

Vanderbilt Medicine

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A Shining Light

Aspirnaut program guides students to educational opportunities beyond poverty

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Photo by John Russell



For thousands of years pipelines have been constructed in various parts of the world when there's a critical need to convey water.

A Vanderbilt-based pipeline, founded seven years ago, is fulfilling a critical need of another type—bringing the support of a research university and professionals in science, technology, engineering and math (STEM) to rural teachers, students and school districts. The Aspirnaut program targets STEM achievement in students beginning in elementary school and continues through post-graduate training. The hypothesis is that achievement in STEM increases the odds of a student's entry into a STEM profession.

Julie K. Hudson, M.D., assistant vice chancellor for Health Affairs at VUMC and the program's director and co-founder, says the Aspirnaut program's K-20 STEM pipeline has many points of entry. "A student could engage in grades K-3, grades 3-5, middle school, high school, college, graduate school and beyond or anywhere along the way. And early engagement of students with STEM is key."

Hudson and her husband, Billy Hudson, Ph.D., run the Aspirnaut program, housed at Vanderbilt University Medical Center (VUMC) and funded through a combination of donations, cost-sharing with partner schools and grants. Aspirnaut currently focuses on two major programmatic efforts: weekly live and interactive videoconferences of hands-on inquiry-based STEM labs, conducted by Vanderbilt undergraduate and students, post-doctoral researchers and faculty for students in rural Arkansas, Maine, Montana and Tennessee; and summer research internships at Vanderbilt for rural high school students, and diverse undergraduate and graduate students.

According to the World Economic Forum, the United States is ranked 48th out of 133 developed and developing nations in the quality of mathematics and science education. There's also a shortage of workers in STEM careers, and rural students are a largely untapped pool of talent that can be brought into the STEM workplace, the Hudsons believe. Twenty percent of K-12 students live in rural areas.

The kidneys at a fifth-grade level

About 15 third- to fifth-grade students from rural Maine listen intently as Billy Hudson, Ph.D., stands in a lab on a bleak February day at VUMC talking about the kidneys and the toll that diabetes takes on them. Hudson, an internationally recognized kidney research scientist, tells them how much blood flows through the kidneys each day—each kidney about the size of a standard computer mouse. He asks the students if they know someone with diabetes and talks about how the kidney filtration system is affected in a person with disease.

"You know those orange barrels on the highway?" the white-haired professor asks the students. "They hold about 50 gallons each. About 10 of those barrels of blood flow through your kidneys every day." He pauses for effect. Nobody says a word. Then Hudson introduces his lecture companion, Roy Zent, M.D., Ph.D., a Vanderbilt nephrologist, and asks the students if they know what a doctor who specializes in kidney disease is called. "A kidneyologist?" one of the students asks. Hudson and Zent, both wearing white coats, laugh and so do the rural Hancock, Maine, students who are seated at their classroom desks watching Hudson and Zent on a TV monitor.

Videoconferencing sessions are organized as themed sets spanning several weeks. The units start with fundamental concepts and foundational knowledge. "We then build on that framework toward higher concepts and real-life applications of that science—all in the context of hands-on activities," Julie Hudson said. "In a few weeks' time, we've connected the dots from fundamental knowledge to solving real-world problems."

Options beyond poverty

The Aspirnaut program is the brainchild of Billy Hudson, a survivor of child abuse and poverty who grew up in rural south central Arkansas. His mission is to “shine a light” to show students there are options beyond poverty and poor living situations. Hudson, the Elliot V. Newman Professor of Medicine, Biochemistry and Pathology, and director of the Center for Matrix Biology at Vanderbilt University, helped discover the molecular underpinnings of autoimmune and hereditary kidney diseases. He’s also an entrepreneur who co-founded two biotech companies to bring a potential treatment for diabetic kidney disease he helped to market.

