

BY ERIN GREENE

A Scientific Method

The **Students on the Forefront of Science** internship program offers Brooks students the chance to experience science in the real world. Students work in labs alongside research scientists, put on scrubs to observe surgeries, and even work in diverse fields such as engineering, construction and computer product design. Dozens of Brooks alumni and current students have benefitted from the program. They say that it informed their college applications, their fields of study and, ultimately, their careers.

[Fig. 1] Renu Mukherjee '15 (left) listens as Dr. William Curry explains an upcoming surgery.





MORGAN DUNN '15 TAKES A SMALL AMOUNT OF DNA,

and, making tiny wells in a tray of agarose gel, uses a syringe-like pipette to insert the DNA into the gel. She then adds dye to make the DNA more visible.

After covering the gel, she runs a current of electricity through it and looks at it under ultraviolet lights to determine the size of the DNA. If the fragment size is correct, she can be sure the specific gene mutation has been correctly inserted into the DNA.

This process is called gel electrophoresis, and it's just one step in a complicated set of procedures Dunn undertook to study mutations in the DNA of potassium channels as an intern at Massachusetts General Hospital last summer.

As an intern with the Students on the Forefront of Science program, now in its 10th year offering science internships to rising sixth-formers at Brooks, Dunn was taking what she had learned in AP Biology at Brooks leaps and bounds further: She was working with Dr. Joseph Cotten to research the role of potassium channels in the regulation of breathing while under anesthesia in a lab at MGH alongside post-doctoral students.

She had done gel electrophoresis once before in her AP Biology lab at Brooks. “Now I’ve done it at least 20 times,” Dunn says.

Dunn wasn’t just able to research the neural mechanisms of anesthesia; she also observed surgeries to watch those mechanisms in action.

“We spent a lot of time on genetics in class, which is great because that’s what I’m doing in the lab, and I understand why it’s important,” she says. “Being in the operating room really solidifies that — it’s more real, and it helps me understand why research is so important. And it’s not like you’re in another room peeking in. You’re standing next to doctors, which is amazing.”

That is the essential premise of SFS. In the classroom, students can learn the material, perform experiments and hear what it’s like to be in a hospital setting or work in a lab. But, as SFS interns, Brooks students get an opportunity that’s not typically offered to high school students

[Fig. 2] Morgan Dunn '15 got to observe surgeries during her SFS internship. “You’re standing next to doctors, which is amazing,” she says.

[Fig. 3] Matt Myers '15 interned with the Quebec-Labrador Foundation through SFS. The QLF is a nonprofit organization that promotes the stewardship of natural resources and cultural heritage.



[Fig. 2]

to perform real research next to doctors, residents and post-doctoral students.

And, the Brookians learn that science is more complicated in the real world. “The labs that students run in class are built to be done successfully, but most of science is not successful,” says science teacher and founder of the SFS program Brian Palm. “It’s important for students to know that.”

A WEIGHT OF OPPORTUNITY

Palm has thought a lot about the limitations of classroom-based learning. When he came to Brooks in 2003, he wanted to find ways to further engage students in the sciences.

“When you’re sitting there in class as a fourth-, fifth- or sixth-former, you don’t have a sense of what science is,” Palm says. “What does it mean to do science? I thought our kids who are most successful here could be doing some great work.”

With that belief in mind, Palm reached out to alumni and parents in the fields of science and medicine. He connected with Dr. Robert Langer P’09. An internationally renowned chemical engineer, Langer holds a professorship at the Massachusetts Institute of Technology and manages a laboratory — Langer Lab — that performs cutting-edge work at the intersection of biotechnology and material science.

“Dr. Langer is one of those incredible out-of-the-box thinkers,” Palm says. “I thought we’d get pushback of ‘these are high-school kids, we hire post-docs.’ Instead, Dr. Langer said sure, so we matched up two of our kids with scientists in his lab.”



[Fig. 3]

“That was the first time I had been in a lab, and I got to learn a skill set I never would have had exposure to. It put me one step ahead in college and allowed me to focus on my interests.”

—JILL GERATOWSKI '07

Langer says that his wife, former trustee Dr. Laura Langer P'09, helped convince him to offer a few spots in his lab to Brooks students. MIT, known for providing a strong foundation for its undergraduates, encourages students to explore research opportunities in its labs. Providing similar research opportunities to Brooks students wasn't much of a stretch from there. Langer invited the Brooks students to assist the undergraduate and graduate students working in his lab.

Langer Lab provided initial funding for SFS, and Palm's vision started to become a reality as the program grew. Palm found it easier to make phone calls with Langer's backing, and increasing numbers of doctors and scientists began to offer summer internship opportunities to Brooks students.

“SFS would never be where it is today if not for Dr. Langer's giving legitimacy to the program,” Palm says.

