

At the forefront of *science in royal gardens*

In February, a Brazilian biologist will assume the role of scientific director of Kew Gardens in the United Kingdom

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In 1996, at 17 years of age, Alexandre Antonelli, born in Campinas, began to study biology at the University of Campinas (UNICAMP). The call for adventure was too strong to deny, and six months later, he put his studies on hold to spend a year and a half backpacking across Europe. He later moved to Central America and met his future wife, who is Swedish, when they were working for a diving school in Honduras. He went with her to Gothenburg, Sweden, where they settled. He returned to study biology in Sweden and dove into biogeography to see how plants in neotropical regions, such as the Amazon, evolved and conquered their surroundings. During his doctorate, he collected samples in the Amazon for the first time in 2003.

In 2010, after completing a postdoctorate in Switzerland, he returned to Gothenburg to work as the curator of the city's botanical garden, the largest

in Scandinavia, with 16,000 species of plants. Five years later, he returned to work as a professor of biodiversity at the University of Gothenburg. In 2017, he established the Gothenburg Center for Global Biodiversity, which currently has close to 10 million specimens of plants and animals.

At 40 years of age, he holds three citizenships—Brazilian, Swedish, and Italian—and is married to Anna, who manages a psychiatric clinic. The couple has three children: Gabriel, aged 14, and the 12-year-old twins Clara and Maria. At the end of June 2018, Antonelli was at Harvard University as a visiting professor when he was invited to apply for the position of scientific director for the Royal Botanical Gardens in Kew, or Kew Gardens, in London, one of the largest botanical research institutions in the world. The institution brings together 22 million plant species in the garden and 7

million in the herbariums, as well as 1.2 million fungus samples and a bank of 2 billion seeds of close to 40,000 species.

In October, upon publicly announcing his appointment, Kew director Richard Deverell said, "Alex's experience and scientific specializations complement and broaden Kew's strong points. We are enthusiastic about his ability to apply his experience and ambition to further increase the quality and global impact of our science. I am confident that he

Antonelli: ready to bring researchers closer to each other and to the gardeners, as he did in Gothenburg



will not only inspire the scientists and students at Kew but also a new generation through engagement and promotion of science.”

Antonelli will start February 4th with the tasks of increasing integration among the 320 researchers and strengthening Kew’s brand, visibility, and scientific production. One of his intentions is to increase collaboration among Brazilian researchers—not only botanical—as he shares in the following interview.

What do you plan to do as scientific director of Kew?

I have not yet finalized my plans. In the first months, beginning in February, I want to spend time getting to know the areas of work, needs, and plans for each

group in the botanical garden. There are eight departments and close to 25 research groups. One of the priorities is to broaden and strengthen the master’s and doctorate programs in botany and ecology, capitalizing on Kew’s human resources, with more than 320 researchers, and its immense collections. Along with my predecessor, Kathy Willis, Kew developed a strategic plan for scientific research from 2015 to 2020. Now, one of the tasks is to draft and lead a strategic plan for the five following years, through 2025, and to work with the document released a few months ago on the strategy for the maintenance and expansion of the collections through 2030. We need to consolidate these plans before incorporating my ideas and the challenges, such

as climate change. We need to think not only about threats to biodiversity but also about work opportunities around the study of botanical collections.

How do you intend to integrate the living collection of cultivated plants in the botanical garden with the Kew herbarium?

One of the things I plan to initiate soon after I begin is a digitalization project of the living collections and the herbarium. My dream is that any visitor can open their smartphone camera and, with an arrow, understand more about any plant species, fungus, and microorganism being viewed. This will require close to 100 to 150 images per species in different levels of development, before flowering,

with flowers, and with fruits. We are also discussing a new building to update the herbarium, which will be a very large building, as well as integrating Kew's two research buildings. The laboratory is still separate from the herbarium. We want to merge them in order to increase collaboration among researchers. Another objective is to strengthen the connection between the gardeners, who take care of the living plant collections, and the researchers, who work primarily with the herbarium. As the scientific curator of the tropical collections of the Gothenburg Botanical Garden, I took part in a collection trip in South Africa. Half of the team was composed of researchers and the other half of gardeners. It was fantastic. There was a very rich exchange of knowledge between those who cultivate plants and those who study them in their natural habitat. The botanist tends to focus on the plant that represents the standard for a given species, while the gardener observes other characteristics that the botanist often overlooks, such as variation in size and color between plants of the same species. There are also other differences. The university researcher begins work late, sometimes at 10:00 am, while the gardener must start at 6:30 am.

What did you learn in Gothenburg that could be useful for you now?

Something I really like about Scandinavia is the lack of hierarchy in organizations. Both in universities and at the botanical garden, there is a significant openness to differences in opinion and decision-making processes. My impression is that in England there is a much higher level of formality, and each person has a very well-defined position in the organogram. I will work to increase collaboration between research groups and departments. It is important that researchers do not feel suppressed, mentally or in practice, by the organizational structure.

What was the selection process like for the position of scientific director?

