



ARGENTINA'S STAR IS RISING

THE COUNTRY'S COMMITMENT TO RESEARCH AND EDUCATION HAS MADE IT A LEADER OF SCIENTIFIC ADVANCEMENT IN THE SOUTH.

From a reputation in the biomedical sciences that grew from three Nobel prizes, to new prominence in the study of astroparticles, modern-day Argentina is an appealing place to be a scientist. By strongly supporting its public universities and institutions, the country has built a scientific framework for research in biomedicine, agrotechnology, physics, space sciences, climatology and Earth sciences. Now, the nation is a model for scientific growth in the developing world.

The central piece of Argentina's scientific framework is CONICET, the National Scientific and Technical Research Council, established in 1958, which supports thousands of scientists and their research. The Argentinian daily newspaper *La Nacion* said recently that CONICET financially supports 6,000 researchers, 2,500 technicians and 8,500 fellows at institutions and colleges. Further demonstrating the importance of science to its agenda, the Argentinian government appointed chemist Lino Barañao its first-ever minister of science, technology and productive innovation in 2007.

This autumn, for the first time ever, TWAS is bringing its General Meeting to Buenos Aires, the capital of



Argentina. TWAS's annual event has been held in Latin America four times before: in Venezuela (1990), in Mexico (2008), and twice in Brazil (1997 and 2006). This year's meeting will run from 1 to 4 October, and those who come to Buenos Aires for the meeting will find a

nation focused on science, engineering and technology. It can claim a range of significant scientific accomplishments in recent years, and it is confidently scaling up its ambitions for the future.

A LIVELY PLACE FOR LIFE SCIENCES

Argentina has a longstanding tradition in the biological sciences, including three Nobel Prize winners: Bernardo Houssay, Luis Federico Leloir and César Milstein (see boxes). Leloir's work allowed Argentina to set initiatives and found institutes on molecular biology in the early 1980s. Leloir and his fellow laureates' accomplishments served as an inspiration for Argentines everywhere, including for Alberto Kornblihtt, a molecular biologist with the University of Buenos Aires and CONICET. Kornblihtt is a 2011 TWAS Prize winner in the medical sciences and one of Argentina's

The Leloir Institute in Buenos Aires, Argentina, at night. The institute is a centre of biomedical research founded by Argentinian Nobel laureates Luis E. Leloir and Bernardo A. Houssay (Photo: Leloir Institute).

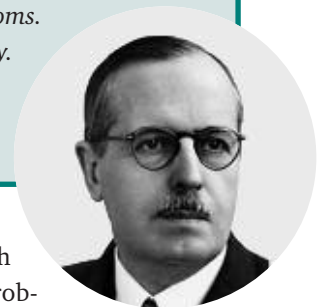


BERNARDO A. HOUSSAY, NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE, 1947

- **Houssay (1887–1971)** won the Nobel prize for his discovery of how pituitary hormones regulate blood sugar while working for the Institute for Biology and Experimental Medicine in Buenos Aires.

Houssay entered the School of Pharmacy of the University of Buenos Aires at the age of 14 and just three years later took a job with the Department of Physiology. By 1910, he became a physiology professor in the university's veterinary medicine school. He became a physiology professor in 1919 at the Medical School at Buenos Aires University.

He worked in almost every field of physiology, having a special interest in the endocrine glands. He worked on many other topics in physiology and pharmacology, including the physiology of circulation and respiration, the processes of immunity, the nervous system, digestion, and snake and spider venoms. He also had an active role promoting education and science research in his home country. Houssay was also the first-ever director of the National Scientific and Technical Research Council, the main Argentinian government agency that supports Argentinian science.



six foreign associates with the US National Academy of Sciences.

“Undoubtedly I am a product of the Leloir school”, said Kornblihtt. “I did my PhD with Héctor Torres who had done his PhD with Leloir, who in turn had done his PhD with Houssay, and my postdoc with TWAS member Tito Baralle, who in turn had been formed in the Leloir school. In that school I learnt a love for experiments and the importance of commitment and rigorosity.”

