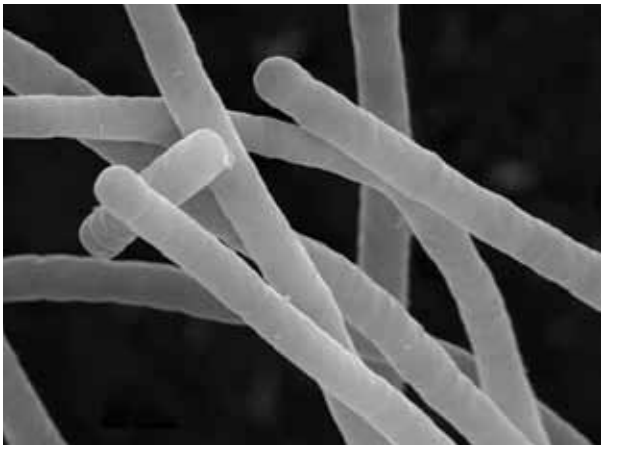
Feature

Change in the air

Life on earth has always had a fight on its hands, as species struggle to adapt to change. The scientists who study evolution, like the rest of us, have to cope with developments in their own lives. Some, like Dr Patricia Sanchez-Baracaldo, manage to combine family and career. But not without a battle – and not without support.

By **Nick Riddle**



Above A large bloom of cyanobacteria seen from space
Right Filamentous cyanobacteria (*Planktothrix agardhii*) as seen under an electron microscope

Under a microscope, they look like thin, translucent filaments of hair. From space, thermal imaging shows them as great swirls of green spreading across oceans and freshwater lakes. They're known as cyanobacteria, or blue-green algae. Not only are they probably the most successful micro-organisms on the planet, but without them, life as we've come to know it would never have evolved.

'Cyanobacteria transformed the atmosphere during the early Earth,' says Dr Patricia Sanchez-Baracaldo. 'They were the first micro-organisms on the planet to perform oxygenic photosynthesis, and in doing so they released huge amounts of oxygen into the air.' This large-scale release – known as the Great Oxygenation Event, and estimated as having happened some 2.3 billion years ago – caused the mass extinction of most anaerobic organisms, which had been the predominant life forms on the planet.

Sanchez-Baracaldo, who trained as a plant evolutionary biologist at Berkeley, California, first looked at cyanobacteria in depth when she moved to Bristol with her husband and began working on molecular ecology as a postdoctoral researcher in the School of Biological Sciences. As a side-project she developed her own ideas on evolutionary biology. 'I was wondering where they sit in the evolutionary scheme of things, and when oxygenic photosynthesis first evolved,' she says.

It was long thought that cyanobacteria first appeared in the world's oceans. But as more and more microbial genomes are sequenced, researchers have been able to begin mapping more accurately the evolution of certain species and their relationships with each other. Sanchez-Baracaldo and a colleague in the States used these new techniques to establish that the first cyanobacteria actually appeared in freshwater rather than marine environments.

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There are still many questions to be answered about the first cyanobacteria to colonise the oceans. Since they would have used carbon dioxide to photosynthesise, this would have had major effects on global nutrient cycles and the climate of the early Earth. Indeed, the geological record shows major climatic events such as global Earth glaciations following the rise in atmospheric oxygen. So how are these events linked? And what role do micro-organisms play in regulating the global environment?

The parental era

Some chains of cause and effect are much easier to trace. Sanchez-Baracaldo had already changed research fields after moving to Bristol from Berkeley; then, having gained a foothold in phylogenetics, she entered another period of change with the birth of her first child.

That brings an environment all its own: round-the-clock duties, sleep deprivation, sickness, baby talk … hardly conditions in which academic-level work can thrive. 'I wanted to take a year off with each baby, and I don't regret it for a moment,' she says. But it came at a cost. After her second child, born 18 months after the first, she left science to concentrate on parenthood.

'After so long away from science, you lose confidence,' she says. 'Your field moves on, your peers move up, new techniques come along. The statistics show how many women leave science after having a baby. And I wonder if some of them regret having left.'

Strictly speaking, she never left science entirely. 'During maternity leave I explored different ideas,' she says. 'I wanted to do something worthwhile for society.' In 2007-08, she advised the Ministry of Environment in her native Colombia on the effects of climate change on high-altitude ecosystems in the Andes: 'The higher temperatures put those ecosystems at greater risk, and they'll eventually disappear. That work sparked my interest in climate change.' She also collaborated on a paper with a colleague in the States, an experience she recalls with mixed feelings. 'That was hard – she would email me drafts, but I was totally sleep-deprived; it felt like an achievement if I managed anything beyond keeping my children happy, clean and fed.'

At the end of her second maternity leave she worked part-time in Biology, running a training programme for PhD students. 'But then several people told me there were funding opportunities for women who had left science for caring responsibilities, and I decided to look into it. I was convinced there was no chance – I'd packed away all my notebooks …'

THE FELLOWSHIP BRINGS HIGH EXPECTATIONS AND I WANT TO FULFIL THEM

It may be easy to say now, but the chances are that the scientist who, as a child in Colombia, loved 'watching all the nerdy nature documentaries and reading science encyclopedias' would probably have found a way of getting back to something that is clearly her passion.

The turning point came when she heard about the Daphne Jackson Trust, a charity that helps scientists, engineers and technologists to re-enter their field after a career break for family, caring or health reasons. She sent them her CV and a personal statement, was invited to apply, and was accepted. And thus began her own Great Oxygenation Event.

Deep breaths

'It was great to have the Trust tell me that I had a great CV and great publications,' says Sanchez-Baracaldo. 'They were saying "We believe in you", and that's all it takes to spur you on.' She started contacting people at Bristol, beginning with Professor Andy Ridgwell in the School of Geographical Sciences, who studies climate change. 'He liked the work I'd done, and agreed to be my mentor. He was so enthusiastic, I really felt I was on to something good.' Professor Alastair Hetherington in Biological Sciences agreed to be a second mentor.

She then wrote a proposal for a project – studying how events such as the evolution of cyanobacteria influenced the global environment and past climatic events – and applied to the Royal Society for a Dorothy Hodgkin Fellowship, which is designed 'for excellent scientists in the UK at an early stage of their career who require a flexible working pattern due to personal circumstances such as parenting or caring responsibilities or health issues'.

'Applications to the Royal Society have a tiny success rate,' she says. 'I worked so hard on it; as soon as my baby was asleep, I was at the computer.' But it paid off: in 2011 she was awarded a prestigious Dorothy Hodgkin Fellowship, with five years' funding.

Labs and laundry

'It's still a challenge,' says Sanchez-Baracaldo. 'The Dorothy Hodgkin Fellowship brings with it high expectations, and of course I want to fulfil them. But if I didn't love challenges, I probably wouldn't have got the Fellowship in the first place. When I was doing my PhD at Berkeley, we worked such long hours in the lab that doing laundry felt like a holiday. Laundry is still one of my favourite chores.'

But, as with the early Earth's atmosphere, it's all about finding the right balance. She had given up a postdoctoral fellowship at Yale to follow her husband to Bristol, a decision that caused some of her peers to raise their eyebrows; and at times, she admits, 'I regretted changing research fields, which I had to do when I came to Bristol. But now, I have support from the Royal Society and the University, I'm doing interesting work, and I have two beautiful kids.

'It's amazing how things have worked out,' she concludes. She's referring to her own career, of course, but the same goes for the evolution of life on Earth; life that she and others have devoted their careers to studying. ●

Patricia Sanchez-Baracaldo portrait © Nick Smith