Perspectives from María Isabel Yuseff

Associate Professor and group leader, Pontifical Catholic University of Chile | EMBO Global Investigator

Was it difficult to move after your PhD in Chile to the Curie Institute in Paris?

It was challenging for two reasons – not because of our scientific knowledge in Chile which I'm really proud of – but because I switched gears in my field of research. I was really into cell biology and switched to doing my postdoc in immunology – something I said I would never do because I thought it was so complicated! I had to learn quickly to speak a new language. I was learning to speak French and learning to speak immunology.

Was it a deliberate choice to challenge yourself?

What happens in Chile frequently is that people do their undergraduate thesis and then the PhD and postdoc in the same lab – focusing almost on one protein. For me, I like being challenged, and looking at different cells, fields, topics really helps me to develop into a scientist that asks the more important questions.

What are you researching now?

I look at immune cells a little differently than a classical immunologist. I look inside the cells at the mechanisms. That's what motivates me and my students. I want to understand how B lymphocytes become activated initially. When they receive the first signal from an antigen presenting cell, they establish an immunological synapse. If they don't do this efficiently, if the cell biology doesn't work at this point, you don't have an efficient immune response.

The flipside is if it works too well, you get types of autoimmunity diseases. If you understand how to fine tune the initial activation, you can think of modulating responses. If you want to improve vaccine, how do you present an antigen to these cells, or if you want to develop cancer immunotherapy, for example.

Is there a specific purpose or do you simply want to know how this works?

Sometimes it's just where the curiosity takes you. Intrinsically, I'm wired just to understand basic science. That's my motivation. I really want to know how these cells work and how they're so clever in becoming activated, and interpreting all of these extracellular cues and developing different responses. In the end, of course, if this information is available to finetune immunotherapy that's great but it's not my focus for now.

How would you describe the life sciences in Chile?

Being in Chile has its ups and downs. We're doing things that ten years ago were impossible. On the other hand, when I go to EMBO meetings I see people with higher technology and think we're growing further apart in the technological reach. That troubles me a bit, but we still have this global interaction. That's why global networks are so important because you talk to people who are pushing the limits and then you can collaborate and get to know all the new things that are happening.

On the good side of being in Chile, since we don't have this massive access to everything you want in the moment, you get to think about things a little bit more. You really ask the questions and take the time to figure out what's the smartest and most efficient way to answer this question. It really trains you as a PI. It challenges you and it challenges your students. You have to be more inventive.

What was it like moving back to Chile?

Mixed feelings. You usually come back mostly for personal reasons, because family is involved. That's one of the main things I would say, especially for women.

Once you're here, you realize you don't have the same advantages you have in Europe, US or more developed countries – the first three years are very frustrating because you come from a postdoc position in my case from the Curie Institute where I would just go down and access all the microscopes or see people with Nobel Prizes giving lectures.

But then you realize that science is all about the questions that you want to ask. It's about getting a group of people discussing how to solve interesting questions. Then you start interacting with students, you get your group and it starts growing and you feel like 'hey, there's a scientific vibe here'. The questions we're asking are the same questions people at NIH are asking, and they have similar approaches. It's just that they have more money to do so.

The EMBO global network really makes a difference because you're part of a larger community and it doesn't matter so much where you are geographically, you can still really connect. We speak the same language: science!

What advice do you give people in Chile considering a career in the life sciences?

I think it's great, especially for women. If there's one moment in time where it's good to be a female scientist, it's now. It's good for women in science and good to do science because more and more scientists are respected worldwide. We can really contribute to making a difference in health sciences – vaccines are a clear example. I tell students it's a great place to work.

I think the main barrier for students to go into graduate programmes is because they're scared they're not good enough. I try to overcome this and say 'I thought I wasn't good enough at the beginning and look where I am!' Don't be afraid to try.

I have a twelve and ten year old and my oldest daughter once said 'Mom, why do I see you working so much? Do you need to earn more money or something?' I said it's not about the money, it's that I found something that I really love, and I hope someday you find the same passion.

Meet scientists from the EMBO communities

Christian González-Billault
Will we ever fully understand the brain?

Vice-Rector of Research and Development, University of Chile, Santiago | EMBO Associate Member

Studying how human brains age has particular challenges for researchers like EMBO Associate Member Christian González-Billault. For a start, experimenting on a living brain is clearly out of the question, but what happens in a mouse model might not be the same as in a human brain.

"Also, the experiments that we can do in humans using brain image analysis or brain metabolism do not provide resolution enough to understand what's going on in single synapses or even at the molecular level," he says.

González-Billault and colleagues are using novel techniques to overcome the challenges: "We have to obtain human neurons produced from other sources. We're using skin cells collected from humans by a simple biopsy procedure and we convert them into neurons."

