RICE 360°: INSTITUTE FOR GLOBAL HEALTH TECHNOLOGIES

Volume 3, Issue 1—Fall 2011

RICE 360°
Institute for Global Health Technologies

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"Students and faculty in Rice 360° are developing solutions to some of the world's most difficult challenges of health and poverty. The program is an outstanding example of how premier scholarship, research and education come together at Rice to move beyond the walls of the academy for global benefit."

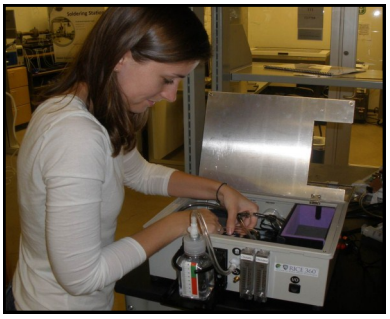
- David W. Leebron, Rice University President

RICE'S 'INFANTAIR' DEVICE WINS BIG IN INTERNATIONAL CONTEST

Rice University's low-cost "infantAIR" device — a global health technology invented by Rice students to help newborns struggling with respiratory distress — was one of 19 projects selected for seed-grant funding July 29 at the Saving Lives at Birth global health contest in Washington, D.C.

The contest, which was jointly sponsored by the U.S. Agency for International Development (USAID), the Norwegian government, the Bill and Melinda Gates Foundation, Grand Challenges Canada and the World Bank — drew more than 600 entries.

In Rice's project, a team from the United States and Malawi will refine Rice's bubble continuous positive airway pressure device — or bCPAP — and implement it in Malawi. The device is designed to help infants breathe when they are struggling with acute respiratory infection, the leading cause of global child mortality.



Jocelyn Brown prepares the bCPAP device she designed as a senior in bioengineering for a clinical trial in Malawi.

"We believe that the bCPAP device has the potential to greatly reduce neonatal mortality related to respiratory distress in low-resource settings, and we are so pleased to have been nominated for funding to implement this life-saving technology in Malawi," said Rebecca Richards-Kortum, Stanley C. Moore Professor of Bioengineering and director of Rice 360°.

The bCPAP was invented and improved by undergraduates in Rice 360°'s Beyond Traditional Borders program. The students worked at the Oshman Engineering Design Kitchen under the mentorship of pediatricians from Baylor College of Medicine, Texas Children's Hospital, and the University of Malawi's Queen Elizabeth Central Hospital (QECH).

"The bCPAP is proven therapy to treat neonates in respiratory distress, but it is often too expensive for hospitals in the developing world," said Jocelyn Brown, who began developing the device in 2009 as part of her senior design course. "The device we developed has been shown to deliver the same therapeutic pressure as the bCPAP

(Continued on page 3)

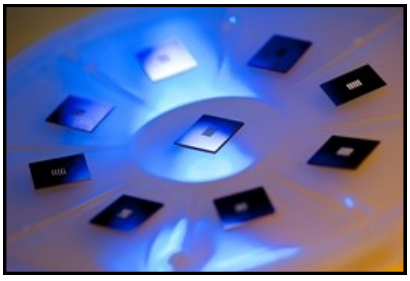
DIAGNOSTIC CHIP MAY HELP HEARTS, CUT COSTS

New microchip technology from Rice University is expected to advance the art of diagnosis of heart disease. Cardiac disease is the focus of one of six ongoing major clinical trials of Rice's programmable bio-nano-chips (PBNCs).

PBNCs combine microfluidics, nanotechnology, advanced optics and electronics to enable quick, painless diagnostic tests for a wide range of diseases at minimal cost.

Current clinical trials employ PBNCs to test more than 4,000 patients for signs of heart attack, ovarian cancer, prostate cancer, oral cancer, and drug abuse. Versions to test for HIV/AIDS and other diseases are also in development.

"With this test, we expect to save lives and dramatically cut the recovery time and cost of caring for those who suffer from heart ailments," said Professor John McDevitt, Rice's Brown-Wiess Professor of Chemistry and Bioengineering and a member of Rice 360°'s executive committee. McDevitt is a pioneer in the creation of microfluidic devices for biomedical testing. He anticipates the PBNCs, when manufactured in bulk, will cost only a few dollars each.



