

CAREERS

GALACTIC EXPLORER Cosmologist aims to map the Universe's changes **p.251**

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Students occupy Argentina's Science and Technology Ministry in December 2016 to protest against huge cuts to researcher numbers.

FUNDING

Austerity bites deeply

Institutions in Argentina and Brazil are struggling to maintain their funding and talent.

BY ANNA PETHERICK

PhD students in Luiz Davidovich's quantum-optics laboratory at the Federal University of Rio de Janeiro (UFRJ) in Brazil are afraid to turn on the lab's main laser in case it malfunctions. Davidovich encourages them to be extremely careful. "If it breaks — and lasers do break — that's it," he says. "There's no money to replace or fix it."

Davidovich, who was elected president of the Brazilian Academy of Sciences last year, says that institutions supported by Rio de Janeiro's state government are reeling from the latest round of funding cuts.

Salaries are several months in arrears at Rio de Janeiro State University, which forced it to close for three months earlier this year.

The state's research funding agency, FAPERJ, is bankrupt, yet still publishes calls for new projects. "There's a law that says they have to — but they know they don't have money to pay for the projects they have already approved," says Davidovich. "It's a theatre of the absurd."

Brazil's bleak financial picture has caused great disquiet among researchers across the nation. In March, the federal government announced that it was slashing the proposed 2017 science budget by 44%, bringing it to the lowest level in 12 years — 2.8 billion reais (US\$888 million). Although cuts were made across almost all federal ministries, the reduction in science spending hit particularly hard because the budget had already been chopped every year since 2013 (see 'Brazilian science funding squeeze').

Yet Brazil is not the only South American nation where scientists are struggling because of the dire economic situation. Researchers in Argentina, which has the most Nobel prizes of any South American country, also face an uncertain and potentially grim future. Both countries have undergone political swings to the right in the past few years, electing governments that dismiss the value of science funding.

Argentine President Mauricio Macri cut the science ministry's budget by 36% in real terms as part of an austerity programme that he hopes will attract foreign investment. Argentine researchers now fear that if Macri's party gains a congressional majority in October's mid-term elections, he will fuse the science and education ministries. "It would imply that Macri's government sees science as ►

► having more to do with culture than with industry and innovation,” says César Bertucci, an astrophysicist at the University of Buenos Aires. And the nation’s commitment in 2013 to steadily increase its stock of scientists by 10% every year to 2019–20 is faltering.

Some researchers forecast a brain drain from both nations. “When that comes, as always, it will be the best who leave,” says Davidovich.

DECLINE AND FALL

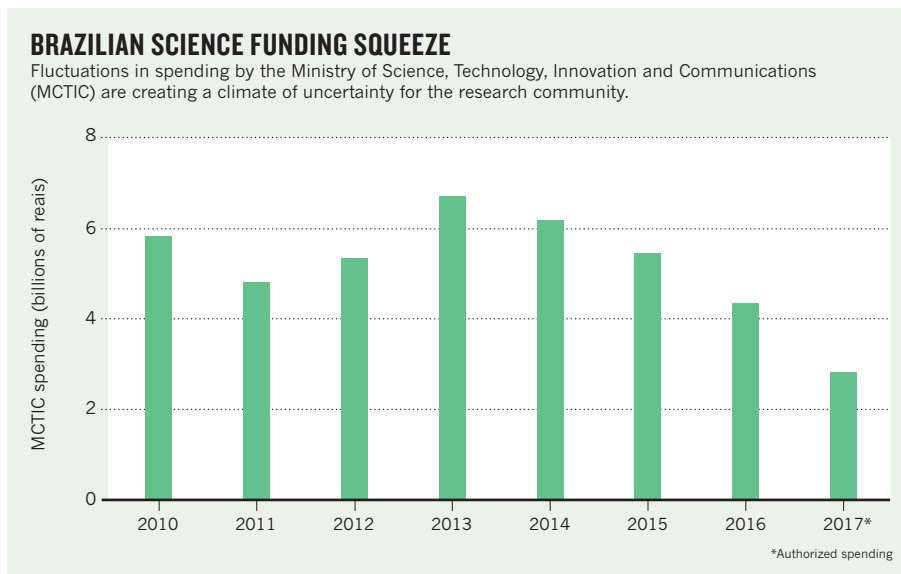
Bertucci returned to Argentina about ten years ago, when both his native country and Brazil were enjoying a scientific blossoming. This was thanks to increasing amounts of public funds supporting research and heads of state who perceived such support as a means to economic and social development.

