RICE 360°
INSTITUTE FOR GLOBAL HEALTH TECHNOLOGIES

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Institute for Global Health Technologies

Inside this issue:

Beyond Traditional Borders wins Science magazine's IBI Prize

By Jade Boyd

HOUSTON — (April 26, 2012) *Science* magazine has awarded a *Science* Prize for Inquiry-Based Instruction (IBI) to Rice University's hands-on engineering education program Beyond Traditional Borders (BTB) as a model for other schools. In the program's first six years, more than 10 percent of Rice undergraduates have participated in BTB and produced 58 low-cost health technologies, including two that have already been broadly distributed at a national level.

As an IBI prize winner, the BTB program is highlighted in *Science* this week in an essay aimed at spreading the word about BTB and showing other educators how to replicate the program on their campuses.

"The essence of the BTB approach to learning is captured in the Haitian saying, 'You don't learn to swim in the library; you learn to swim in the river,'" said BTB founder Rebecca Richards-Kortum, Rice's Stanley C. Moore Professor of Bioengineering.

Babies in Lesotho under a BTB phototherapy light. Melissa Yuan

BTB, which was launched in 2006 with a $2.2 million grant from the Howard Hughes Medical Institute (HHMI) through its Undergraduate Science Education Program, challenges students to come up with practical solutions to real-world health care problems in the developing world. It uses the engineering design method to teach students from all disciplines to meet global health challenges.

BTB has captured the imagination of Rice's students in a remarkably short time. More than 10 percent of Rice undergraduates — including many nonengineering majors — have taken a BTB course. Thanks to HHMI funding,

(cont'd on page 2)

Indian District plans to adopt 50,000 I-slate tablets

By Jade Boyd

HOUSTON — (March 19, 2012) The U.S.- and Singapore-based creators of the I-slate educational tablet and local government officials in India's Mahabubnagar District plan to adopt 50,000 of the low-cost electronic educational slates into classrooms throughout the district over the next three years.

The I-slate, a low-cost learning tool designed for classrooms with no electricity and too few teachers, is under development by the I-slate Consortium, which includes Rice and NTU, ViDAL and a design team in Los Angeles.

The district of Mahabubnagar in the Indian state Andhra Pradesh has about 500,000 students in government schools. Consortium leaders and Mahabubnagar officials said they hope to supply I-slates to at least 10 percent of the students over the next three years.

"The I-slate project is about empowering local communities with education and knowledge," said Rajeswari Pingali, ViDAL founding chairwoman.

I-slate creator Krishna Palem,

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Letter from the Director

Each year, nearly four million babies die within the first month of life -- 450 newborns every hour. 99% of these deaths happen in low-income and middle-income countries, and most are preventable. While the technologies to save newborn lives exist, these tools often cannot be used in the developing world, where hospitals lack infrastructure, medical and maintenance personnel, and reliable power.

Rice 360° is working with the Texas Medical Center and the University of Malawi to change this. We have begun to develop a Nursery of the Future for hospitals in the developing world. The Nursery is a set of technologies to keep newborns alive by combatting the most common causes of death. These technologies are robust and do not require complex maintenance, numerous consumables, or constant monitoring. They cost ten to 100 times less than alternatives, without compromising performance.

Our vision is to create a sustainable, high-performance Nursery that a district hospital serving 250,000 people could implement for $5,000. To realize this vision, it is not enough simply to design new life-saving technologies. We must also deliver these tools into the hands of physicians.

We will take a tremendous step toward this goal this year, when we begin work on a Saving Lives at Birth-funded project to disseminate the low-cost bCPAP device we designed for infants with respiratory distress in Malawi.

The first patient we put on CPAP in Malawi last year was a bronchiolitic baby who was non-responsive when she arrived at the hospital. Within minutes of receiving CPAP support, she was able to interact with her mother. Hours later, she was able to nurse. Five days after that, she was discharged from the hospital.

We want every mother in the world to know the joy of bringing a healthy newborn home. As we continue to develop the Nursery of the Future, we bring this aspiration closer to reality.