In 2005, not content to rest on their laurels, the Hudsons chose to help other students in his struggling community become doctors and dentists, veterinarians, scientists and engineers. Initially a three-year pilot project, the Aspirnaut program equipped school buses with broadband Internet access via cell-phone towers, laptops and flat-screen TVs, —a mobile one-room schoolhouse—so that students could complete online STEM courses or watch STEM-related content designed around their school’s curriculum while riding on long bus routes.

The program evolved to include a summer research program at Vanderbilt University where more than 35 high school, undergraduate and graduate students are paid a stipend and receive room and board to work in research laboratories at Vanderbilt and experience discovery science. This summer will be the summer research program’s fifth. Aspirnaut also has an affiliation with Berea College in Berea, Ky., Tennessee State University in Nashville, and the United South and Eastern Tribes, Inc. (USET), headquartered in Nashville.

The summer research program is a 40-hour-a-week “immersion experience” for the students who come after Memorial Day and live on campus for up to 10 weeks. “It’s not just about the ‘how-to’s’ but also the ‘whys’ or ‘big questions’ being tackled in the lab,” Hudson said. “The students join a scientific team. The intent is that the students rapidly gain enough skill to become contributing members of the team and accelerate the ongoing progress of science in that lab. They will also learn a considerable amount of basic science along the way. The students are challenged to think critically and creatively.”

In addition to lab work, all students have individual career planning sessions and weekly roundtable luncheons and late afternoon discussions with key campus faculty. High school interns participate in ACT prep, meet with Vanderbilt financial aid and admissions counselors about the college application process, and experience firsthand living on a college campus in the dorm. “While we would love to recruit all of the research interns to Vanderbilt, we work hard to demystify the college application and funding process in general,” she said.



The summer research program is an “immersion experience” for the students who live on campus for up to 10 weeks and become contributing members of a lab team. Photos by John Russell.

Vanderbilt via video

Many of the students who participate in the summer research program go back to their communities to help with Aspirnaut videoconferencing during the school year, which has doubled from five sites participating in 2010-2011 to 15 this year.

Aaron Fidler, a Berea College graduate and Vanderbilt graduate student from Ashland, Ky., has worked with the Aspirnaut program

from its beginning when he participated as an undergraduate student doing summer research.

Fidler, who assists with elementary and middle school videoconferencing curriculum development and mentors high school and undergraduate students for the summer research internships, leads at least two of the videoconferences each month during the school year. “They’re going through a lot of things in life,” he said of the students, “and it takes a little more to get them excited. We want to motivate students, keep the excitement in science, and also advance the learning. It’s so rewarding when you see the light bulb go off, and you literally can see it.”

Videoconferencing is tailored to each teacher’s curriculum and follows the STEM framework established by each state. “The classroom teacher is a pivotal partner and directs which labs are included in the schedule. They’re truly partners about what they wish to see happen,” Julie Hudson said.

Most elementary and middle school teachers have a degree in education, not in science, math, engineering or technology, she said. “Classroom teachers have my highest admiration. They have many points of accountability, and often, with minimal resources. In regard to STEM curriculum, we who work in major research universities are challenged to keep up with the rapidly evolving generation of new knowledge. How could a classroom teacher realistically be expected to do the same? The practical solution is not to re-train teachers, but it is to partner the content and experiential expertise of university STEM professionals with the classroom expertise of the teacher.

The weekly videoconferences achieve this partnership. Moreover, the STEM students and professionals are not only experts in the scientific material they are teaching but also communicate firsthand about educational pathways, career opportunities, and the rewards and the excitement of discovery.”

A secondary benefit is professional development for teachers. “The program, almost vicariously, administers onsite professional development every day we’re in the classroom,” Hudson said.

