CAREERS

Lessons in becoming a scientist

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Careers

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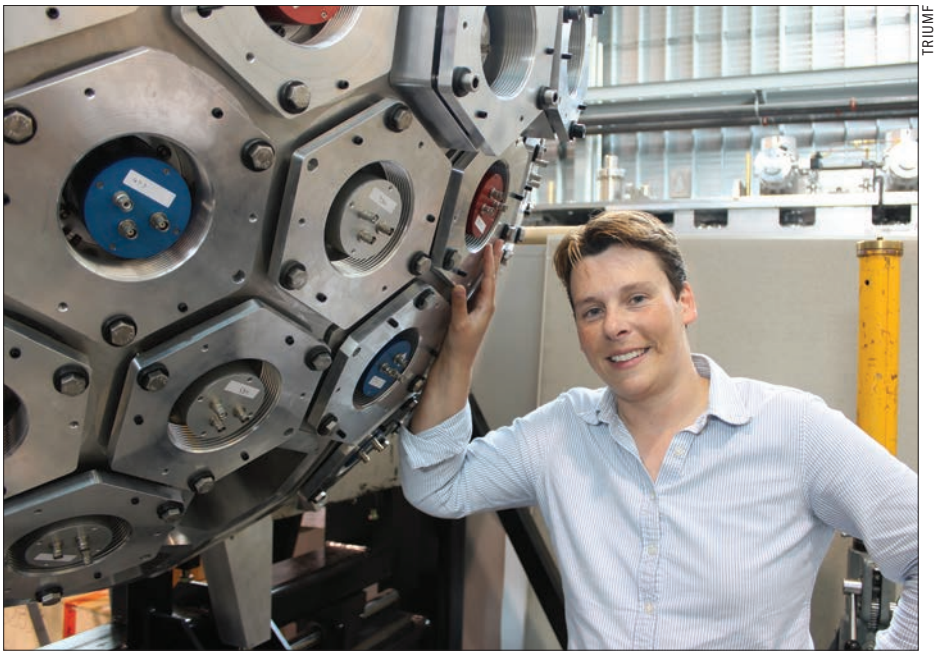
Iris Dillmann describes her journey through a profession that requires people to be both "flexible like a rubber band" and also "hard as steel"



TRIUMF

Passion for science Iris Dillmann has moved her location and her concept of "dream job" over her career.

As a research scientist at TRIUMF, Canada's flagship nuclear physics laboratory, I am, in principle, living my dream – almost. As a child, I actually wanted to become an astronaut. But how do you prepare for such a career as an eight year old growing up in Germany? I decided to pursue my dream by reading all the books I could get hold of about the Russian and American space programmes; the Moon, Sun, stars and planets; and where all the matter around us comes from. But it soon dawned on me that becoming an astronaut wasn't going to be easy. After all, you don't see many astronaut job ads in the local newspaper.

I decided that maybe I could become an alchemist instead, turning lead into gold. This was the first of many career compromises I would make, but unfortunately, my redirected efforts were hampered by my over-protective mother, who refused to buy me a children's chemistry kit because she was afraid I would blow up our house. Instead, I had to wait for the hands-on physics and chemistry classes at school, and then – finally – for do-it-yourself chemistry experiments at the University of Mainz.

Forward and back

Studying chemistry taught me several lessons. First, science is not a 9-to-5 job: the chemical reaction you are carrying out determines your working day, not vice versa. Second, even if you leave the lab at 6 p.m., you are not free. Homework, exams and preparation for the next day won't wait. Third, if you take your studies seriously, there is no time for earning money during the academic year. I was lucky that the German university education system is free of charge, since I would not have been able to afford tuition fees with the little support my widowed mother could give me.

After I received my diploma (Master's) in chemistry, I went on to do a PhD in nuclear astrophysics, and I learned another important lesson: sometimes, taking one step backwards brings you two steps closer to your goal. My first step back was quitting my first PhD thesis topic after 14 months due to strong "disagreements" with my supervisor. I then started work on a new topic in a different city, 130 km away from my fiancé, which meant that I had to commute on the train for around four and a half hours every day. However, the experiences I had in my new research group at the Karlsruhe Institute of Technology were worth every single hour and every single kilometre I had to travel. I am still benefitting from the great time I had there – from the way they did research, how they worked together as team and in a collaboration, and how they behaved as scientists.

Another painful step backwards that eventually brought me two steps forward was the chain of events that led me to move to TRIUMF. After doing postdocs at Karlsruhe and Munich in Germany, I obtained a prestigious grant from the Helmholtz Association as part of their Young Investigators Group programme. This grant would support me through five years of independent research and it came with a lot of money, including the promise of a tenure-track position at the end. With this grant I could – for the first time in my young scientific career – breathe deeply and focus on research instead of constantly thinking about what my life would look like at the end of a two-year postdoc contract.

On paper, life was good: I was back in the Frankfurt am Main area, close to family and friends, with my scientific future on solid ground at a great radioactive beam facility like the GSI Helmholtz Centre for Heavy Ion Research in Darmstadt. What more could I want? Unfortunately, the same grant that gave me such security also created envy among some of my older colleagues, and they preferred to work against each other instead of together. After I participated in a one-year mentoring programme with the Helmholtz Association, I discussed my situation with my mentor, explaining that I felt like I was in a golden cage, a scientific cul-de-sac. I wanted to develop myself further, in a place where my scientific ideas would be valued and supported. After many meetings, my mentor told me that I would not become happier in my position in Germany, and if I did not leave, the frustration would slowly eat me up.