BTB wins Science Prize

"Today students really want to make a difference and have impact, and BTB provides the possibility for incredible experiences for the students that decide to take on real-world challenges," said Ned Thomas, dean of Rice's George R. Brown School of Engineering.

approximately 12 Rice students travel abroad each summer to implement their designs in partnership with physicians in Africa and Latin America.

"Today students really want to make a difference and have impact, and BTB provides the possibility for incredible experiences for the students that decide to take on real-world challenges," said Ned Thomas, dean of Rice's George R. Brown School of Engineering. "Professor Richards-Kortum and her team find critically important global health problems, and the students solve them and bring working prototypes to the field, refine their designs and in some cases go on to deploy thousands of actual medical devices."

Notable BTB technologies include:

- A hand-powered centrifuge for laboratory blood testing constructed for $35 using a salad spinner and found to be as accurate as a commercially available model costing 10 times more.

- LED-based phototherapy lights to treat neonatal jaundice made for less than $100. A clinical study in Guatemala found the low-cost lights were as effective in treating neonatal hyperbilirubinemia as conventional phototherapy lights that cost thousands of dollars.

- A portable, battery-operated fluorescence microscope made for $240. In a side-by-side comparison with a laboratory-grade instrument, the low-cost microscope proved as effective at detecting tuberculosis-infected sputum samples in more than 98 percent of samples.

- The Lab-in-a-Backpack, an ultraportable backpack containing a microscope, centrifuge, pulse oximeter, otoscope and other clinical tools. The Lab-in-a-Backpack was deployed countrywide by Ecuador's Ministry of Health.

- "DoseRight" syringe clips, which fit into the barrel of an oral syringe to ensure accurate dosing of HIV/AIDS medication. Swaziland health officials oversaw the countrywide distribution last year of approximately 214,000 DoseRight syringe clips.

"We have discovered that giving students the opportunity to solve real global health problems not only creates leaders for tomorrow's global health technology workforce, but also produces technologies with the potential to revolutionize health care delivery in poor settings," they wrote.

The BTB curriculum has been adapted for high schools, and the Texas Education Agency has approved the curriculum to count toward the state's graduation requirement in science. More than 2,000 high school students have participated in courses based on this curriculum.

Rice's student-designed device to help babies breathe wins more support

by Mike Williams

HOUSTON – (July 30, 2012) Rice University's low-cost, student-designed device that helps newborns in respiratory distress is one of three projects nominated this month to receive up to $2 million from the Saving Lives at Birth partners to deploy the technology in Malawi.

Bubble continuous positive airway pressure (bCPAP) devices are commonly used in the developed world to treat infants whose respiratory systems are underdeveloped or compromised by infection. However, at $6,000 each, the devices are often too expensive for hospitals in the developing world. The bCPAP device developed by Rice can be built for $160 and delivers the same therapeutic pressure as devices in hospitals in the developed world. Rice's bCPAP device, a project in Rice's Beyond Traditional Borders initiative, was developed at Rice's Oshman Engineering Design Kitchen by seniors as their engineering design capstone project in 2010.

"We are very grateful for the opportunity to continue the important work we began with Saving Lives at Birth seed funding to evaluate and implement the low-cost bCPAP device in Malawi," said Rebecca Richards-Kortum, Rice's Stanley C. Moore Professor of Bioengineering and director of the Rice 360°: Institute for Global Health Technologies. "Preliminary data from our clinical trial at Queen Elizabeth Central Hospital in Blantyre, Malawi, suggest that our bCPAP device can significantly improve survival for infants struggling with respiratory distress. We look forward to bringing this life-saving device to central and district hospitals in Malawi."

Saving Lives at Birth is sponsored by the U.S. Agency for International Development, the government of Norway, the Bill & Melinda Gates Foundation, Grand Challenges Canada and the U.K.'s Department for International Development. Last year, Rice's bCPAP device was one of 19 projects selected for seed-grant funding. The device competed with more than 600 submissions. This year, Rice's bCPAP device was among three of 14 applicants nominated to receive a larger "transition-to-scale" grant. The additional funds are intended to scale up the technology for widespread deployment in Malawi. Rice will now enter into negotiations before the award is finalized. The grants are typically worth $2 million.

