My Summer at *Scientific American*

Evelyn Lamb

Each year the AMS sponsors a fellow to participate in the Mass Media Fellowship program of the American Association for the Advancement of Science (AAAS). This program places science and mathematics graduate students in summer internships at media outlets. In this article the 2012 Fellow describes her experiences during her fellowship at *Scientific American*. For information about applying for the fellowship, see the "Mathematics Opportunities" section in this issue of the *Notices* or visit the website `http://www.ams.org/programs/ams-fellowships`. The application deadline is **January 15, 2013**.

Writing for a popular science news outlet was the perfect way for me to spend the summer after finishing my Ph.D. in math at Rice University. I walked into the *Scientific American* offices not really sure what to expect. By the end of my first day, I had successfully proposed an article about geometry labs to my editor, found a paper about "natural" selection in music that I wanted to cover, and was knee deep in freshman-year physics for an article about optics. It was a bit daunting but exhilarating as well. Over the course of the summer I wrote quite a bit about math, but I also wrote about a new battery design, the genome of a fungus used in making miso, prostate cancer screening, and much more.

In many ways, working for a news outlet is the polar opposite of doing math research. Some news pieces took several weeks to prepare, but most of them were written two or three days after I found out about them. I got many of my ideas from press releases, which we get a few days before the public. (In an attempt to level the playing field and prevent hastily written, inaccurate news stories, journals and universities give information to the press before it can be released to the public on the condition that the reporters will wait until the "embargo" to break the news.) When working on a piece that is under embargo, the goal is to publish the piece at the embargo time, if possible. This meant very quick assimilation of new material, often in a field where I had almost no experience. I found that my work often had an ebb and flow, with many assignments cropping up in a short time followed by a less busy spell, when I would take time to survey the territory, work on long-term projects, and poke around for fun new stories.

One of the challenges of the job was recognizing whether a particular study was newsworthy or not. Press releases and embargoes have a purpose, but they often serve to create a false sense of urgency about a paper. I am glad that my editor, while appreciating coverage of embargoed news, also encouraged me to look beyond press releases for news. Finding stories was often a challenge, not because science papers are rare, but because they are so abundant. It was like drinking out of a fire hose, and I worried about covering one story when I should have been covering something more important. My editor encouraged me to pitch as many stories as I wanted, and she accepted most of what I proposed.

Scientific American has a variety of different types of content, and I was able to experiment with many of them. In addition to traditional news stories, I wrote blog posts, podcasts (which I also voiced), images with extended captions, and slide shows. Some of my articles made it into the print magazine as well. I really enjoyed exploring the different media. Some stories made more sense in one format than another, and blogging even gave me a chance to write a few opinion pieces.

In late July political scientist Andrew Hacker wrote an op-ed piece called "Is Algebra Necessary?" for the *New York Times*, putting forth the idea that algebra education is an unnecessary waste of time and talent. My husband and I found the article ridiculous and spent much of the evening talking about it. The next day I wrote a blog post about it, and it took off. In addition to getting dozens of comments, "likes", and "shares", it led to an appearance on the PRI show "The Takeaway" later that week. Although I wish I could have been more eloquent on the radio, even at 7 a.m., the experience was positive. While all of that was happening,

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it finally dawned on me that I was now a member of the media. I would have had the exact same opinions of Hacker's piece whether I had been writing for a major news outlet or not. All of a sudden I was in a position not just to talk to my husband about it over dinner, but to have thousands of people read it as well. It's still a little surreal to realize that my opinions on math education were so widely read.

The idea that the public hates math and is not interested in learning about it is widespread in the mathematical community, but I think some of that attitude might be defensive on our part. We often have trouble communicating math, and we are all too willing to believe that others are hostile to us. Among the comments on my algebra education post were dozens from musicians, artists, real estate agents, and others who don't work in STEM careers telling me how glad they were to have learned algebra or how useful math had been in their lives. This and my other math articles showed me that there is a market for good, accessible math writing. People are inherently curious about numbers and shapes. Data visualization and mathematically inspired art are immensely popular. The challenge is to find ways to summarize dense research-level math for a general audience. It's difficult but rewarding when it works.

I found that writing about a subject I know so well was a double-edged sword. I had the mathematical background to assimilate information quickly, but I didn't always have perspective about what would be difficult for a nonmathematical audience. I would often work on a piece and not realize that a reference to the complex plane or even the use of the word "function" needed to be explained.

One issue I noticed was that members of my audience weren't nearly as comfortable not understanding new concepts as mathematicians are. A mathematician is likely to accept a statement along the lines of, "The researchers study mathematical objects called fluxtrons. Specifically, they are trying to determine whether all fluxtrons have the gromlick property." Most people would want a deep understanding of fluxtrons and the gromlick property before continuing, whereas mathematicians are often content to read the rest of the story, later going back to learn about fluxtrons and gromlicks if they decide they want to know more. As John von Neumann said, "In mathematics, you don't understand things. You just get used to them." There were several times when an editor would comment that I needed to define what something was, while I just assumed readers would know that the point wasn't the object but how it was used later. In those situations, my initial impulse was always to walk over to the editor's desk and explain to him or her what I meant. I had to keep reminding myself that I can't lean over each reader's shoulder to clarify a point. If an editor tells me something is confusing, my readers will need more clarification.