JEFF FITLOW

Programmable bio-nano-chip.

PBNCs analyze a patient's saliva for biomarkers associated with cardiovascular disease. PBNCs now in development deliver results in as little as 20 minutes and provide clinicians with timely information

Letter From The Director

Beyond Traditional Borders, Rice 360°'s undergraduate education program, continues to produce amazing young leaders in global health. In 2011, thirty students graduated with a minor in global health technologies — more than double the number of graduates in 2009 and 2010 combined.

At the core of Rice 360°'s mission is the belief that healthcare innovation should be available to all of the world's citizens. Over the past year, we have brought this vision closer to reality. Beyond Traditional Borders, our undergraduate education program, continues to produce amazing young leaders in global health. In 2011, thirty students graduated with a minor in global health technologies — more than double the number of graduates in 2009 and 2010 combined. Graduates included a Rhodes Scholar, a Fulbright Scholar, and a member of Phi Beta Kappa. Student-teams won prestigious awards for their global health technology designs from the American Society of Mechanical Engineers, IEEE, and the National Collegiate Inventors and Innovators Alliance.

Rice 360° is expanding support for graduate student research. Benjamin Grant, in Brown-Wiess Professor John McDevitt's group, worked with partners at the University Teaching Hospital in Lusaka, Zambia, to advance an innovative low-cost device the lab has designed to measure CD4 counts at the point of care.

Natalia Gonzalez-Pech, in Kenneth S. Pitzer-Schlumberger Professor and Vice Provost Vicki Colvin's group, worked in Guanajuato, Mexico, to advance research around nanotechnology based arsenic removal from water. Rebecca Gimbel, a graduate student in Anthropology whose advisor is Professor and Chair Nia Georges, is researching the influence of historical and political imagery on people's conceptualization of their bodies and the process of healing at Port-au-Prince's Cuban medical mission.

More people than ever are benefitting from Rice 360°'s technologies. For the first time, we licensed a student-designed technology — the DoseRight© syringe clip — to 3rd Stone Design, a private industry partner. In partnership with 3rd Stone Design, the Clinton Health Access Initiative, and Swaziland's Ministry of Health, we delivered more than 213,000 clips to Swaziland, where they are being distributed to mothers in the country's national program for the Prevention of Mother to Child Transmission of HIV/AIDS. The student-designed Community Health Outreach pack is being used in Malawi by 14 health workers at St. Gabriel's Hospital. One community health worker said, "Our patients will see us coming with the packs, and they will say, "Oh yes, our doctor is here."

With each new technology they design, students and faculty in Rice 360° open up new possibilities for healthcare in poor communities around the world. They are changing lives. Thank you for being part of our team.

Rebecca Richards-Kortum, Ph.D.
Stanley C. Moore Professor of Bioengineering
Director, Rice 360°: Institute for Global Health Technologies

Rice 360° & Beyond Traditional Borders Collaboration Sites

"[One of the best parts of the experience] was working on a project that was needed on a national scale – seeing how useful the dosing clips were. I was glad that this project would be making a concrete difference for HIV-positive children in Swaziland." - 2011 BTB intern Caren Abraham, who worked on implementing the DoseRight syringe clips in Swaziland.

'InfantAir'

(Continued from page 1)

setup at Texas Children's Hospital, while costing almost 35 times less."

Rice proposed to refine and test the bCPAP device and to develop a plan to scale up distribution in rural hospitals throughout Malawi. Bioengineers from Rice 360° will collaborate with pediatricians at QECH and Texas Children's, and with industrial design engineers from 3rd Stone Design.

Pediatricians from QECH will oversee the clinical trials of the device and offer design feedback. The team will also work with physicians in Malawi to help facilitate country-wide scale up.

A team from Baylor and Texas Children's will expand and refine clinical protocols and job aids for the bCPAP. It will also develop training materials for caregivers, help to assess data gathered in clinical trials and develop guidelines to help community-health workers recognize infants who would benefit from the device.