With seed funding, Rice 360° and its partners, the University of Malawi, Baylor College of Medicine and 3rd Stone Design, evaluated the bCPAP device in a clinical trial at Queen Elizabeth Central Hospital this year, developed training programs, designed a commercial prototype and held a countrywide stakeholders meeting to gather feedback on the device. With transition-to-scale funding, the team, joined by MD Anderson Cancer Center, will implement the device in all central and district hospitals in Malawi, develop a campaign to educate mothers about bCPAP and assess the device's cost-effectiveness. An estimated 178,000 babies could be saved each year if the device is disseminated throughout Africa.

In February, design team member Jocelyn Brown, now a staff member at Rice 360°, was one of four representatives invited to the White House to present at an "Innovations in Global Health" event. Also on the design team were Rice alumni Michael Pandya, Joseph Chang, Haruka Maruyama and Katie Schnelle.

Baby being treated with the bCPAP device at Queen Elizabeth Central Hospital. Jocelyn Brown

"This award really validates what we've already accomplished," said Brown, who helped to administer the clinical study in Malawi. "We're thrilled to be able to go back and tell the doctors and nurses that we're continuing, and that we can bring bCPAP to more hospitals."

Earlier this month, Rice alumna Jordan Schermerhorn was on the road in Africa as the winner of a competition to travel on a reporting trip with Pulitzer Prize-winning *New York Times* columnist Nicholas Kristof. While in Malawi, Schermerhorn and Kristof visited Rice students who were "tasked with field-testing health technologies developed in the classroom." In her blog for *The New York Times*, Schermerhorn also wrote about the clinical trial in Blantyre.

"When I came into hospital, my baby was not breathing well...But when they put her on CPAP, she started breathing much better...There is very good care [at Queen Elizabeth Central Hospital]. I never thought I would see my child become healthy."

—Mother of an infant treated with Rice's bCPAP device in Malawi.

Global health project lands Grand Challenge Point-of-Care Diagnostics Grant

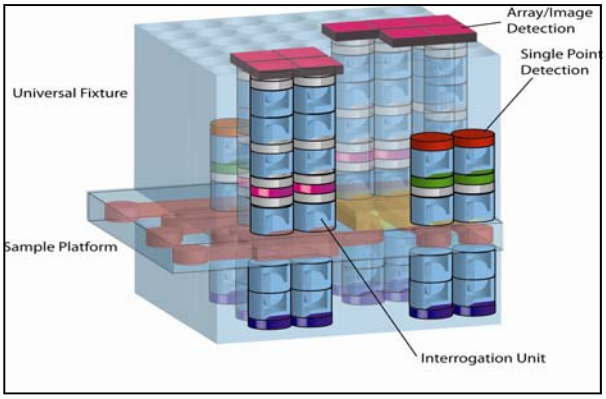
By Mike Williams

Miniature optics in an easily configurable system — as simple as a child's LEGO blocks and as sophisticated and effective as a hospital lab — are the basis of a revolutionary method for diagnosing a range of diseases that, till now, have required complex and costly laboratory work.

HOUSTON —(December 16, 2011) A project led by bioengineers Rebecca Richards-Kortum and Tomasz Tkaczyk has landed a grant from the Grand Challenges in Global Health, an initiative created by the Bill & Melinda Gates Foundation, to create an affordable, palm-sized, programmable system to diagnose disease in the developing world.

Miniature optics in an easily configurable system — as simple as LEGO blocks and as sophisticated and effective as a hospital lab — are the basis of a revolutionary method for diagnosing a range of diseases that, till now, have required complex and costly laboratory work. The goal is to revolutionize health care in resource-poor settings.

"Our goal is to develop and implement a new modular design approach to build a reusable Readout and Signal Device component that is more sensitive, robust, compact, power-efficient and cheaper than large-scale counterparts and that can easily be customized to interface with a wide variety of point-of-care sample platforms," Richards-Kortum said.