I have no doubt that my work this summer will have payoffs in my teaching. After seven years of being elbow deep in mathematicians, I was reminded of what concepts are hard for people. The algebra education post and its aftermath also gave me a lot of food for thought about the purpose of math education and what methods work or don't. I will probably still have problems getting through to some of my students, but now I have more ideas about how to get them interested.

My mathematical training helped me understand and assimilate new scientific material quickly. In the case of physics, much of the content itself is based on mathematics, and I could pick it up fairly easily. My first assignment, a story about optics, was full of vectors and derivatives. In other fields, almost all science papers contain descriptions of study methods and the statistical results of the experiments. I was able to dive in and see past the hype that sometimes comes in press releases. The fact that I can evaluate the statistics in a paper with ease is a boon to me in my efforts to present accurate information about the significance of scientific results.

Interviews ended up being some of the most rewarding parts of my job. I am a naturally phone-averse person, and picking up the phone for the first interview was a challenge. But researchers were generous with their time and eager to share their work with me. Several scientists told me that I had written the first article about their work to get all the details correct. My talks with mathematicians were especially nice. For my slide show about the geometry labs at the University of Maryland, University of Texas Pan-American, and University of Illinois Urbana-Champaign, I interviewed people in my own field about their remarkable undergraduate research and outreach programs. Talking with them about their passion for undergraduate research and how they started their work was truly inspiring. I would recommend that all mathematicians take some time to interview a colleague about his or her teaching, outreach, or what they love about math. You'll see them in a different light, and you might get excited about working on a new project.

In addition to research and writing, I found myself immersed in the social network of science writing. I had never used Twitter, but I started an account this summer in order to keep up with science and math news. I use Twitter to promote my own work and to point out good math content that I see. Content that I find on a math blog and tweet about often ends up getting spread to a wider group of people who are interested in science in general but perhaps don't know much about math. I also try to share content related to my stories as a way to give some extra information to those who are interested. When I created a slide show of art from Bridges, a math-art conference, I tweeted a link to an applet created by David Chappell, one of the featured artists. Using Twitter this way gave me the chance to give more content to those who were interested without overwhelming casual readers. I am still learning how to use social media effectively for math communication, but I think it has the potential to be a valuable resource.

I loved the variety of my assignments and the challenge of learning new science quickly, but I missed the process of discovery itself. In some ways, I feel like two different people. One of me wants to take any possible opportunity to educate people about all kinds of math, while the other one wants to discover new theorems. During the 2012–2013 academic year, since I do not have an academic position, I am continuing to write for *Scientific American* as a freelancer while also attending math conferences and working on my own research. In August 2013, when I begin my postdoc at the University of Utah, I plan to continue science and math communication for a general audience through blogging and freelance writing. Writing has joined research and teaching as an important and rewarding part of my career.

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"A Modest Proposal" Research Base

Max Warshauer

Jonathan Swift's original "A Modest Proposal" [1] was a thought-provoking satire designed to help deal with a food famine and its root causes of overpopulation. Schoenfeld's "Modest Proposal" [2] is designed to deal with a different kind of famine, namely, an intellectual famine brought about by not incorporating real sense making into the teaching of mathematics.

We extend Schoenfeld's proposal by suggesting that all students can do mathematics at a high level if properly challenged and engaged, and provide a collection of research questions to examine this proposition. Evidence abounds that students are having great difficulties in learning algebra [6]. We realize algebra is not a synonym for "sense making", and indeed algebra can be taught in a procedural way that does not encourage sense making at all. The reason that we focus on algebra as a proxy for sense making is that, when properly taught, algebraic reasoning provides students a powerful tool for explaining ideas rigorously and precisely.

Over the past six years a group of mathematics faculty has developed a curriculum, Math Explorations [13], designed to prepare all students for algebra by grade 8 or earlier, weaving in the type of sense making that Schoenfeld so elegantly describes. Students are engaged in exploring problems deeply and learn to explain simple ideas, such as adding and subtracting integers, with visual models. Variables and algebra are integrated throughout. Here we shall describe research questions that have arisen and propose a framework for further study.

Consider Suzuki's work on talent development in music [3], [4]. Suzuki observed that "any child is able to display highly superior abilities if only the correct methods are used in training." A method for teaching mathematics with the Suzuki method was described by the author previously in [5]. One of Suzuki's fundamental tenets is that, if one begins learning music when older, this may be a harder task than if one learns music as a child,

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