He credited Argentina's public education system for the country's strength in biochemistry and medical sciences. “Our university system is an open one”, he said. “There are no fees for students; all throughout there is a principle that it's open to everybody.” It also helps that Argentina has been a free society without intellectual repression for 30 years. “We've had democracy since the end of 1983”, Kornblihtt noted.

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There are several research teams working on important problems in biology at the moment, Kornblihtt noted. Hugo Daniel Luján's research team at Catholic University of Cordoba and CONICET has done landmark work on controlling human parasites, such as the

single-celled *giardia* that wreaks havoc on the human digestive system. Andrea Gamarnik, an independent researcher for the Argentinian Council of Investigation, discovered a method the deadly Dengue virus uses to reproduce. Alejandro Schinder, at the Leloir

Institute in Buenos Aires, is one of Argentina's leading neuroscientists, and demonstrated that neurons created in the adult brain function in a fundamentally different way from other neurons. Cancer researcher and 2010 TWAS Prize winner Gabriel Rabinovic has published important contributions on the biology of malignant



Left: A sunflower field in La Pampa, Argentina. Sunflowers are a major crop in Argentina (Photo: Wikimedia/Claudio Elias). Close right: A surface detector at the Pierre Auger Observatory in Argentina, 1.4 kilometres above sea level (Photo: Pierre Auger Observatory). Center right: A close-up view of a telescope mirror and camera in a Pierre Auger Observatory fluorescence detector (Photo: Pierre Auger Observatory). Far right: Argentina's National Atomic Energy Commission in Buenos Aires (Photo: Wikimedia/Pepe Robles).

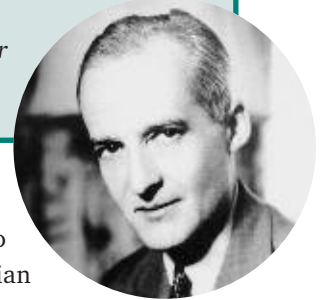
LUIS F. LELOIR, NOBEL PRIZE IN CHEMISTRY, 1970

- **Leloir (1906–1987)** won the Nobel prize for identifying and isolating specific sugar molecules with a role in building carbohydrates while working at the Institute for Biochemical Research in Buenos Aires, Argentina.

His findings proved important for treating a genetic metabolic disorder called galactosemia. The disease interferes with the body's ability to use a sugar called galactose to make energy, and can lead to liver, brain, kidney and eye damage in infants.

Leloir received most of his education at the University of Buenos Aires, and started his scientific career working with Bernardo A. Houssay in 1932. His career flourished, and he did biochemical research in Cambridge before returning to Buenos Aires. He was a Founding Fellow of TWAS.

Houssay and Leloir founded a major biochemistry research centre known as the Leloir Institute. It is now connected to the University of Buenos Aires.