So I applied for a position in Canada, 8000 km away from home, family and friends. I never expected that TRIUMF would take me, but they did, and they also convinced me that I had exactly the attitude and skills they were looking for. I had never heard such words in Germany, where the attitude is generally, "Here is your contract. Be happy that you can work for us." At TRIUMF, I immediately got more responsibility and I am more closely involved with the lab business than I was in Germany. My colleagues and I are measuring the physical

properties of exotic, short-lived radioactive isotopes that can be produced in explosive stellar scenarios such as the core collapse of a supernova or a merger of two neutron stars. Our goal is to understand how heavy elements (between iron and uranium on the periodic table) are produced in a process called "rapid neutron capture". This process is responsible for half of the abundances of elements heavier than iron, and studying it is the prime motivation for almost all current and next-generation radioactive beam facilities in the world – including at TRIUMF, where we are building a new facility called ARIEL (Advanced Rare IsotopE Laboratory). In essence, I am doing the same research as before, but under much better conditions, and with like-minded people who want to work together to do the best possible science.

Like a rubber band

The other important (and related) lesson I have learned is that to become a "good" scientist, you need to be flexible. You need to be able to cope with changes such as lab closures and shifts in research priorities, and it also helps if you are willing to move to the place where you can do the best science. I have moved six times since 2006, and during the nine years I was married, my now-ex husband and I lived in the same place for only three and a half years as we both tried to pursue academic careers. I managed it; my ex did not, and he now has a well-paid job in industry. Many of my other colleagues also decided to give up their academic careers.

The truth is that a scientific career is not for everyone. You have to be "hard as steel from Krupp", as we say in Germany, but at the same time flexible, like a rubber band. And you probably won't get rich: the salaries for postdocs and young researchers are not high, and it is hard to save money when you have to pay for two apartments. Sometimes I get jealous of the higher salaries and normal (family) lives my friends have. But then I see the freedom my job gives me: travelling to a conference in South America this week, being at a workshop in the US next month, performing an experiment with colleagues from all over the world in Japan, then lecturing and educating students. Never a dull moment!

My current grant, while large by Canadian standards, is small compared with my previous Helmholtz grant. Nevertheless, I think I have found my lab, my city, my life. I don't know if it will be "forever", because I have learned that circumstances can change, and what works well now can be "outdated" in 10 years. But I have not yet regretted my big step to the we(s)t coast of Canada two years ago, nor have I ever regretted my decision to become a scientist. It's not only my job; it's my passion. And as for my dream of becoming an astronaut, I did finally find a job ad for the European Space Agency's Astronaut Selection Programme in 2008, so I applied for it…along with about 10 000 others. I was one of the 800 who made it over the first hurdle, but not among five lucky ones selected. However, I read recently that Germany would like to have a female astronaut, and to send someone to the Moon. So I will try again!

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Careers and people

Spotlight on: Daniel Rothman

Daniel Rothman is used to working across disciplines. After earning his undergraduate degree in applied mathematics at Brown University, US, in 1979, he spent two years as a research geophysicist with Western Geophysical (now part of Schlumberger) before moving to Stanford University to do his PhD in geophysics. Later, as a geophysicist at the Massachusetts Institute of Technology (MIT), he worked on topics as varied as statistical physics, seismology and biogeochemistry.

As the co-director and co-founder of the Lorenz Center, a privately funded climate research organization at MIT, Rothman has applied this wide-ranging background to investigate the dynamics of the Earth's carbon cycle. In a recent paper – for which he won the American Mathematical Society's 2016 Levi L Conant Prize – he explained that studying how carbon moves through the biosphere poses unique challenges to mathematicians and scientists alike. "Because the carbon cycle represents the coupling between life and the environment – metabolism at a global scale – its mathematical description inherits the difficulties of biology in addition to physical science," he wrote in "Earth's carbon cycle: a mathematical perspective" (2015 *Bull. Amer. Math. Soc.* **52** 47). Consequently, he added, our theoretical understanding of carbon-cycle dynamics "remains more qualitative than quantitative", even though in parts, the carbon cycle "exhibits behaviour that is simple enough to comprehend mathematically". Rothman has also proposed a "stress test" for the Earth's carbon cycle to determine whether increased emissions could lead to a mass extinction.

Movers and shakers

The Royal Society has selected three physicists to receive the Wolfson Research Merit Award. **Thomas Krauss** of the University of York, **Edmund Linfield** of the University of Leeds and **Colin McInnes** of the University of Glasgow were among 15 researchers honoured in the awards, which are designed to attract or retain scientific talent in the UK.

Optoelectronics expert **Min Gu** has been appointed as the new associate deputy vice-chancellor for research innovation and entrepreneurship at RMIT University in Melbourne, Australia.

Michael Hartridge, a physicist at the University of Pittsburgh, US, has been awarded the Michelson Postdoctoral Prize for research that involves making quantum bits, or qubits, from superconducting materials.

Mikhail Lukin of Harvard University, US, has won the Julius Springer Prize for Applied Physics for his work on quantum plasmonics and quantum optics.

Particle physicist **Helen Quinn**, a professor emerita at the US's SLAC National Accelerator Laboratory, has won the Karl Taylor Compton Medal for Leadership in Physics from the American Institute of Physics.

Geophysicist **Christopher Scholz** has won the Seismological Society of America's highest honour, the Harry Fielding Reid Medal, for his seminal work on the tectonics of the Earth's crust and its applications to the physics of earthquakes.

Space scientist **Kenneth Sembach** has been appointed director of the Space Telescope Science Institute in Maryland, US.

The American Physical Society has named the string theorist **Edward Witten** as the first recipient of its new Medal for Exceptional Achievement in Research.

Yingcai Zheng of the University of Houston, Texas, US has won the 2015 J Clarence Karcher Award from the Society of Exploration Geophysicists for his work on the geophysical characterization of fractured underground reservoirs.