In its first year, SFS facilitated three internships: two at Langer Lab and one at the Quebec-Labrador Foundation, an organization devoted to leadership

development, environmental research and environmental stewardship in eastern Canada and New England. This past summer, eight interns took positions at organizations in locations ranging from Newfoundland to Boston's Brigham and Women's Hospital and MGH. Dr. Mary Jo Carabatsos, chair of the science department at Brooks and the current director of SFS, says the pool of applicants keeps getting stronger and more diverse.

“It's growing because kids want this experience for a variety of reasons,” Carabatsos says. “Some just want the experience. Some want to explore career possibilities. All of that is driving interest in the program.”

SFS is now funded out of Brooks's operating budget, which ensures it will continue to be a part of a Brooks education; but Palm and Carabatsos still spend time thinking about the program's future.

“It's institutionalized, but you wonder if it is institutionalized enough,” Palm says. “The challenges are funding and staffing it. We constantly need to develop new relationships. We need to have a pipeline.”

[Fig. 4]



The program only works with each lab for three or four years with the exception of the Quebec-Labrador Foundation internship, which has the longest-running relationship with Brooks and is more equipped to take on high school students as interns. Palm wanted to be conscious of not wearing out the school's welcome at the labs and also of sending students who are up to the challenge.

“Every year doctors come back to us and tell us that our kids do work on par with post-doctoral students,” he says. “We're choosing self-starters who are capable and confident in roles that are not clearly defined, and who are motivated to find out how to do what they need to do. Hopefully they feel a weight of opportunity.”



[Fig. 4] Lidiana Lantigua '15 conducted anesthesia research as an SFS intern. She worked with Dr. Ken Solt, and she had the opportunity to conduct laboratory experiments and to observe surgeries. Lantigua says that her internship was a learning experience that taught her how to work independently. "I feel blessed to have had the opportunity to work with Dr. Solt and his assistant," she says. "I learned so much from them."

BETTER THAN THE BEACH

This past summer, Renu Mukherjee '15 woke up at 5 o'clock every morning to travel from her home in North Andover to a lab associated with MGH in Boston. Mukherjee was an SFS intern paired with Dr. William Curry, whose work focuses on the way cancer cells interact with the human immune system. This field is known as cancer immunology, and its goal is to develop methods of stimulating the immune system to battle cancerous tumors.

Mukherjee was surprised at how much fun she had working in the lab. The researchers in her lab would give "lab homework" over the weekend, which often consisted of watching a movie so they could discuss it the following Monday.

The first week, Mukherjee spent a lot of time watching the other

researchers. The second week, she dove right in.

"It actually is a big deal if you mess up," she says. "But it gave me confidence and reassurance that I could do this. No one treated me like a high school student. They treated me like a colleague."

Mukherjee also found she could use her status as a high school student to her advantage. Doctors and Ph.D. students were constantly teaching her what they knew, she said, and Ph.D. students would give her papers they were writing to take home and read. Mukherjee relished this opportunity. "It would take me an hour to read a paper that was four pages long," she says, "because I had to look up every word."

In addition to working in the lab, Mukherjee observed surgeries

several times a week, standing right next to Dr. Curry in the operating room.

To hear Mukherjee tell it, watching brain surgery is the most exciting thing to ever happen to her. She was able to observe an awake right-frontal craniotomy, during which the patient was asked to read words off cards during surgery — the doctors needed to make sure the procedure would not affect her speech. Mukherjee will tell anyone who will listen about this experience. "I told all my friends that this is better than the beach!" she says.

Mukherjee's father is a doctor, and listening to his stories growing up made her want to be one herself. Her SFS internship at MGH solidified her goals.

"This has made me realize that not only do I want to go into medicine, but I want to be a surgeon," she says. She plans to study molecular biology and English in college and then go on to medical school.

The breadth of what Mukherjee learned during her internship can't be quantified, but a big portion of it was just what Palm hopes students take away: a real understanding of the scientific process.

"In the classroom, if you don't get good results it affects your grade," Mukherjee says. "Here, it's normal to fail. It forces you to think outside the box."

A STEP AHEAD

Jill Geratowski '07, an SFS alumna, minored in psychology with a concentration in neural and behavioral science as an undergraduate at Haverford College. Now she's a second-year student at the Philadelphia College of Osteopathic Medicine, where she studies how

[Fig. 5]



[Fig. 5] Renu Mukherjee '15 in the operating room during her SFS internship. Mukherjee plans to go to medical school and become a surgeon.

“No one treated me like a high school student. They treated me like a colleague.”

—RENU MUKHERJEE '15

the brain functions at the molecular level.

She wouldn't be where she is today, she says, if not for her SFS internship. In the summer of 2006, Geratowski interned at the Center for Blood Research in Boston, where she studied short interfering RNAs and how they can be used to target HIV.

“That was the first time I had been in a lab, and I got to learn a skill set I never would have had exposure to,” Geratowski says. “It put me one step ahead in college and allowed me to focus on my interests.”