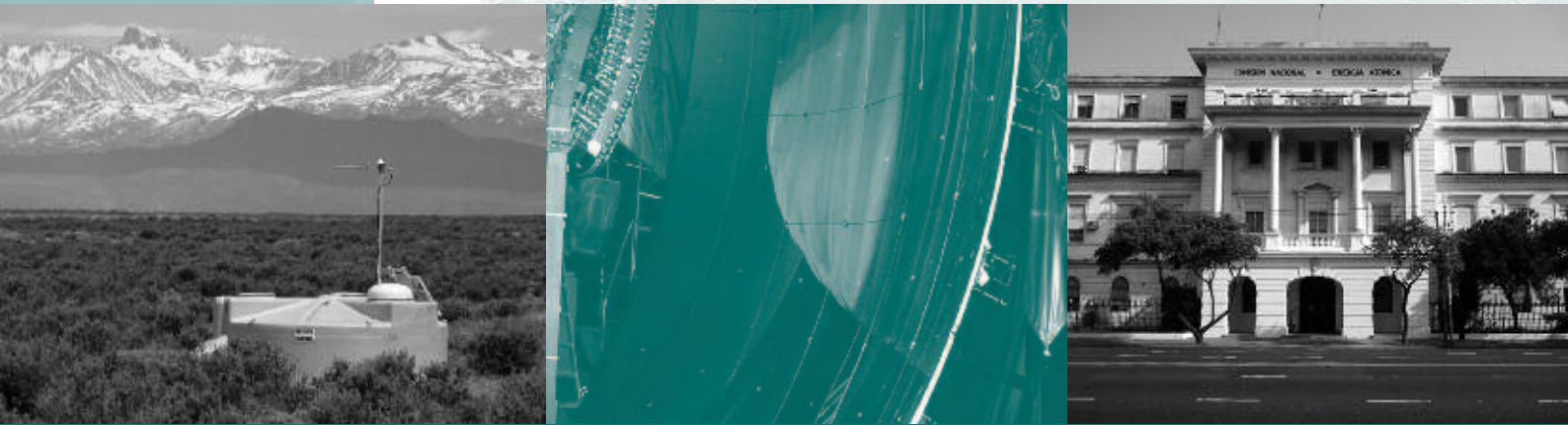
cells in *Nature Medicine*, *Nature Immunology* and *Cancer Cell*. Kornblihtt's lab at the University of Buenos Aires has been recognized for its work in gene expression and how a single gene can generate multiple proteins – the molecules that travel between genes and other biological structures, with papers in *Cell*, *Nature Structural and Molecular Biology* and *Molecular Cell*.

Argentinian scientists also have an important part in science institutions around the world.

“The Howard Hughes Medical Institute had grant programme many years ago for Canada and certain countries in Latin America, including Argentina”, said Kornblihtt. “Those programmes were five-year grants – very competitive. For years, Argentina had almost as many resident scholars as Canada.” Today Schinder and Kornblihtt are two of the 13 senior international scholars of the institute.

Some major findings in agricultural technology have also been made through Argentinian science. A study by biologist José Estévez of the University of Buenos Aires and CONICET on how sugars affect plant growth was published by *Science* in 2011. Also, Raquel Chan's team at the Agrobiotechnology Institute of the Universidad del Litoral last year was able to use genes from sunflowers, one of Argentina's major crops, to make a more resilient strain of corn. Argentina is also home to Instituto Nacional de Tecnología Agropecuaria (INTA), a government agency founded in 1956 that is dedicated to agricultural technology research, studying a range of plants from crops to forest trees. In an interview with the Argentinian journal *Revista de Investigaciones Agropecuarias*, Barañao called INTA “one of the pillars of scientific and technological activity in our

Argentina is in the running for the Cherenkov Telescope Array, the location for which will be decided by November 2013.



country” that carries out good basic research combined with “irreplaceable outreach activities”.

REACHING FOR THE SKY

Argentina also holds a prominent place in the physical and space sciences. Argentina is part of the six-nation consortium behind the Gemini Project, which is building, installing, commissioning and operating two new 8.1 metre diameter optical and infrared telescopes, one in Hawaii, the other in Chile. Argentinian astronomers involved with Gemini receive 2.5% of the observation time available for their own studies, said Federico Sánchez of the Institute of Technology in Detection and Astroparticles (ITeDA).

But that’s just a small element of the space science in Argentina – the country is also home to the Pierre Auger Observatory, the world’s largest cosmic ray observatory, aiming to discover the origin of the most energetic particles in the universe so far observed from Earth.

Cosmic rays are mostly protons and more complex atomic nuclei that hail from deep space and largely originate either from supermassive black holes at the centres of distant galaxies or stars that died in huge explosions. They travel near the speed of light to the Earth and produce cascades of other particles when entering the atmosphere. One cosmic ray can produce millions of those other particles spanning several kilometres on the Earth’s surface.

