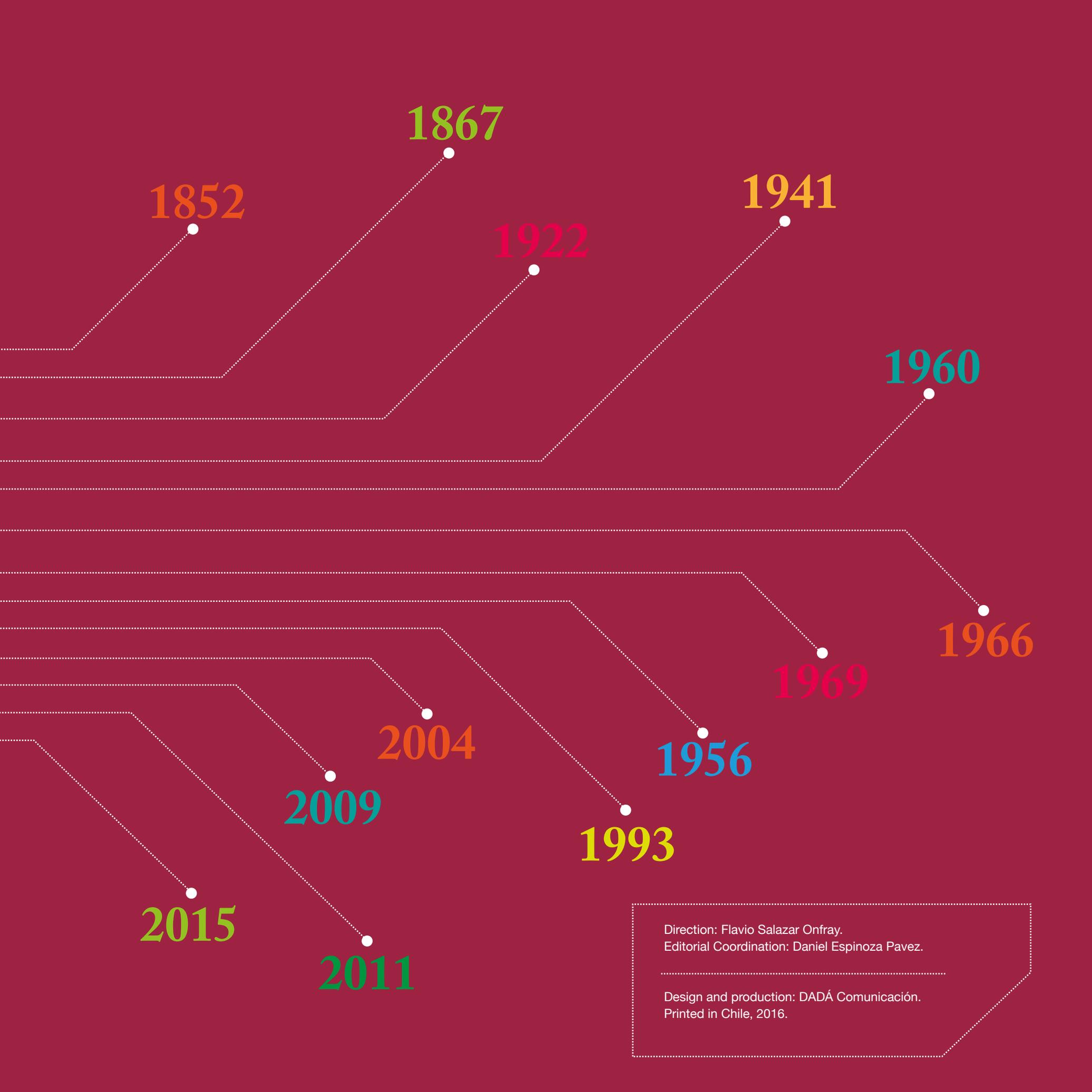
Universidad de Chile Milestones



- Creation of the National Astronomical Observatory
- Ignacio Domeyko conducts the first geological and mining study of the country
- First female teacher, Amanda Labarca
- First radio broadcast in Chile
- Creation of the Chilean Symphonic Orchestra
- First live television broadcast in Chile
- First kidney transplant
- First Chilean meteorological satellite image
- Creation of the “copper T” intrauterine device
- Creation of the Institute de Nutrición y Tecnología de los Alimentos, an institution that ended malnutrition in Chile
- Pioneer in implementing the internet in Chile
- Discovery of the fossil Chilesaurus diegosuarezi
- Application of the first Chilean cancer vaccination
- Contribution to the discovery of the accelerated expansion of the Universe
- Development of genetic therapies against neurodegenerative illnesses

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