But that halcyon era is over, and for some scientists, the current financial struggle has already proven too much to withstand. Neuro-anatomist Suzana Herculano-Houzel returned to Brazil in 1999 after completing her postdoctoral studies at the Max Planck Institute for Brain Research in Frankfurt, Germany. She worked as a visiting scientist at a museum, then moved to the UFRJ in 2002 and was promoted to associate professor in 2005. By then, she had won a small three-year grant from FAPERJ and was using a saline suspension and DNA dye to count the neurons in rodent brains — the first time such a method had been accurately applied to brain cells, she says. She later applied the method to larger rodents and, eventually, to primates, earning recognition from colleagues and fanfare, particularly after producing a TED talk about it. “After that initial bit of funding, things went really well in Brazil until about 2014,” she recalls.

But the rot set in for her that year, at around the same time that a corruption scandal started to engulf Petrobras, Brazil’s partly state-owned oil company. The scandal grew as the government grappled with an economic crisis that led to widespread public-spending cuts, which cast a pall over many Brazilians’ hopes for the country’s upward mobility, particularly in the scientific realm.

Herculano-Houzel had applied for a \$30,000 grant from the Brazilian National Council for Scientific and Technological Development, but learnt late in 2014 that she would receive just \$13,000. Even worse, it took several months for the funds to arrive. In the meantime, she supported her lab from her FAPERJ stipend, and eventually turned to crowdfunding to leverage funds for research aiming to show that the folding of the cortex region of mammals’ brains follows a simple mathematical pattern.

Her lab received more than \$30,600 from that effort, enough to keep it running for six more months as students completed projects. Then Herculano-Houzel bolted in 2016 for a tenured faculty position at Vanderbilt University in Nashville, Tennessee. “It was like — of



SOURCE: MCTIC

course I’m leaving,” she says. “When I arrived here at Vanderbilt, I realized I had developed a chronic anxiety disorder.” Nearly all her former lab members in Rio have also since left Brazil, she says, thanks to funding woes.

In Argentina, the outlook is especially grim for junior researchers. The National Scientific and Technical Research Council (CONICET) has reduced its proposed number of new research posts for 2017 by 50% as a result of funding cuts. Perversely, this is encouraging some of Bertucci’s former students — who are now doing postdocs in France — to try to return sooner than they otherwise would have for fear that things could get worse in the future. Nahuel Andrés, a postdoc in the plasma-physics lab of Pierre and Marie Curie University in Paris, expects to apply for a post this December, accelerating his planned return to Argentina by a year. “I have to apply now so as not to lose one of the last permanent positions that there may be for many years,” he says.

“It’s a huge crisis. Nobody knows how we are going to escape from this.”

LIFE AT A CROSSROADS

For Guadalupe García, things have already got worse. She is one of around 400 researchers who were recommended for a seven-year fellowship at CONICET after three stages of competitive evaluation. Last December, she learnt that her fellowship had been cancelled owing to budget cuts. As a medical anthropologist trained at the University of Buenos Aires, she has developed relationships with hospitals in the low-income suburbs around the city and says that she is not keen on setting down research roots elsewhere. In her work, she analyses how medical technologies become integrated into patients’ lives.

While she awaits the result of a professional appeals process, García plans to teach. In the long term, if a CONICET position fails to

materialize, she may go into teaching more permanently — or move abroad to continue a research career. Neither option is her first choice. “I worry that if I stop research to teach, I will become out of touch with cutting-edge methods in my field,” she says. “And although I am looking for positions abroad, I don’t want to emigrate. I want to give back to the society that has invested in me, in my training.”

Researchers in both nations are trying to plan their futures. “Argentine scientists are getting together and discussing science’s place in society,” says Bertucci. “We are receiving messages from the president of CONICET, Alejandro Ceccatto, that we’re in a war economy.”

In Brazil, PhD student Kleber Neves at the UFRJ has noticed the same shift. “People here were very comfortable just staying in the university and doing their research,” he says. “But suddenly they are aware of the necessity of convincing society at large that what they do is important — the feeling is that the public needs to be on your side, otherwise the cuts will go through and nobody will care.”

To this end, Davidovich and his colleagues in the Brazilian Academy of Sciences are working on a report that will explain what better-resourced science could do to alleviate some of Brazil’s problems, from the Zika virus to deforestation, as well as to boost the economy. Davidovich expects to deliver the report to the science minister by the end of the year. “And, maybe just symbolically to the president, whoever that may be,” he adds, half in jest. Davidovich is referring to allegations of corruption against current president Michel Temer and the impeachment last year of former president Dilma Rousseff after she was found guilty of breaking budgetary laws. “It’s a huge crisis,” he says. “Nobody knows how we are going to escape from this.”

Neves has ten months left of a PhD that he started in 2014 in Herculano-Houzel’s lab. He completed the experimental part of his project

before the lab's funding became really tight, but he is starting to doubt that a research career is for him. "Here people work like crazy for a few years, then they go abroad, come back and become professors here — at least that's what happened with the previous generation. This generation might be forced to change this," he says. "Young people are seriously considering doing their whole careers abroad."