Converting the cells into specific neuron cell types could serve as a proxy that allows an understanding of activity within the brain of an individual. The technique also preserves the age of the sample, so a skin sample from a person of 25 or 77 will produce neurons of 25 or 77 respectively.

"In that way we're trying to understand the consequences of aging and we're talking only about aging," González-Billault says. In a leadership position from 2023 at the University of Chile as Vice-Rector of Research and Development, González-Billault is proud of his nation's achievements in the life sciences despite the relative size of the community. "We do pretty cool stuff," he says.

Cesar Antonio Ramirez Sarmiento
Designing new plastic-eating enzymes

Associate Professor and group leader, Pontifical Catholic University of Chile | EMBO Global Investigator

The UN Environment Programme (UNEP) says the world is 'choking on plastic' with 400 million tonnes of plastic waste produced each year. EMBO Global Investigator Cesar Antonio Ramirez Sarmiento is helping address the problem by seeking to develop new plastic-eating enzymes able to work at room temperature.

His interest on these enzymes started early in his life. He recalls his mother telling him insects would eat the plastic bags she used to protect plants in the garden, followed by the subsequent revelation in recent years that certain insects have specific enzymes in their saliva and gut that degrade polyethylene. "After that it was demonstrated that different enzymes were able to degrade other plastics, such as PET and some bioplastics" he says.

Many enzymes that degrade the PET polymer found in plastic bottles have been discovered in plant compost as they primarily target plant polymers. "The current industrial implementation of these enzymes to degrade plastic requires very high temperatures. But if we want to consider plastic-degrading enzymes for bioremediation of rivers and streams or to lower the cost in industry you need enzymes that work efficiently at room temperature," he says.

His group is using enzyme engineering and artificial intelligence (AI) to design improved enzymes that operate at room temperature. "This is pretty new for Chile and even for the Latin American region," he says.

María José Pérez Jiménez
Investigating rare genetic diseases

Postdoctoral researcher at the Imagine Institute, Paris, France | former EMBO Fellow

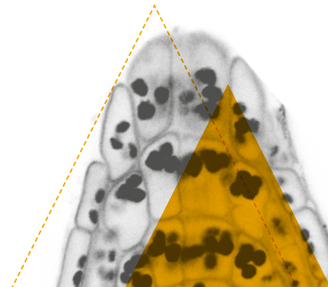
María José Pérez Jiménez moved from Chile to Germany as an EMBO Postdoctoral Fellow to explore the relationship between mitochondria and common neurodegenerative diseases. She is now based in Paris, investigating the connection with rare genetic diseases in children.

"When examining the brains of Alzheimer's or Parkinson's patient, some mitochondrial dysfunction features are also present in the children with rare genetic disorders. This raises the question: What targets can we find that are common between them?" she says.

Pérez Jiménez describes mitochondria as the powerhouse of the cell. "When mitochondria fail, the organs that are most compromised are muscles and the brain. Mitochondrial disorders progress rapidly, and you wonder what we can do for these patients with such aggressive symptoms," she says. "My focus now is to find mechanistic links between rare genetic disease and common neurological disorders, aiming to identify shared therapeutic targets for both."

Perez Jiménez acknowledges the pivotal role of the EMBO Fellowship in her career because it offered financial flexibility and the opportunity to meet other researchers from a wide range of backgrounds at fellows' and other EMBO meetings. "You find people that work in cancer, in Drosophila, in everything," she says.

She is keen to expand her scientific network in Chile. "We want to do research together, apply for grants and bring students to Europe to motivate them. This is a way for me to contribute to the country without returning completely," she says.



Chile and EMBO in numbers

3 **EMBO Associate Members**[a]

Santiago

3 **EMBO Global Investigators**[a]

Santiago

13 **EMBO Courses & Workshops**[b]

733 participants
422 Chilean nationals attended EMBO Courses & Workshops

22 **EMBO Scientific Exchange Grants**[c]

Santiago

Contact

Gonzalo Arenas
Head of International Relations, Chilean ministry for science

Contact point for the EMBO-Chile cooperation agreement

a working in country as of July 2024
b 2018 to May 2024
c awarded to scientists based in Chile for training abroad 2018 to May 2024

Opportunities for life science researchers based in Chile

EMBO Postdoctoral Fellowships

fund internationally mobile researchers for a period of up to two years. Applications are open all year around.

The EMBO Global Investigator Network

supports group leaders within their first six years of setting up their laboratories in Chile. They receive financial support for four years for training and networking activities, providing them with opportunities to form collaborations with scientists in their region and in Europe. Application deadline: 1 June.

The EMBO Young Investigator Programme

supports group leaders in the early stages of setting up their independent laboratories for a period of four years. Networking is a key aspect. Application deadline: 1 April.