It was overwhelming to join a research team in a lab as a high school student, Geratowski says, but the knowledge she gained was invaluable.

“I discovered that I like all the questions you can ask,” she says. “You come up with a problem and there are endless questions. That's also frustrating, though. It never ends — you find one result and it leads to another question. I really think SFS helped me grow as a young scientist.”

Geratowski is one of 76 Brooks alumni who have been through the internship program. It has steered them toward careers in scientific fields such as medicine and engineering. It has also steered some alumni away from careers in the sciences and into pursuits such as business and acting. This is a good thing: SFS alumni agree that the program helped them gain an understanding of what it would be like to work in a science-related career, and which aspects of the work they do and do not like. This knowledge helped them hone their focus as they went on to college.

James Williams '12 is currently a junior at the University of North Carolina, where he holds a double

major in economics and Chinese and a minor in statistics.

“I realized through the internship that I didn’t want to be contained in a laboratory every day for my profession,” Williams says. “I wanted work that was more interdisciplinary, that included more interaction with people, and that looked at the larger picture rather than looking very narrowly at cells and molecules. It directed where I went in the future.”

Joe Napolitano ’09 took an SFS internship with Consigli Construction in 2008. Now he’s been working as a project engineer at Consigli for just over a year, and he loves every aspect of it.

In 2008 Brooks was on the verge of building a new science center. Napolitano watched construction workers begin the job and asked former science teacher Bob Moore how he could get involved. SFS was able to design an internship specifically tailored to Napolitano’s interests: Todd McCabe ’89, P’15 was the project executive for Consigli, and he enthusiastically took Napolitano on as an intern.

“Brooks 100 percent put me in the place I am today,” Napolitano says.

Another important aspect of SFS is that it teaches students the basics of holding a job: Students learn the importance of arriving on time, figure out how to communicate effectively with colleagues and gain experience in how to ask questions that advance professional goals.

Daniel Conway ’11 is currently a senior at Georgetown University, where he’s majoring in finance, but he says his SFS internship at New England Medical Center with Dr. Charles Cassidy ’79 taught him how to operate in a work environment.

“Something that struck me was how well Dr. Cassidy treated the people around him,” Conway says. “He treated everyone with the same

amount of respect regardless of their level. He was a great character, and he made it an enjoyable experience. I’m very fortunate I had the opportunity to shadow him for eight weeks.”

Though the experience also taught Conway that a medical career wasn’t for him, he is still in awe of what he was able to do.

“I saw upwards of 60 surgeries that summer, and I was literally leaning over the operating table,” he says. “It was a once-in-a-lifetime opportunity.”

INTEGRAL TO BROOKS

For Mukherjee, the program has affected not only what she wants to pursue as a career, but also where she chose to apply to college. She applied almost exclusively to research universities that offer the option of applying to medical school at the end of sophomore year.

“I had such a good time this summer contributing and seeing my work make a difference,” she says. “It’s something I want to get back into as soon as I can.”

Mukherjee is taking honors anatomy and physiology this year at Brooks to put the knowledge she gained over the summer to use, but she feels eager to get out of the classroom and back into the lab.

“A lot of the things we’re learning in class I’ve seen or done or experienced,” she says. “Honors anatomy is wonderful, but I don’t think I’ll get another experience like SFS until I’m a fourth-year medical student.”

Carabatsos, the program director, says roughly 35 to 40 percent of students who go through SFS end up working in science-related fields. Mukherjee will likely be one of them.

“I think what happens as a result of SFS is that students who think

they have a passion for something leave the internship fully empowered to pursue what they’re passionate about,” Carabatsos said. “That’s what happened for Renu.”

And, Brooks is looking for new ways to offer these experiences to students. For the first time, Brooks is partnering with Apple to offer a two-week-long internship in Cupertino, Calif., to four students this summer. The experience will offer Brooks students exposure to the elements of product design.

This fits right in with where Carabatsos sees SFS going.

“The program will continue to fulfill Brian Palm’s initial goal, which is to give students applied experiential opportunities,” she says. “As the field of applied sciences evolves, we may need to add internships to meet the needs of students. We need to offer experiences that match experiences in the real world.”

The Apple internship, like all SFS internship opportunities, was secured through a Brooks connection. It’s important to Carabatsos that this remain central to the program. It’s also important that the program remain selective.

“We want to expand our options without increasing the total number of students accepted to the program,” she says. “It’s a matter of maintaining the integrity of the program. There’s an application process — there’s vetting.”

Carabatsos is excited about the future of the program, which she believes has become an essential Brooks offering. “It’s become such an integral part of the science program here at Brooks,” she says.

Mukherjee, of course, agrees.

“I think this is really unique that Brooks lets you do this,” she says. “It really is a once-in-a-blue-moon experience.”