from the distinctive blue blood of the Atlantic horseshoe crab. The cells contain a blood-clotting mechanism triggered by the presence of bacterial endotoxin. The test serves as an effective detection tool that today prevents the use of intravenous fluids, injected drugs, and implantable medical devices that contain potentially dangerous concentrations of endotoxins. Levin's research was funded by the U.S. Atomic Energy Commission and the NIH National Heart, Lung, and Blood Institute and Bang's by the U.S. Public Health Service's National Microbiological Institute.

As with Sachar's cholera research, the collaborations of Rose and Witebsky, and of Levin and Bang, were built upon multiple experiments over years. Still, Sachar points to the cholera patient experiment as the watershed moment for his research.

Learning how to effectively measure the electrical charge within the patient's intestine had taken Sachar, at the request of his superiors, from Dhaka to Copenhagen, where he moved his wife and 10-month-old baby. Copenhagen was home to a laboratory run by the physiologist Hans H. Ussing, who had devised the Ussing chamber to test the functions of biological membranes using the skin of a frog. Sachar was tasked with figuring out how to adapt the tool for cholera research on humans. Upon returning to Dhaka, Sachar's patient experiment put his adapted meter to the test.

Turns out, a sodium solution trapped in a malfunctioning intestine, as the standing theory held, would alter the electrical charge within a cholera patient's intestine. A properly working intestine would register a negative charge and be able to absorb a sodium solution through the intestine's lining to hydrate a patient with cholera. Evidence of a negative charge would disprove the prevailing theory's position that cholera broke the human intestine mechanism.

The experiment verified the effectiveness of the adapted device to measure the electrical potential across a biological membrane, established that the patient's intestine was functioning normally despite cholera, and showed that when glucose was added to the sodium solution dripping into the patient, the negative charge in the intestine shot up dramatically. This proved that sodium was absorbing through the lining of the intestine, hydrating the cholera patient. Thus, the standing theory was wrong.

"The moment when the needle on a dial started to move steadily off to the end of the dial and off the scale," Sachar said, he and Saha began "whooping and clapping" and "dancing around the laboratory," making such a commotion that Norbert Hirschhorn, the senior laboratory manager, entered to find out what was going on. "The system works; we add sugar and the electric potential goes up. So, that means the cholera patient's intestine is not poisoned," Sachar told Hirschhorn. Within moments of taking in the report, Hirschhorn declared, "Well, then that's the treatment."

> ***"...a discovery that has saved 50 million to 100 million lives."***
>
> **David Sachar,**
> Mount Sinai School of Medicine

Importantly, without operating on a patient, the research validated his method of measuring transmural electric potential inside the intestine. Sachar also "showed that contrary to prevailing opinion, the absorption mechanisms of the intestine, the ability of the intestine to absorb sodium and to absorb it even better with sugar, was perfectly normal during an attack of cholera." With that, the research cleared the way for today's lifesaving oral rehydration therapy.

"It has been gratifying to know over the last 50 years that the two years I spent as an active-duty commissioned officer in the Public Health Service paid off and it continues to pay off, " said Sachar. "From a physiology laboratory looking at a frog skin in Copenhagen, to a research-oriented hospital in Dhaka, East Pakistan, to using a technique adapted for living humans and then taking it out to villages where there was nothing, no intravenous, no labs, no nothing. Within years we have a discovery that has saved 50 million to 100 million lives."

AAAS programs train new generation of science journalists

Mass Media fellows and Diverse Voices interns spend summer in newsrooms

By **Adam D. Cohen**

As a fifth-year Ph.D. student studying the courtship dances of jumping spiders, Sebastian Echeverri is not accustomed to his expertise attracting the attention of anyone beyond a handful of fellow arachnologists.

This summer, however, Echeverri found himself on staff at *The Philadelphia Inquirer*, pet tarantula on his desk, writing about the real-world biology behind Spider-Man's superpowers. The 1200-word article covered everything from spiders' sensitive body hairs to the ability of certain species to cling to walls while holding 170 times their own weight. On 16 July, two weeks after the release of Sony Pictures's *Spider-Man: Far From Home*, *The Inquirer* gave the piece a full-page spread on the cover of its Life section. Its affiliate tabloid, the *Philadelphia Daily News*, also ran the story as a lead feature.

"When I sent my friends and family the story, there were a lot of Peter Parker jokes going around, because I had the exclusive scoop on Spider-Man's powers," said Echeverri, who is working on his dissertation at the University of Pittsburgh. "Obviously, for me, that was a dream come true. I've always felt a connection to that character."

The Spider-Man story was one of nine pieces of science news that Echeverri wrote for *The Inquirer* this summer, thanks to a Mass Media Science & Engineering Fellowship from the American Association for the Advancement of Science. Each year, in a 10-week program, AAAS places advanced undergraduate, graduate, and postgraduate scientists as Mass Media fellows at news organizations across the United States.

At the same time, the organization hosts the Diverse Voices in Science Journalism Internship, placing undergraduate journalism students on the news team at the AAAS-published *Science* magazine for the summer. Together, the programs work to train the next generation of science writers and strengthen the connections between scientists and journalists, sharpening researchers' ability to communicate complex science to the public while enhancing the breadth and depth of science-related coverage in the mainstream media.

