

learning system, will 'chunk' material into concept modules and avoid long passages of unbroken text. But that doesn't mean all writing must be condensed into Twitter-sized bites. "It's going to come down to the writing, regardless of whether it's in electronic format or on paper," says Emlen.

The structure of textbooks is also in flux. Digital textbooks are becoming increasingly modular, as many publishers are selling individual chapters and allowing teachers to build customized versions. Some textbook producers are also migrating towards more open-ended navigation in which students can skip to topics rather than follow the linear ordering used in print. "Think about it as building a big website as opposed to building a book," says MacInnis. This approach may not work for every subject; trigonometry, for example, requires some linear progression.

Once a publisher has accepted the concept, the author needs to guide the publishing team that will execute the idea. Authors have to be at the centre of the creative process, says Roberts. "There will be animators, developers and instructional designers all trying to get their calling orders from the author." Authors must clearly communicate their vision and be prepared to iterate it as elements such as artwork and simulations are developed. And, because publishers are still working on the best approach to digital textbooks, authors also need to adjust their vision in response to feedback from testing with potential users. Compared with print textbooks, the authors have to be much more flexible and more attentive to the learner, says Strand.

Aspiring authors should use existing science apps and digital textbooks. They can get their feet wet by being a reviewer for one or authoring a component of a digital textbook or online learning system, such as a module, simulation, case study or assessment questions. For example, about 40 authors and reviewers worked on the digital *Principles of Biology* textbook from Nature Education, a division of Nature Publishing Group, which publishes *Nature*. And authors should consider teaming up with a multimedia-savvy partner, especially if the person is also an expert in their subject area. Graduate students may already have those skills, says Ryan.

In the end, authors should not get distracted from the core task of trying and validating better teaching methods. What makes a great author has not changed, says Susan Winslow, a publisher for life sciences at WH Freeman in New York (WH Freeman is owned by Macmillan, which also publishes *Nature*). "They're capable, in any medium, of connecting the dots for a novice." ■

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TURNING POINT

Mark Lawrence

Atmospheric scientist Mark Lawrence was named scientific director of the Institute for Advanced Sustainability Studies in Potsdam, Germany, last October, after a 19-year research stint at the Max Planck Institute for Chemistry in Mainz.

What drew you to Earth and atmospheric sciences?

I intended to study medicine at university, but after learning about the realities of being a doctor, I decided to move into basic physics. Towards the end of my undergraduate studies at the Georgia Institute of Technology in Atlanta, I spent a couple of semesters at the tyre manufacturer Michelin working on cutting edge car-suspension systems and ways to analyse how roads affect car tyres. However, I realized it was important to me that my work had a societal impact, so I switched to Earth and atmospheric sciences, which gave me the chance to combine broad aspects of physics as well as chemistry, and even some topics related to biology. It was an intellectually challenging science.

How did you end up in Germany and why have you stayed?

I wanted to see the world, and Germany seemed to be a good place because my now-wife was heading back to Germany to finish her studies. I had a US National Science Foundation graduate fellowship, so I contacted the then-director of the Max Planck Institute for Chemistry, atmospheric chemist Paul Crutzen, who agreed to supervise my thesis. I had planned to return to the United States after my PhD, but Paul jointly won the Nobel Prize in Chemistry in 1995 for his part in work on the ozone layer, and he persuaded me to stay at the institute for a postdoc, studying atmospheric models and the pollution outflow to the Indian Ocean — preparation for the 'Indian Ocean Experiment'. At the same time, qualifications started to take priority in German academia, and it became easier for young researchers to progress. In 2000, I won a grant from the German Federal Ministry of Education and Research to lead a junior research group — a five-year funding opportunity for young scientists seeking to establish themselves in the field — focused mainly on large-scale atmospheric pollution in the tropics, especially Asia.

How did you get your new post?

Through Paul, I met Klaus Töpfer, founding director of the Institute for Advanced Sustainability Studies. I gave him some of my



climate papers to read, and he later invited me to Potsdam. The research collaboration grew from there. When the institute started looking for a scientific director, I was fortunate enough to be the right person in the right place at the right time.

My group is focusing on how humans are modifying the composition of the atmosphere and how this affects human life — for example; how ozone, methane and soot modify the composition of the atmosphere. We hope to find ways to make our modern lifestyles more sustainable by reducing pollution.

What is your secret for success?

I have a passion — I want to make a contribution to society through science. My job is more of a calling than a career. Honest self-analysis is important for professional success. We are very good at analysing our environment, but we should also look at ourselves and ask, 'What are our personal strengths and preferences, and where can we make a difference?'. Students should figure out what they can really do well that will make a positive contribution.

How do you juggle your work and personal life?

I spend weekends with my wife and children in Mainz, but my weekdays are concentrated on work. To focus, I usually get up early, meditate, go jogging and take a cold shower. Then I work until midnight. I find it is sustainable — the magic word — only if I keep my focus on my scientific contributions rather than on my career accomplishments, such as publication and citation numbers. ■

INTERVIEW BY ALEXANDRA BELL