3rd Stone Design will perform a needs assessment in Malawi to develop a clinical evaluation unit of the bCPAP device. The team will also identify engineering, medical, market, and regulatory requirements for the bCPAP device.—

By Jade Boyd, from Rice News

"The [bCPAP] device we developed has been shown to deliver the same therapeutic pressure as the bCPAP setup at Texas Children's Hospital, while costing almost 35 times less."

Clinton Lauds Global Health Technologies

Former President Bill Clinton recognized four students at the 2011 Clinton Global Initiative University (CGI U) Meeting in San Diego.

President Clinton honored the students for their commitment to disseminate inexpensive plastic dosing clips — a student-designed technology from Rice 360°.

The clips fits into an oral syringe and stops the syringe's plunger when the right dose of medicine has been drawn.

The clips have been licensed to 3rd Stone Design, which has worked with Rice 360°, the Swaziland Ministry of Health, and the Clinton Health Access Initiative to disseminate more than 213,000 clips to the participants in Swaziland's program for the Prevention of Mother to Child Transmission of HIV/AIDS. - *by Jade Boyd, from* Rice News

ADAM SCHULTZ

Rice 360° students were recognized by President Bill Clinton at the annual Clinton Global Initiative University meeting in April 2011 .

You Don't Learn to Swim in a Library

Melody Tan reports on her experience as a Beyond Traditional Borders intern in Ecuador last summer.

Melody Tan in Ecuador.

Beyond Traditional Borders provided the service placement for my Loewenstern Fellowship. I spent two months in Ecuador with the local organization, Fundación Futuro. The Fundación's empowerment initiatives include opening clinics, starting recycling programs, agricultural training, microfinance, clean-up of the coast, and a youth orchestra.

It is easy to get emotional and feel a sense of outrage hearing about those living on less than a dollar a day and dying of preventable causes. It is far more difficult to translate that passion into actions that empower and create real change.

My first couple of weeks were spent at the Fundación office in Quito as we learned more about Fundación Futuro, visited clinics, and prepared for our move to Planchaloma, a small rural community, by finishing the second Malaria and Tuberculosis Field Staining Kit, making posters, and doing some Spanish translations. In Planchaloma, we demonstrated some BTB-student designed technologies — the Global Focus microscope, Sally Centrifuge, and my group's Malaria and TB Kit — to the clinic staff and solicited feedback on these technologies and ideas for future projects. BTB left 25 lab-in-a-backpacks in clinics throughout Ecuador, so we visited two of the other clinics to collect data and us-

(Continued on page 4)

SAVE THE DATE

February 28, 2012

National Academy of Engineering Meeting/ De Lange Conference session

1:15 p.m.

Bioscience Research Collaborative

Rice University

March 30, 2012

Undergraduate Global Health Technologies Design Competition

12:00 –6:00 p.m.

Bioscience Research Collaborative

Rice University

"These bags have given us an identity. The tools and drugs are now secured. We are well honored in our community."

"Our patients will see us coming with the packs, and they will say, "Oh yes, our doctor is here."

"This should just be the beginning. We need more packs."

— Community health workers in Malawi on the backpacks that were designed for them by a student in Beyond Traditional Borders. Twelve packs were delivered to St. Gabriel's Hospital in January 2010.

You Don't Learn to Swim in a Library

age feedback. As our clinic-assigned project, we taught at the daycares about hand-washing and environmental preservation through the proper disposal of trash. Finally, we had personal projects. I was interested in water purification, as Nicolas, a community member who works for the clinic, had told me that parasitism was a persistent problem due to the unchlorinated water supply. I researched water chlorination and filtration, and contacted many water-project organizations to determine if there was a feasible solution for Planchaloma. It resulted that, with the types of parasites in the water, a more extensive solution was needed than chlorination, so eventually I created "Boil Water" and Tuberculosis detection and prevention posters.