Readout and Signal Device Schematic Tomasz Tkaczyk

The $10 reusable platform would consist of a universal fixture that accepts a library of "plug-and-sense" interrogation units — arrays of light sources and lenses — tuned to detect signs of specific diseases.

Those components would incorporate solar-powered LED light sources for transmission, reflectance, light scattering and fluorescence analysis of biological samples. The interrogation units would analyze samples on plastic or paper microfluidic devices or slides and feed images to low-cost CMOS array detectors.

The approach leads to a ROST with the sensitivity of large-scale optical readers while reducing the size and cost by more than two orders of magnitude. The only consumable component would be the solar-rechargeable battery, which could last 8-10 hours on a single charge, with an estimated lifespan of 1,000 charge cycles.

"New and improved diagnostics to use at the point-of-care can help health workers around the world save countless lives," said Chris Wilson, director of Global Health Discovery at the Bill & Melinda Gates Foundation. "Our hope is that these bold ideas lead to affordable, easy-to-use tools that can rapidly diagnose diseases and trigger timelier treatment in resource-poor communities."

Indian District plans to adopt 50,000 I-slate tablets

"The I-slate is not a tablet computer. It is a device designed for a single purpose — education in a low-resource environment."

a professor at both Rice and NTU, said. "The I-slate is not a tablet computer. It is a device designed for a single purpose — education in a low-resource environment."

Palem, Rice's Ken and Audrey Kennedy Professor of Computing, initially conceived the I-slate in 2008. He thought power would be the biggest hurdle, because many rural schools in India lack electricity. A solar-powered I-slate would need to run on no more than three watts of power. However, as soon as students in Mohamed Hussainpalli Village began testing early prototypes, it became obvious that usability and effectiveness would also be a challenge.

The I-slate's Los Angeles-based design team volunteered its time to work with ViDAL, NTU specialists in human-computer interaction and Rice student interns. The designers evaluated feedback from children at Mohamed Hussainpalli Village School and spent thousands of hours scrutinizing the features and the way children interacted with the I-slate.

The hardware and graphic content for the I-slate are being developed in tandem because they will ultimately use a revolutionary low-power computer chip — another of Palem's inventions. The new chip, which could be ready for the I-slate by 2013, will cut power requirements in half and allow the device to run on solar power from small panels similar to those used on handheld calculators.

OEDK Director wins national award

By Patrick Kurp

HOUSTON — (April 24, 2012) The American Society for Engineering Education (ASEE) has honored Maria Oden, professor in the practice of engineering education and director of the Oshman Engineering Design Kitchen (OEDK) with its prestigious 2012 Fred Merryfield Design Award.

"Dr. Oden has helped more than 1,665 students learn engineering design processes and the value of teamwork, communications and entrepreneurial skills," said Rebecca Richards-Kortum, the Stanley C. Moore Professor and chair of bioengineering, who nominated Oden for the honor. "Last year, one-quarter of the 42 design teams participated in national/statewide competitions and won top prizes. Maria gets much of the credit for those accomplishments."

Oden joined the Department of Bioengineering at Rice as a lecturer and laboratory coordinator in 2004; she guides technical design efforts of undergraduates participating in Beyond Traditional Borders and Rice 360°: Insitute for Global Health Technologies. Oden has mentored more than 160 students in 43 design teams in the bioengineering capstone design course sequences that she developed and taught.

Maria Oden Donnie Soward

In 2008, Oden became the inaugural director of the OEDK, where she has inspired hundreds of students to work in teams of four or five to complete design challenge projects. More than 15 teams have won regional and national awards at design competitions. Several of their devices are being tested in the United States and abroad, and 15 students have graduated with patent applications.

"Maria has an incredible flair for inspiring and guiding students to solve design challenges that are 'real world,'" said Edwin "Ned" Thomas, the William and Stephanie Sick Dean of Engineering at Rice University. "The teams often end up morphing the challenge and coming up with workable prototypes, some of which result in filing of intellectual property disclosures and even the occasional student-led startup that solves the original real-world problem."

