

By Nicola Spaldin

# Find your most interesting question

It started with a casual remark over coffee. It was the late 1990s, and I was a postdoc in Karin Rabe's ferroelectrics research group, then at Yale University. Ferroelectrics are materials that exhibit a spontaneous electric polarization that can be reversed by applying an electric field. Although they were named after an analogous magnetic phenomenon—ferromagnetism—ferroelectrics were generally thought to not have magnetic properties, which made me, a budding magnetism researcher, an apparently odd fit for the laboratory. That odd juxtaposition, though, turned out to be crucial to my career. "It's a pity there are no magnetic ferroelectrics," my labmate said to me as we guzzled espresso, "because then we could collaborate."

"Woah! Is that really true?" I thought. "Are there really no magnetic ferroelectrics? And if so, why?" It was an intriguing fundamental question, and such materials could be technologically useful if they could be made. It soon became, for me, the most interesting question in the world. So when I took my assistant professorship at the University of California (UC), Santa Barbara, a few months later, I abandoned my plan to work in the well-established field of semiconductor nanostructures and embarked on a single-minded hunt for magnetic ferroelectrics.

My quest for these multiferroics was quixotic, but my timing was fortuitous. First-principles electronic structure theory had matured to the point where materials I thought might be good candidates could be studied. My postdoctoral work had involved extending electronic structure methods to study magnetic systems—exactly what I needed to predict the properties of new multiferroics.

Armed with these tools, I set out to create computer models of magnetic ferroelectrics. I calculated, thought, and calculated some more until, in 2000, I was ready to publish at least a partial answer to the question, "Why are there so few magnetic ferroelectrics?"

Around that time, though, I discovered a downside to having so much scientific fun: Solving difficult problems takes time, and my publication record wasn't strong enough, according to my pretenure review. Also, when you work in a field no one else works in, you don't garner a lot of citations. Kind mentors advised me to start doing something more mainstream—quickly.

Instead I kept going, hoping to see my predictions tested in the lab. I embarked on a pretenure lecture tour, proselytizing about the emerging field and seeking collabora-



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tors. My enthusiasm rubbed off, and some excellent experimentalists began making structures I had designed. I gathered the courage to organize the first-ever multiferroics session at the 2001 March meeting of the American Physical Society, which gave the field a further boost. A year later, I was tenured. Phew!

In 2003, in collaboration with the group of Ramamoorthy Ramesh (now at UC Berkeley), we succeeded in producing and understanding thin films of what is now one of the most-studied multiferroic materials, bismuth ferrite. This led to a *Science* paper and an important lesson: A high-profile publication can really help stimulate a field. Soon after, many research groups and industrial labs began working on multiferroics. Before I knew it, multiferroics were no longer "mine." They had a life of their own, with thousands of active researchers around the world.

Frighteningly, I have reached the stage in my career when young people often ask me for advice. My safe and sensible side tells me to pass along the same advice I received: Make a solid contribution to an established field and publish a lot to become known and respected by your community. Save the high-risk stuff until after tenure. But, deep down, I hope young scientists—you—will choose not to follow that advice. I hope instead you will find the question that for you is the most interesting in the world, go after its answer with all your youthful passion, and pioneer your own science revolution. ■

*Nicola Spaldin is a professor at ETH-Zurich in Switzerland and winner of the 2015 Körber European Science Prize for "la[y]ing the theoretical foundation for the new family of multiferroic materials." For more on life and careers, visit [sciencecareers.org](http://sciencecareers.org). Send your story to [SciCareerEditor@aaas.org](mailto:SciCareerEditor@aaas.org).*

# Science

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