programming. He finished the semester feeling comfortable writing some code and teaching himself additional programming techniques as needed. "My successes in the class motivated me to work on programming more outside of class," he says.

Katerina Georgiou, a graduate student studying soil chemistry at the University of California, Berkeley, enrolled in an applied statistics course that featured group projects pairing students who specialized in statistics with those who worked in life or physical sciences. The statistics students got a better idea of how to incorporate 'domain knowledge', such as what data mean and how robust they are, and the science students saw how people with rigorous coding and programming experience break problems into programmable chunks. Even if you can pick up the basics on your own, says Georgiou, it is hard to get fluent in programming without working with others. "Being able to read the code of someone with a stronger background than you is very enlightening."

A shorter, two-day option comes from the sibling non-profit organizations Data Carpentry and Software Carpentry, which have instructors all over the world and have trained thousands of researchers. All the lessons are available online, but in-person instruction is more effective, says Jonah Duckles, executive director of Software Carpentry. Sitting alone in front of a computer to learn data-analysis skills can be discouraging because there are so many ways to get stuck.

Software Carpentry helps researchers to use the command line and programming tools to manipulate files, create graphs and track changes. Data Carpentry offers discipline-specific sessions on how to manage data sets and spreadsheets; it assumes little or no programming experience. Last year, the two non-profits together arranged for trained volunteers to offer more than 350 two-day workshops at research departments and institutions worldwide (host institutions cover an administrative fee plus trainers' travel expenses; information about hosting a workshop or finding upcoming ones can be found on the Carpentry websites). These help people get off to a good start and plug into a network through which they can get more support, says Tracy Teal, head of Data Carpentry. "We want to teach the skills and also instil the confidence that they can keep learning more."

"Being able to read the code of someone with a stronger background than you is very enlightening."

MAINTAINING MOMENTUM

Being familiar with computing tools is not the same as incorporating them into the research routine. Perhaps the biggest barrier is insecurity, says Anelda van der Walt, a volunteer with both Data and Software Carpentry and head of Talarify, a company in Cape Town, South Africa, that provides computational training to geneticists. "Many people think, 'I'll just figure it out on my own first. I'm not good enough yet to ask questions'," she says. Instead, they should seek help from others to gain more skills.

People who can offer help need not be on campus. "The thing that was most valuable to me in getting familiar with R was the network of people on Twitter," says Kara Woo, who taught herself to apply the programming language when she was managing data on microbes in frozen lakes at the National Center for Ecological Analysis and Synthesis in Santa Barbara, California. Many of her Twitter contacts who offered advice were ecologists and biologists whom she had already been following for their research. Other resources include subreddits (themed discussion groups hosted by the social-news site Reddit), the #rstats and #python tags on Twitter and the online community Stack Overflow.

Novices users of these forums should follow certain norms, especially when accessing online platforms such as Stack Overflow that are frequented by hardcore programmers. First, they should search for answers to questions that are similar to their own and that have already been explained. Next, they should describe how they have tried to solve the problem on their own. Experienced programmers will quickly spot mistakes that novices overlook, and they can decipher error messages. But they are likely to get annoyed if a question comes across as one from a teenager who is outsourcing homework.

Small meetup.com groups and hackathons, where coders come together to work on common interests, can provide a comfortable setting in which to ask questions and share problems. Next month, research institutions in Australia and elsewhere are hosting digital literacy festivals, collectively called the Research Bazaar, to help to build support communities. In the end, learning to code is much like getting to grips with any other unfamiliar experimental technique, says Marquitta White: researchers have to identify others to help them learn the necessary skills.

Graduate students who can incorporate programming into research will have their pick of postdoc positions and other offers, says Schloss. Such skills — or access to people who have them — are increasingly necessary for the big-data questions that scientists want to pursue. "If they think they have a lot of data now, in ten years we are only going to have more," he says. "If they don't figure it out now, it's just going to get worse." ■

Monya Baker *writes and edits for* Nature *from San Francisco, California.*

TRADE TALK
Research writer

Daniela Hernandez realized during her PhD at Columbia University in New York City that she preferred writing about science to doing it. Now, she's digital science editor at The Wall Street Journal.

Why did you leave research?
Doing science was lonely: you're in the lab at odd hours, with nobody around. I realized that my strengths were in communication.

Describe the transition.
At Columbia, I interned for ABC News. Then, during graduate school, my principal investigator connected me with the Michael J. Fox Foundation for Parkinson's Research in New York City for some science writing. I also did some paid fact-checking at the National Geographic Channel: as a grad student in New York, the cash certainly didn't hurt.

What was your next step?
While I was at grad school I learnt about the media fellowships offered by the American Association for the Advancement of Science. These place science students in newsrooms around the country. I got one at the *Los Angeles Times*. After that I joined the science-communications programme for the University of California, Santa Cruz, hoping to meet possible future employers and colleagues.

How did that go?
It worked out! I did an internship at *Wired* magazine and got hired — it was great fun. After a year, I moved to Kaiser Health News as a reporter. I got hired by *The Wall Street Journal* last February.

Do you like it?
Yes — it's a lot of fun. Everybody is really thoughtful, collaborative and smart.

Any advice for budding science writers?
It's a really enjoyable job, but it can be taxing. And if you freelance, you need to know how to make ends meet. Reading voraciously is important. You need to know what's going on and how other people cover stories.

INTERVIEW BY JACK LEEMING

This interview has been edited for clarity and length.