EMBO Scientific Exchange Grants

fund research exchanges of up to three months. The grants facilitate collaborations with research groups with expertise, techniques, or infrastructure that is unavailable in the applicant's laboratory. Applications open all year around.

EMBO New Venture Fellowships

help early career scientists to explore topics outside their current area and enter a new research direction. They fund research visits of up to three months. Applications open all year around.

EMBO Core Facility Fellowships

support training for staff of core facilities that provide services to research institutions or universities. They fund international exchanges of up to one month. Applications open all year around.

EMBO Courses & Workshops

stimulate exchanges of the latest scientific knowledge and provide training in experimental techniques. Application deadlines: 1 March and 1 August. Travel grants, childcare grants and fee waivers for scientists in Chile are also available to attend EMBO Courses & Workshops.

EMBO Global Lecture Series

enhance collaboration between scientists worldwide. The series of lectures are given at institutions outside Europe by EMBO Members or Young Investigators, or by leading researchers from Chile who visit European institutions. Applications are open all year round.

EMBO Press

publishes five journals that serve the global life science community: The EMBO Journal, EMBO Reports, EMBO Molecular Medicine, Molecular Systems Biology, and Life Science Alliance, which is published in partnership with Rockefeller University Press and Cold Spring Harbor Laboratory Press.

Find more EMBO schemes at *embo.org/funding*

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Information as of July 2024
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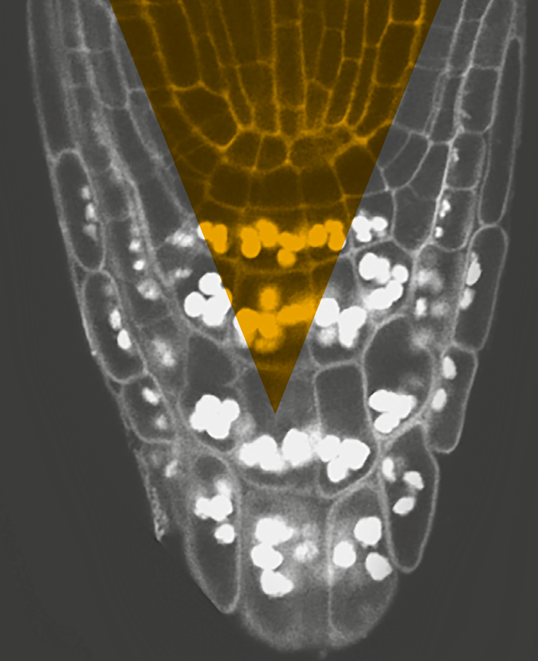

Focus on Chile

EMBO

Facts and figures

The Republic of Chile hosts world class astronomy facilities in the Atacama Desert including the ALMA radio telescope and the European Southern Observatory's Paranal Observatory[1]. Chile has also adopted the 2022 Declaration of Puntas Arenas recognizing the country's southern regions as a natural laboratory for observation, study and adaptation to climate change.[2]

Chile has 61 state and private universities.[3] The University of Chile in Santiago was founded in 1842 and is the country's oldest. It has 16 faculties and three interdisciplinary institutes and attracted 46,937 students in 2021.[4]

National enrolment in universities exceeded 1.3 million in 2023 with female participation of 53.5% representing a 2.5% increase in female enrolment over the previous year. Doctoral students comprised less than one per cent of total enrolment.[5]

In 2020, estimated gross expenditure on R&D was 675 billion pesos or 0.33% of GDP. Government and the business sector accounted for a third of the total each and the higher education / non-profit sector one quarter.[6] About 16,300 people in Chile were employed in R&D work in 2020.[7]

Most patents in Chile are filed from abroad, with 2,764 patent applications submitted by non-residents and 3,136 total applications filed in 2022 to the Instituto Nacional de Propiedad Industrial (INAPI) .[8]

The Chilean government created the Ministry of Science, Technology, Knowledge and Innovation in 2018 and published a national strategy in 2022[9] with the vision of strengthening the country's research ecosystem. Government R&D expenditure in Chile is undertaken through two funding agencies: the Chilean economic development agency (CORFO) and the National Agency of Research and Development (ANID).

A scientific and technological cooperation agreement was signed in 2002, allowing Chile to participate in the European Commission research and innovation programmes.[10]

EMBO and Chile's cooperation agreement commenced in 2018.

Key figures

Population: 19.8 million[11]

R&D spending: 0.33% of GDP[6]

People employed in R&D: 16,348[7]

Patents (INAPI): 3,136[8]

Higher education institutions: 61[4]

Higher education enrolment: 1,301,925[5]

Horizon 2020 & Horizon Europe funding[12]**:**
Number of signed grants: 151
202 participating organizations
One ERC principal investigator
36 Marie Skłodowska-Curie Actions-funded researchers

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