In 1992, American nuclear physicist James Cronin and British astrophysicist Alan Watson wanted to build

the best cosmic ray observatory ever conceived, Sánchez said. The Southern Hemisphere happens to present the best view of the Galactic centre – the rotational centre of the Milky Way. The observatory’s planners also needed enough space, over 3,000 square kilometres over a large flat area for cosmic ray detectors. Finally, they needed the sky above to contain few clouds and a quiet atmosphere. Several workshops later, there were three candidates for host countries, Australia, South Africa and Argentina – and an international panel selected Malargüe, Argentina.

Since then, the Pierre Auger Observatory has produced standout results in the study of cosmic rays. Today the Observatory has more than 490 scientists from all over the world and about 30 Argentinian scientists are members of the collaboration.

“The success of the Pierre Auger Observatory demonstrated that Argentina was a country trustable to host large scientific astrophysical projects”, said Sánchez. “In this sense, it opened the door to other proposals to consider Argentina as a host country.”

Some of these new projects, such as the European Space Agency’s Deep Space Antenna, are already built and installed in Argentina. Argentina is also in the running for the Cherenkov Telescope Array, the location for which will be decided by November 2013.

The conditions for science in Argentina improved quite substantially over the decades, said Juan Pablo Paz, a quantum physicist with the University of Buenos Aires who won last year’s TWAS Prize in physics for his work on the loss of quantum information into its envi-

Right: Headquarters of the Research Centre of the Sea and Atmosphere (CIMA) and the French-Argentinian Institute for Climate Studies and its Impacts (UMI-IFAECI) in Buenos Aires. Far right: (from left) CIMA and UMI-IFAECI director Carolina Vera talks with Virna Meccia and Fernanda Cabre, formerly PhD students at CIMA (Photos: CIMA).



ronment. “People are going abroad for postdocs and are returning back to work here. The number of students graduating increased substantially. There is zero unemployment in physics nowadays, and there is more money flowing into science.”

Physics became a major field in Argentina in the 1950s, Paz said. At the time, the government had developed the National Atomic Energy Commission in a push to develop nuclear power. Now, there are more than 10 universities where people can get a degree in physics in Argentina, and most have a PhD programme. The largest universities are Buenos Aires, Cordoba, La Plata and the Balseiro Institute in Bariloche. In Buenos Aires, which has the largest physics department in Argentina, more than 20 PhD students graduate with a physics degree every year.

“There are about 1,500 physicists working at the moment in the country and they work at a number of institutions, mostly owned by the state”, said Paz. “Research in private companies does exist but is not the main player here. Research in universities suffered a lot during military dictatorships as it was viewed as dangerous to mix scientists with students and politics. But that past seems to be over and, especially during the last 10 years, there are rather good conditions for science in universities.”

Many physicists were involved in the development of the Argentinian company INVAP in the 1970s, noted

Paz. INVAP recently designed and built a satellite called SAC-D that launched in 2011 and carried NASA equipment called Aquarius, which measures global ocean salinity. INVAP, Paz noted, also builds high-tech radars and exports nuclear reactors (see box on page 21.)

DOWN TO EARTH SCIENCE

Earth scientists from Argentina have contributed in three major issues during recent decades, including leading research on the tectonic evolution of the Andes, which are still growing from the effects of the tectonic interaction along South America’s west coast.

The Earth science field also has economic use, said

Victor Alberto Ramos, a geologist with the University of Buenos Aires who studies Andes formation. “The study of the Andes fuels the finding and mining of giant copper and gold mines of Argentina and Chile, as well as the oil fields all along the Andean foothills from Colombia to Patagonia”, said Ramos.