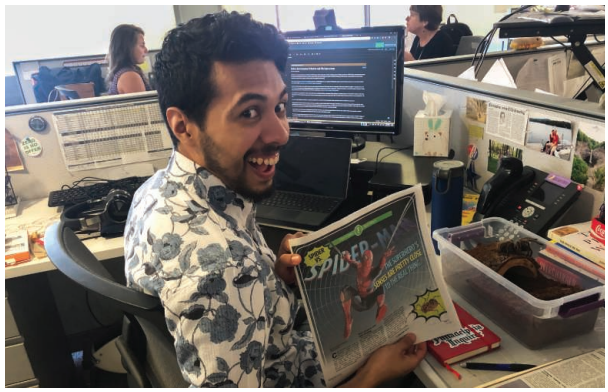
Since the Mass Media Fellowship's inaugural summer in 1975, when 10 scientists participated, the program has grown consistently. In recent years, with the total number of alumni climbing above 700, AAAS has focused on placing more fellows at outlets in the country's heartland, in addition to those on the coasts. With 26 fellows working at a diverse array of print, online-only, and broadcast outlets, this summer's group was the program's largest. Following the fellowship, some participants return to academia, while others go on to

successful careers in science communication, as journalists or public information officers.

"You all are primarily scientists, not journalists," said Kristin Lewis, who leads the Mass Media program for the AAAS Center for Public Engagement with Science and Technology, at the fellows' orientation in June. "At least you were before this summer. Now that distinction might start to blur."

When Echeverri arrived at *The Inquirer* in June, staff immediately appreciated his contributions. He used the critical thinking skills he has built as a researcher in covering topics well outside of his scholarly niche, such as a study on online discrimination and hate crimes, and he stayed on as a freelancer to work on a story about how climate change is affecting the Delaware River watershed, which was published in mid-September. The Spider-Man piece, though, was his magnum opus.

"Sebastian won over readers who thought they weren't interested in science," said Charlotte Sutton, *The Inquirer's* health and science editor. "My husband doesn't read science stories, and he always complains when stories are long. But he was all the way through that one, like, 'what a great story.'"



While arachnologist Sebastian Echeverri (top) was writing for *The Philadelphia Inquirer*, Sabine Galvis (bottom left), Kelly Mayes, and Katie Camero were learning from *Science* editors, including Jeffrey Mervis.

Whereas most interns wait for direction, Sutton said, each of the four Mass Media fellows she has supervised arrived eager to turn their specialized knowledge into stories of interest to a general audience. She appreciates the passion and unique perspective that they bring.

"Science is difficult, and it's under siege these days," Sutton said. "It's more important than ever to get people who are creative in their thinking and how they write about science."

The Diverse Voices internship, which AAAS founded in 2005, seeks to elucidate such creative reporting by introducing the science beat to young writers who already have a solid foundation in journalism. Like Mass Media fellows, Diverse Voices interns work as science journalists for a 10-week stretch each summer. Most of the interns are pursuing or have recently completed an undergraduate journalism degree, rather than an advanced science degree, and many come from communities where science writing has been traditionally underrepresented. Their placement at *Science* magazine gives them exposure to a news operation devoted solely to science reporting.

Diverse Voices interns gain familiarity with many facets of *Science's* operation, including writing 250-word, lay-language study summaries, called ScienceShots, and earning print and online bylines on fully reported stories. Katie Camero, one of this year's three Diverse Voices interns, graduated from Boston University in May with a major in journalism and a minor in environmental science. In crafting stories on turtle embryos, ocean acidification, and more, Camero enjoyed the challenge of tailoring her language to *Science's* readership.

"It was hard to be conversational but academic at the same time; it was hard to figure out what information the audience already knows," she said. "Do I have to explain what an electron is? Do I have to explain what CO_2 stands for?"

While using her fluency in Spanish to help a *Science* editor develop contacts in South America, Sabine Galvis, a 2019 Diverse Voices intern and senior in journalism school at Arizona State University, was able to get in touch with Ecuador's minister of agriculture. The conversation led to a published Q&A about how Ecuador—the world's largest banana exporter—was protecting the fruit against a potentially devastating fungus rumored to have appeared in Colombia. Two weeks later, after Galvis's family in Colombia messaged her confirming the fungus's appearance, she published a story on the country's resulting state of emergency.

"Everyone in the office was very willing to offer their expertise and guidance," Galvis said of the internship. "I think the biggest part of it for me was the mentorship and networking. And I walked away with a couple of clips that I can be really proud of."

As a Mass Media fellow at King 5 News in Seattle, Laura Fattaruso pitched ideas for online stories, some of which became TV segments. Whether learning about the architecture of the mosquito brain or joining University of Washington researchers on a boat to test their newly developed tidal energy turbine, Fattaruso worked to make seemingly incomprehensible topics accessible—first to herself and then to readers and viewers.

"I think a lot of the skills that I developed in this fellowship will translate into better communicating my own research," said Fattaruso, who studies earthquakes as a second-year Ph.D. candidate at the University of Massachusetts Amherst. "Really getting to the point of why I'm doing this, what it means for other people, and how it could be useful."

Jennifer DeMoss, who spent the summer at *The News & Observer* in Raleigh, N.C., decided to apply for the Mass Media Fellowship 4 years ago, after reading a program flyer. Now completing her dissertation research on wilderness education and human-nature relationships at the University of Georgia, DeMoss decided that this summer was the perfect time to participate. The experience left her with no doubts as to what career she plans to pursue.

"I'm deliriously happy," said DeMoss during her second-to-last week at *The News & Observer*. "If they would hire me here tomorrow to be the science writer, I would do it in a heartbeat."

PHOTOS: (TOP TO BOTTOM) KRISTIN LEWIS/AAAS; EVA FREDERICK/AAAS

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