Searching for Answers

BY JANE HARRIS

AN ENGINEERING FACULTY MEMBER HOPES TO SOLVE A MEDICAL MYSTERY IN THE DEVELOPING WORLD

Pediatric neurosurgeon Steven Schiff, the Brush Chair Professor of Engineering and director of the Penn State Center for Neural Engineering, has long focused his research on finding better ways to treat epilepsy, Parkinson’s disease, and other nervous system disorders. But a conversation with a fellow neurosurgeon several years ago inspired him to widen his area of interest.

“A dear colleague of mine, Dr. Ben Warf, had decided to live and work in East Africa for six years,” Schiff explains. “After about five years, I saw him at a surgical meeting, and over dinner, I listened absolutely entranced as he described what he was doing. As he laid out the problems that he was facing in that highly resource-constrained environment, I thought, ‘We can certainly address some of those at Penn State.’ Shortly after, I made my first visit to the hospital he helped build and direct in Uganda.”

One problem in particular attracted Schiff’s attention—the high incidence of post-infectious hydrocephalus among infants in the developing world.

From 1990 to 1998, Schiff was a practicing pediatric neurosurgeon at Children’s National Medical Center in Washington, DC. About half the cases he treated there involved hydrocephalus—an abnormal accumulation of fluid in the brain that can cause rapid enlargement of the head in babies and potentially lead to brain damage.

“Post-infectious hydrocephalus, however, is not widely seen among newborns in the United States and Europe. “We’ve always had a bit of trouble—everyone does—with babies that get infections shortly after birth,” Schiff notes. “These infections can also lead to hydrocephalus, but we’ve reduced them significantly with advanced medical systems—mostly by screening mothers for dangerous bacteria that we know have a predilection for getting into babies in the first week of life.”

In the developing world, it’s very different.

Schiff explains, “It appears that the majority of the hydrocephalus cases in developing countries are the result of infection. This means that a large number of infants around the world have a preventable type of hydrocephalus, but we don’t know the agents. We don’t know if it’s bacterial, viral, or if parasites have a role. We don’t know if it changes by geographic region or weather, which means that we don’t know how to treat whatever ‘it’ is to reduce or prevent these infections.”

Schiff and his colleagues are hoping to solve this mystery through their work in East Africa. At the CURE Children’s Hospital of Uganda in Mbale, they’ve

Schiff and his colleagues locate a child who was treated for post-infectious hydrocephalus. The gourd protects the child from sun and rain while his mother works in the field.
Schiff and his colleagues then conducted environmental sampling in the villages where many of the babies lived. "We found some very close genetic matches to certain fragments we had identified," he says. "We also found that at different times of the year, the spectrum of bacteria seems to change, which seems to point to the environment."

There are still a number of unanswered questions, however. "We don’t know if the bacterial fragments were cause or the condition," Schiff states. They also don’t know if the AIDS epidemic, now increasing again in Uganda, has anything to do with it or if the introduction of new farm animals in this part of the world is changing the microbial flora that is then transmitted to humans. Also unknown is what piece, if any, is coming from the mother.

For Schiff and his colleagues, the search continues. Currently, they’re collaborating with physicians at a large regional hospital affiliated with the Mbarara University of Science and Technology in Mbarara, Uganda. "They see one case of neonatal sepsis or apparent neonatal sepsis every couple of days," Schiff says. "We’ve begun a clinical trial there to sample the blood and spinal fluid from those babies. They have very good microbiologists that we’ve supplied with extra equipment to help culture organisms.” In addition, they’re bringing DNA and RNA samples back to Penn State for both bacterial and viral sequencing, and with permission, they’re testing the mothers for HIV and taking specimens from their birth canals.

“We’re in the process of collecting a cohort of about 75 newborn babies,” Schiff says. “If we can grow that to several hundred, we’re going to see which fraction of these babies go on to get hydrocephalus. That’s the key. And that will tell us if it’s just the manifestation of run-of-the-mill bacterial infections in these babies or a special subset of bacteria or viruses that we need to treat differently when we pick it up.”

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