SEARCH FOR SALVATION

Scientists in São Paulo state are better off than elsewhere in Brazil, thanks to a provision in the state constitution. Under that stipulation, the São Paulo Research Foundation (FAPESP), which provides grants to researchers, has been receiving 1% of São Paulo state's annual tax receipts since 1989. Researchers say that this model buffers shifts in the availability of science funding. Applications for FAPESP postdoc fellowships have risen by 8.5% in the past year.

Still, neuroscientist Miguel Nicolelis, a faculty member at Duke University in Durham, North Carolina, says that he was disheartened by a recent visit to the University of São Paulo (USP), where he earned his PhD and medical degree. "When I heard of the difficulties young researchers were facing, I was ready to cry because, in my opinion, USP is a patrimony of the Brazilian people," he says.

Both nations have tried to expand research in the private sector, but have met with mixed success. Argentina's science minister, Lino Barañano, has prioritized translational research in key areas, including biotechnology and agriculture. But the funding dried up before his efforts had a chance to generate much in the way of profits and jobs, says Tomás Santa Coloma, a biomedical researcher at the Pontifical Catholic University of Argentina in Buenos Aires. Current policies to lure foreign investment don't favour the small- to mid-sized start-ups that Bertucci thinks could power the economy.

Fernanda de Negri, a researcher at the Institute for Applied Economic Research, a Brazilian government-affiliated think tank, says that Brazil's efforts in innovation are stymied by counterproductive legislation. One law, for example, gives tax breaks for corporate research and development, but another discourages investment by the private sector.

It seems that little will soon improve, says Glauco Arbix, former head of FINEP, the Brazilian federal government's primary innovation funding body. "Brazil's system is a jungle of impediments," he says, "dedicated to creating obstacles to research and innovation." ■

Anna Petherick teaches Brazilian politics and public policy at the University of Oxford, UK.

TURNING POINT

Galactic groundbreaker

Astrophysicist Marcelle Soares-Santos, a Brazilian native, leaves the Fermi National Accelerator Laboratory in Batavia, Illinois, this month to launch her own lab at Brandeis University near Boston, Massachusetts. She plans to merge her enthusiasm for galaxy clusters and gravitational-wave research to develop tools to explore how the Universe expands and evolves.

What drew you abroad?

I was doing my PhD at the University of São Paulo in Brazil, researching galaxy clusters, when I received a sandwich fellowship from the National Council for Scientific and Technological Development in Brasília. Under this programme, students start their PhD in Brazil, travel abroad to do research and return to Brazil to graduate. The middle of my sandwich was at Fermilab, and that experience changed the trajectory of my career.

How so?

Cosmologist Scott Dodelson, who works at Fermilab, gave a talk in Brazil the year before I came here. I chatted with him and was able to work with him once I secured the sandwich fellowship, and discovered there that I could build a larger network of collaborators and broaden my research interests.

Were you in the right place at the right time?

Definitely. In 2010, as I was finishing my PhD, the Dark Energy Survey — an international effort to produce a map of the Universe's expansion — was ramping up and I knew I wanted to work on it. So I applied for a postdoc at Fermilab and got it. I was lucky enough to have the opportunity to work on construction of the Dark Energy Camera, which is mounted on a telescope at the Cerro Tololo Inter-American Observatory in Chile. Now I'm analysing data from the camera I helped to build, which is amazing.

How did you get involved in the search for gravitational waves?

In 2013, the multinational collaboration overseeing the Laser Interferometer Gravitational-wave Observatory (LIGO) was preparing to begin observations in 2015 from two gravitational-wave detectors — one in Hanford, Washington and one in Livingston, Louisiana — that detect ripples in spacetime. The collaboration asked for people to look for electromagnetic signals that would corroborate their results. I proposed to my colleagues that we form a team to search for



visible evidence of LIGO-detected events, such as black-hole collisions, which appear bright and then fade. We haven't found anything yet, but it's just a matter of time until we do.

What are your plans?

I want to use gravitational-wave events to map out the history of expansion of the Universe, and, because galaxy clusters grow at a rate that also depends on cosmic history, combining the two is a powerful way to probe cosmology.

What is your response to a recent survey about gender and racial harassment in astrophysics?

I try not to think too much about these issues. Racism and sexism are not easy to talk about when you want to focus on research. It's frustrating because I don't see much change.

How will you try to make a difference?

Starting my own lab provides one space where I can enact change, and be more inclusive, more open and more fair. I will be careful to check my own biases. I am concerned about perpetuating some behaviours, such as preferential support for certain students.

Will you return to South America?

No. The research possibilities would be limited there today, given both the political and funding situation. I maintain contact and collaborations with colleagues in Brazil, and I plan to find ways to improve those connections — perhaps by hosting a student on a sandwich fellowship one day. Most of my colleagues who went abroad returned to Brazil and got established there, which was a big success for the sandwich programme and helped to strengthen research in Brazil. ■

INTERVIEW BY VIRGINIA GEWIN

This interview has been edited for length and clarity.