“The Earth Sciences, mainly geology, was one of the first disciplines taught in the School of Sciences of the Universidad de Buenos Aires, as early as 1865”, said Ramos. There are 14 geology departments in Argentina, including large ones in Buenos Aires, La Plata, Córdoba, Salta and Tucumán. These departments, he said, have staffs of over 40 people.

Argentina also has a long history of natural hazards such as earthquakes and volcanoes and has developed

With more rainfall in some areas and warmer, drier weather in others, Argentina is focused on climate science.

CÉSAR MILSTEIN, NOBEL PRIZE IN PHYSIOLOGY OR MEDICINE, 1984

• **Milstein (1927–2002)** won the Nobel prize for his work on the laboratory production of monoclonal antibodies, an extremely useful medical tool with applications ranging from drugs to diagnostics.

In *Les Prix Nobel*, a yearbook published by The Nobel Foundation, he credited his immigrant parents with the sacrifices that made his academic life possible. He had a prosperous career in the biochemistry of enzymes, but government persecution of scientists and intellectuals interfered with his work and forced him to leave Argentina in 1963 for Cambridge in the United Kingdom. There, Milstein's research interests shifted from enzymes to the immune system. At MRC Laboratory of Molecular Biology, he did landmark work in immunology, discovering a means to produce monoclonal antibodies.

Milstein was an Associate Founding Fellow of TWAS. His work was characterized as “the most important immunological advance of the century” in a commentary by Abraham Karpas, the assistant director of research at Cambridge's Department of Haematology, for a 2002 edition of the British magazine *Times Higher Education*. The work “opened numerous new and unforeseen avenues for research, many with medical implications”, Karpas wrote.



several institutes to monitor them. The recent 2011 Maule mega-earthquake shook and moved the city of Buenos Aires 3 to 4 centimetres in a few hours, Ramos noted. “Based on more than hundred years of experience, our scientists and technicians have developed networks of seismic detection as well as volcanological observatories to mitigate those natural disasters”, he said.

Argentina is also keeping on top of atmospheric, oceanic, and climate sciences through Argentinian organizations, the Research Centre of the Sea and Atmosphere (CIMA) and the French-Argentinian Institute for Climate Studies and its Impacts (UMI-IFAECI).

“Climate-related investigations have remarkably grown worldwide and in particular in Argentina during the past decades”, said Carolina Vera, an atmospheric scientist and director of both CIMA and UMI-IFAECI. “It is now possible for climate scientists to monitor, simulate and project global climate with unprecedented accuracy so that climate information can be used for decision-making.”

CIMA researches how to numerically simulate and predict atmospheric and ocean processes. Since 2010, CIMA became a part of UMI-IFAECI, an international unit jointly sponsored by *Centre national de la recherche scientifique* (CNRS) of France, CONICET and the University of Buenos Aires. The French-Argentinian Institute works to simulate and predict climate variability and change, as well as their impacts in southern South

America and surrounding oceans. It also fosters studies on how climate variability and change will impact population, biodiversity, production and vulnerability.

Argentina has good reason to have a stake in climate science, said Vera. More warm-season rainfall in the central lowlands of Argentina has partly led to agricultural regions shifting from grazing animals to farmland in the 20th century, and modern climate models are projecting those regions will have increasingly wetter summers, which will continue to influence agricultural trends. Meanwhile, in the southern-most region of Argentina, projections expect a warmer, drier climate, which could cause glaciers to further retreat in the region, affecting an important source of fresh water in the country.

The Institute's staff includes 47 researchers with positions. In the last four years, 14 postdocs performed research at the unit, 76 PhD students performed their thesis work, and 35 master-level students have also done their theses in climate science. Between 2010 and 2013, a total of 254 articles were published in refereed journals. UMI-IFAECI researchers also have leadership roles in international panels and programmes like International Panel on Climate Change. “UMI-IFAECI (is) a very powerful research pole not only of relevance in Argentina, but also at the international level,” Vera said. ■

◆◆◆ Sean Treacy