At the end of June, I was contacted by Tomas Borsa, who works with Perrett Laver of London and was contracted to manage the selection of candidates for the role. I was not even aware of the position. I was working as a visiting professor at Harvard, invited by the David



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Rockefeller Center for Latin American Studies. According to Tomas, they thought that I could be a candidate, and he asked if I would be interested. There were others, but I felt very honored because this work is a dream for any biologist. I sent my CV and a letter explaining why I would like to work there. I am very happy with what I did at the University of Gothenburg. I have an excellent research group that I trained over the last eight years after I returned from my postdoctorate in Switzerland. This is a unique opportunity to influence studies on biodiversity in a way that is very rare for a university position. In December, I went to Kew's Christmas party, and then on the 11th, I presented a workshop for their 320 researchers. As there was not enough space for everyone in the auditorium, they had to rent a church. I presented my objectives, and I was very well received with only positive comments.

How is Kew today?

It is much better today than a few years ago. There was a restructuring—a rather dramatic one—four years ago, and many people lost their jobs. Kew has never undertaken so many research projects or had so many researchers as they do today. There are more than 1,000 employees in the botanical garden, and 800 volunteers

also work there. It is the largest botanical research institution in the world.

Could Brexit—the exit of the United Kingdom from the European Union—cause problems with the work and funding of research?

There are still many unanswered questions, such as access to European research-funding programs that were always of strong interest to the United Kingdom. There is considerable concern among researchers regarding what will happen as of March. It is quite chaotic. When I begin, it will be a turbulent time. Another challenge is to convince the general population and the government that Kew is very important for the country to maintain the sustainable development goals put forward by the United Nations. Of the 17 goals, at least four are directly linked to biodiversity. We work with research, conservation, and preservation, but food safety is also very much related to botanical research. Making people understand the importance of research and scientific production is a continuous focus that requires additional effort. In 2019, we will organize two science festivals to encourage students and teachers to meet researchers and visit the collections. They will be simple events but extremely important to maintain the direct connection with the public.

The Kew-Brazil collaboration has shrunk somewhat after the completion of the Re flora Project at Kew. How do you intend to work on this?

Kew collaborates with 110 countries, and in my opinion, it is essential to broaden these partnerships to benefit everyone, but of course not without an internal discussion. I need to understand which collaborations and areas would be more strategic to strengthen. As a Brazilian and a tropical biologist, I am very interested in strengthening collaborations with Brazil. I will do what I can for Brazilian researchers to be able to use the collections and establish both individual and institutional connections with Kew with the least amount of bureaucracy.

With whom do you collaborate here in Brazil?

I have many associates, and I receive many Brazilian doctoral students, postdoc-



View of the garden and palm nursery at Kew Gardens, one of the largest botanical research institutions in the world

toral researchers, and visiting professors. I am working with Rosane Collevatti, professor at the Federal University of Goiás, who is here in Gothenburg for one month. I work with André Olmos Simões and Maria Fernanda Calió of UNICAMP, Lucia Lohmann and José Rubens Pirani of USP [University of São Paulo], and Fernanda Werneck of INPA [National Institute of Amazonian Research]. At the beginning of October, I was at the Federal University of Rio Grande do Norte to teach a doctoral course with Professor Fernanda Antunes Carvalho. I tend to go to Brazil and Latin America three or four times a year for fieldwork and conferences. The greatest part of my research was done in the Amazon and in the Andes.

In an article published in PeerJ in October, in collaboration with other authors, you proposed transdisciplinary biogeography, an area that could bring together not only biologists but also geologists, climatologists, and paleontologists to better understand evolution and the formation of landscapes.

Have you worked with researchers in other areas?

Yes, and it has been wonderful to work with geologists, mathematicians, and other professionals who see the same problem from a different angle. But it is a long process. An article about the influence of climate and geology on the biodiversity of mountains, which came out in October in *Nature Geoscience*, brought together climatologists, geologists, botanists, and ecologists—a little of everything—and took three years to be completed because the discussions were very complex. I have always been interested in comparing plants with other groups of living beings. I have done many studies on the analysis of the biodiversity of serpents with Thais Barreto Guedes and Cristiano de Campos Nogueira, both from USP. A doctoral student who is here in Gothenburg, Josué Anderson, is also working with serpents. In terms of methodology, the work with plants and animals is very similar because we carry out molecular analyses and we compare evolution and the history of groups to find patterns in biodiversity. If we find similar patterns in the diversity of plants and animals, this suggests that there are environmental factors involved. In general, the greater the heterogeneity of an environment, the greater the number of species are in the same area. But there is

considerable variation among the metrics for measuring biodiversity. As Josué has seen, morphological methods and molecular methods can lead to different answers. Quantifying biodiversity is a very difficult task. The doctoral student Camila Duarte Ritter, who finished her research two months ago, studied insects and microorganisms in the soil of the Amazon. When we speak about great biodiversity, people often think about mammals and birds, but the greatest players are microorganisms, fungi, and insects. We are seeing much greater biodiversity and finding very different patterns from those of plants and birds.

What was your work in Sweden?

I was very lucky to receive so much funding in Sweden, as I did in Europe, which allowed me to build a strong research group and the center for biodiversity in Gothenburg, bringing together 13 Swedish institutions. The center has two focuses: to advance scientific research and to increase contact between scientists and the public. We have organized many public events to create new links between the general population, companies, and researchers. Two months ago, we brought [British naturalist and TV host for BBC] David Attenborough, and we have hosted seminars and film presentations that have attracted many people. ■