In Ecuador, my expectations evolved as I came to understand and adapt to the realities and to accept my limitations. I realized that I don't believe in making experiences conform to pre-trip expectations, but that experiences should shape expectations. I often felt that problems I encountered were beyond my and even the clinic's ability to solve. I was frustrated because sometimes it seemed that the "symptoms" were being treated, but not the "disease." This was by no fault of the clinic, but I saw the need for infrastructure and that other organizations have a role to play. Thus, I became more aware of the complexities associated with meeting needs. My interest in public policy is growing, as I know that the technologies to solve many of the problems I saw already exist and could be implemented but for lack of appropriate advocacy and funding. I am now motivated to supplement my Bioengineering/Global Health education by learning about policy.

Melody teaching hand-washing in Ecuador.

What does this experience mean for me and my future? I do believe that healthcare is a human right; I cannot but live accordingly. I have been told that when deciding on a career, I should choose something that I love, that I have the skills for, and that meets a human need. I don't see myself happy otherwise.

Diagnostic Chip

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that can help them manage patients more effectively.

Biykem Bozkurt, the Mary and Gordon Cain Chair and Professor of Medicine and director of the Winters Center for Heart Failure Research, and Christie Ballantyne, chief of atherosclerosis and vascular medicine and professor of medicine at Baylor College of Medicine and director of the Center for Cardiovascular Disease Prevention at the Methodist DeBakey Heart and Vascular Center, are leading the trial at Houston's Michael E. DeBakey VA Medical Center.

The potential cost savings for even a single patient are tremendous, said Vivian Ho, the James A. Baker III Institute Chair in Health Economics and professor of economics at Rice.

"Treating patients in the emergency room is one of the highest costs we have in the health care system," Ho said, "particularly for heart attacks, because heart disease is the leading killer of Americans, and it accounts for a large proportion of our health care costs.

"If we can identify these patients quickly so we can avoid aggressive diagnostic tests further on down the road -- for example, cardiac catheterizations and procedures that cost tens of thousands of dollars -- by instead using a relatively low-cost diagnostic chip, that's a tremendous opportunity to provide better care and lower costs," she said.

McDevitt expects PBNCs and their toaster-sized reader will ultimately find a place at many points of care -- hospitals, doctors' or dentists' offices, pharmacies and remote clinics worldwide -- where they will allow clinicians to quickly diagnose a variety of ailments.

He anticipates Rice's BioScience Research Collaborative, part of the Texas Medical Center, to be the hub of a pipeline in which chips will be programmed to spot biomarkers for many important diseases.

"PBNC technology marries medical devices and microelectronics," McDevitt said, "and it has the potential to revolutionize the flow of information in the practice of medicine while significantly reducing cost. I like to think of it as the iPhone of medicine, with the same potential to be a game changer. And it's just around the corner." - *by Mike Williams, from* Rice News

Owl engineers win second at IShow

A team of new Rice University graduates took second place and a $7,000 prize in the prestigious IShow competition sponsored by the American Society of Mechanical Engineers.

Team Zikomo was one of two groups of Rice students among ten chosen for the fourth annual nationwide competition, held June 11 at the society's convention in Dallas.

The members — Cynthia Sung, Yiwen Cui, Rashmi Kamath, Liz Carstens, and Clare Ouyang — demonstrated their neonatal syringe pump for low-resource settings. The pump is a user-friendly, accurate, inexpensive and robust device that simplifies the intravenous delivery of small volumes of medication at low flow rates. Because the pump is gravity– and clockwork-driven, it requires no electricity. It was developed at Rice's Oshman Engineering Design Kitchen.

"We believe this product has vast potential because of the number of places worldwide that don't have electrical power and where IV fluid and medications need to be delivered in precise amounts," said Maria Oden, professor in the practice of engineering education and director of the OEDK. Oden discussed the concept with health care providers in Swaziland, Botswana, and Malawi last summer while interns with Beyond Traditional Borders refine the device.

JEFF FITLOW

Team Zikomo with the neonatal syringe pump.