The Fred Merryfield Design Award recognizes "creativity and demonstrated excellence in the teaching of engineering design."

"Maria has an incredible flair for inspiring and guiding students to solve design challenges that are 'real world,'" said Ned Thomas, dean of Rice's George R. Brown School of Engineering.

Childhood hunger policies should target neighborhoods

By Amy Hodges

HOUSTON— (March 22, 2012) Policies addressing childhood hunger should target neighborhoods, not individual families, according to new research from Rice University.

Sociologists found that children living in neighborhoods with higher poverty rates and in those with high foreign-born populations and non-English speakers are more likely to experience hunger.

"Policymakers should be thinking about targeting whole communities, instead of what is done now, which is offering public aid programs for individual families," said Rice sociology professor Justin Denney. "Public aid works on a limited basis, reaching approximately 70 percent of eligible individuals. But unfortunately, the remaining 30 percent are unaccounted for."

The study, published in the Journal of Applied Research on Children, was co-authored by Denney and sociology professor Rachel Tolbert Kimbro, co-founders of the Kinder Institute for Urban Research's Urban Health Program at Rice, and postbaccalaureate fellow Sarita Panchang. They used data from the Early Childhood Longitudinal Study, a nationally representative dataset of more than 20,000 kindergarteners in 1998-1999, to examine individual, family and neighborhood characteristics of children who are or are not affected by hunger.

Kimbro said that many of these children facing hunger have foreign-born parents fearful of applying for aid, despite their children's eligibility as citizens of the U.S., or parents ashamed of applying for public aid. By changing the focus of these policies away from the individual and on to the community, she said, parents might take advantage of community food programs.

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Report from Malawi

by Tara Slough

I spent last summer serving as a one of Rice 360°'s Beyond Traditional Borders interns at St. Gabriel's Hospital near Namitete, Malawi. St. Gabriel's is located in central Malawi and serves a rural catchment area of 250,000 people. Along with fellow BTB interns Kamal Shah and Teresa Yeh, I arrived at St. Gabriel's in late May with six student-designed global health technologies in tow, not knowing how the summer would take shape.

Within a few days of our arrival at the hospital, our mentor assigned us a project for our internship: the creation of a database to track the care provided to patients by the hospital's palliative care unit. Unlike the other care provided at St. Gabriel's, palliative care is delivered through a combination of inpatient, outpatient, and home-based care. This end-of-life care relies upon repeated interaction with patients as their conditions progress. The current method of tracking patient interactions—three handwritten registers with minimal information—made it difficult for St. Gabriel's to quantify the activities of the unit and keep track of patient care episodes. Maintaining data on these interactions is critical in Malawi, where provision of these services relies upon funding from grants, in the absence of support from the federal government.

The smiles that I saw daily in Malawi, despite unimaginable hardship, taught me the importance of a positive attitude and perseverance.

We set about designing the DataPall, an electronic medical records system for palliative care providers in low-resource settings, for use at St. Gabriel's. As we refined the system, the clinical staff from St. Gabriel's suggested that our system could also manage data and help generate an evidence base in other palliative care centers in Malawi. We reached out to the Tiyanjane Clinic at Queen Elizabeth Central Hospital in Blantyre, which is the largest palliative care provider in the nation. The staff at Tiyanjane welcomed us for a week as we implemented the DataPall in their practice. They also connected us with Malawi's Ministry of Health. Upon our return to central Malawi, we took our project to the Ministry of Health in Lilongwe, where we received positive feedback. Working with these two pilot sites, we hope to return to Malawi to expand the coverage and improve the functionality of DataPall.

My BTB internship taught me about the challenges associated with work in global health, and in development more broadly. Indeed, I am a less conventional BTB student. I graduated from Rice in May with dual undergraduate degrees in political science and music performance. I am an aspiring political scientist with interests in development and social policy. My internship was a primer on development work at a local level. I will not soon forget the resourcefulness that I saw among the clinical staff and community health workers. On a home-based care visit, we saw a bedbound patient unable to sit. Working with a physical therapist, community volunteers supervised the adaption of a conventional wheelchair into a reclining wheelchair so the patient could leave her home. Moreover, the smiles that I saw daily in Malawi, despite unimaginable hardship, taught me the importance of a positive attitude and perseverance. When I sat in on the appointments of terminally ill patients who live with diseases like AIDS and cervical cancer, I was inspired by their ability to smile and laugh.