Reachable dreams

Siblings Jeremiah and Sarah Beth Ellis, of Omaha, Ark., are Aspirnaut program success stories. Jeremiah, who participated in the summer program for several years and received his bachelor’s degree in industrial technology last year at Berea College, is one of the first

Aspirnaut participants to graduate from college. He and Sarah Beth, a sophomore at Berea, are two of 16 children (some adopted) raised by Joe and Kitty Ellis. Both in their 60s, Joe is a retired truck driver and Kitty, a high school library worker who has battled lung cancer. Jeremiah, who participated in the summer research program for several years, Sarah Beth, and six siblings were in foster care when the Ellises adopted all of them.

“Jeremiah works hard and is going places,” said Sarah Beth, who participated in the summer internship in 2011 working with Vanderbilt veterinarian Kelly Boyd, DVM. She hopes to become a veterinarian working with large animals. “Dr. Billy and Dr. Julie have made my dream reachable,” she said. “I’ve known for a long time that I wanted to be a veterinarian. I just wasn’t sure how it would happen. Without the Aspirnaut program I could have gone either way.”



Julie Hudson, M.D., and Billy Hudson, Ph.D., want to engage students in a love of math and science through the Aspirnaut Program. Photo by Daniel Dubois.



Vanderbilt student Cody Stothers, right, from rural Arkansas, is the first Aspirnaut student accepted into medical school. Photo by Daniel Dubois.

Cody Stothers, another Aspirnaut success story, is a rising Vanderbilt University senior from Sheridan, Ark., “population 4,500 on a good day.” He became involved early on in the Aspirnaut program as a school bus rider on the laptop-equipped buses, and then as a summer research program participant. He currently works as a resident assistant, supervising new participants during the summer and also leads a couple of videoconferencing sessions during the school year. And late last year he became the first Aspirnaut student accepted into medical school. Accepted through early admission to Vanderbilt University School of Medicine, he will pursue a medical degree beginning in fall 2014.

Stothers, born in the prison where his mother was incarcerated, was raised by his disabled grandmother, who gets by on about \$9,500 a year from her government disability pension. “My grandmother got a call from prison when I was born, saying they were going to put me into foster care if she couldn’t take me. She said yes, which was obviously awesome for me, but a burden for her. She worked her whole life and her jobs weren’t super well-paying and didn’t have a lot of benefits. She never graduated from high school. She didn’t have an easy life and taking over the responsibility of a child was hard, but she chose to and I’m thankful. She’s always been the most supportive person in my life. She made me realize I could do anything if I tried hard enough.”

Stothers said that paying for college on his own was not an option. “My plan was always to try hard and try to get a scholarship,” he said. And he did—a full ride to Vanderbilt.

Planting a seed of hope

Although individual success stories warm their hearts, Julie and Billy Hudson believe helping more than 2,000 students in multiple states isn’t enough. And there’s already more demand for videoconferencing than the Aspirnaut program can provide. They continue to hope the Aspirnaut program will serve as a model for other universities to start similar endeavors and that the videoconferencing model will become a template for other research universities to replicate. “Our colleagues here and at other universities don’t have time to develop programs from the ground up,” Julie Hudson said. “We have spent seven years developing a model that could be replicated. Here’s a template.”

She said it’s easy to get overwhelmed when you fully realize the extent of the need. So it’s important to stay focused. “We won’t solve all problems, but we could potentially impact many more students if the model is replicated,” she said.

Jeremiah Ellis said the Hudsons have helped him obtain confidence and experience. “They’re both brilliant people who are very much down to earth. They care for people—those with potential and desire, with a passion to learn, but without the opportunity. “They’ve helped me look at life differently, to see the challenges and understand that you’re not supposed to know everything, that you just have to push through and learn it.”

And that’s what it’s all about, says Billy Hudson—planting a seed of hope and hoping the student takes it from there. “Brainpower is distributed randomly. It doesn’t go by who you are, and how much money you have, or the color of your skin, or what religion. A lot of kids out there are isolated in rural America, and they’re special people who can contribute to society. I want to shine a light on those people.

“If kids know that others, like me, have overcome these circumstances, and they can identify with any part of it, it might give them hope. I know what it’s like not to have hope.”

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