At present, I am living in Bogotá, Colombia, where I work for a national foundation that promotes social development through music education. As I reflect upon my experience in Malawi, I am tremendously grateful for the lessons that I learned in and outside of the hospital. Daily, I rely on the skills I observed in Malawi: resourcefulness, perseverance, patience, and the ability to smile.

Tara Slough in Malawi. Kamal Shah

Childhood hunger policies should target neighborhoods

"If we have policies targeted at neighborhoods rather than individuals, no one is excluded," she said.

The authors hope their findings will influence future policies around childhood hunger.

"Families are critical for childhood development, but communities and neighborhoods have significant impacts as well, as this study clearly demonstrates," Kimbro said.

The study was supported by the Kinder Institute for Urban Research's Urban Health Program at Rice University.

An urban community garden. Photos.com

Student and Faculty Award Winners

Faculty

Pedro Alvarez, Athalie Richardson Irvine Clarke Prize from the National Water Institue; AAAS Fellow

George Bennett, AAAS Fellow

Jane Grande-Allen, American Heart Association Established Investigator Award

Brent Houchens, Nicolas Salgo Distinguished Teacher Award

Rachel Kimbro, Phi Beta Kappa Teaching Prize

Maria Oden, Fred Merryfield Design Award

Krishna Palem, AAAS fellow; Forbes India award for "18 Scientist Who Are Changing the World"

Kyriacos Zygourakis, AIMBE fellow

Students

Danielle Brown, Alan Grob Prize

Ann Chou, Spirit of Service Award

Lila Kerr, Alan Grob Prize

Rahul Kamath, Truman Scholarship

Amber Kunkel, Samuel T. Sikes Jr. Scholarship

Chethan Ramprasad, Alan Grob Prize; John. W Brelsford Award for Superior Scholarship, Leadership or Service; Spirit of Service

Jordan Schermerhorn, *NYT* columnist Nicholas Kristof's "Win-a-Trip" Competition

Tara Slough, Wagoner Scholarship

Design Teams

Team Breath Alert

(Rachel Alexander, Rachel Gilbert, Jordan Schermerhorn, Bridget Ugoh, and Andrea Ulrich)

1st Place, Rice 360° 2012 Undergraduate Global Health Design Competition

1st Place, Rice Undergraduate Venture Challenge

1st Honorable Mention, NCIIA BMEstart 2012

1st Honorable Mention, NIBIB DEBUT Challenge

2nd Place, 3rd Annual Rice Alliance Undergraduate Elevator Pitch Competition

Semi-Finalist, Dell Social Innovation Challenge

Students Choice Award, 2012 Rice Engineering Design Showcase

Team IV Raid

(Thor Walker, Kamal Shah, Taylor Vaughn, Melissa Yuan)

Best Freshman Design, Rice Undergraduate Design Showcase 2012

Students Choice Award, Rice 360° 2012 Undergraduate Global Health Design Competition

Team SAPHE

(Lila Kerr, Kate Barnett, Chthan Ramprasad, Ana El-Behadli, Amit Suneja)

Best Global Health Technology, Rice University Engineering Competition 2012

Beyond Traditional Borders

National Academy of Engineering's Prize for Real World Education

Science prize for Inquiry Based Instruction

Upcoming Events

April 5, 2013

National Undergraduate Global Health Technologies Design Competition

Rice University

For more information: www.rice360.rice.edu

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Rice 360° brings together an international group of faculty, students, clinicians, and private and public sector partners to design innovative health technologies for poor settings, increase access to these technologies, and prepare students to lead tomorrow's global health technology workforce.

Beyond Traditional Borders — the undergraduate initiative of Rice 360° — challenges students through multi-disciplinary education programs to develop sustainable innovations in technology and education that address pressing global health challenges.