Oden said two members of the team, Cui and Carstens, worked at Queen Elizabeth Central Hospital in Malawi on behalf of BTB last summer and saw the need for their device firsthand. "They saw how critically important this is and shared with their teammates, who really got engaged in solving the problem."

She said the team included bioengineering and mechanical engineering majors who employed their skills "in a way that any single discipline might not have been able to do as effectively."

Oden and Renata Ramos, lecturer in bioengineering; Tracy Volz, senior lecturer in professional communication in the George R. Brown School of Engineering; Kim Kimmey, lecturer in communications at the Jones Graduate School of Business; and Thomas Kraft, director of technology ventures development for Rice Alliance, mentored the team. — *by Mike Williams, from* Rice News

"We believe this product has vast potential because of the number of places worldwide that don't have electrical power and where IV fluid and medications need to be delivered in precise amounts."

Recent Student Publications

JV Colindres; C Rountree; MA Destarac; Y Cui; MP Valdez; MH Castellanos; Y Mirabal; G Spiegel; R Richards-Kortum; ZM Oden; **Prospective Randomized Controlled Study Comparing Low-Cost LED and Conventional Phototherapy for Treatment of Neonatal Hyperbilirubinemia**, Journal of Tropical Pediatrics 2011; doi: 10.1093/tropej/fmr063.

J Brown, L Theis, L Kerr, N Zakhidova, K O'Conner, M Uthman, ZM Oden, and R. Richards-Kortum; **A hand-powered, portable, low-cost centrifuge for diagnosing anemia in low-resource settings,** Am. J. Trop. Med. Hyg, 85(2): 327-332, 2011.

C Sung, R Kamath, Y Cui, C Ouyang, and E Carstens; **Design of Novel Mechanical Syringe Pump for Neonatal Care in Low-Resource Settings,** Conf Proc, IEEE Eng Med Biol Soc. 2011.

Rice 360° Student Award winners

Christine Bohne, Princeton in Africa Fellowship and Wagoner Foreign Study Scholar

Diana Cahill, Wagoner Foreign Study Scholar

Mina Fitzpatrick, Fulbright Scholar and Wagoner Foreign Study Scholar

Nicky Mehtani, Alan Grob Prize and Loewenstern Fellow

Ye Jin Kang, Rhodes Scholar

Elizabeth Nesbit, Dr. and Mrs. David M. Mumford Health Professionals Leadership Award

Joshua Ozer, Emory Global Health Case Competition Innovation Award

Beverly Patuwo, Phi Beta Kappa National Honor Society, Dr. and Mrs. David M. Mumford Health Professionals Leadership Award, and Weber-Durkheim Award for Excellence.

How to Give

To learn more about how you can contribute to Rice 360°, please contact Sara Lillehaugen at 713-348-3189 or sdl@rice.edu.

RICE
George R. Brown School of Engineering

RICE 360°
Institute for Global Health Technologies

De Lange Conference

National Academy Of Engineering 2012 Regional Meeting

Engineering for Impact: Effecting Sustainable Change in the Developing World

Tuesday, February 28, 2012
1:15 p.m.- 5:15 p.m.*

Reception to follow

Bioscience Research Collaborative
Rice University

***Business meeting and lunch for NAE members only, 12:00 p.m.– 1:15 p.m**

Presented in conjunction with the

De Lange Conference VIII: The Future of the Research University in a Global Age

February 27-28, 2012

Registration and agenda for the NAE/ De Lange Conference on February 28 available at **www.rice360.rice.edu.**

Registration and agenda for the full De Lange Conference on February 27-28 available at **http://delange.rice.edu.**

Rice University Global Health Technologies Design Competition

March 30, 2012

The Global Health Technology Challenge

Identify a challenge in delivering health care in the developing world and design a technology to solve the problem.

The 2012 Competition:

- **Open to teams of undergraduates made up of students from any major.**
- **The competition registration form is available at http://tinyurl.com/ricedesign.**

  Forms must be completed by noon on January 27, 2012
  Accepted teams will be notified by February 24, 2012.

- **Accepted teams are eligible to receive a stipend of at least $300 to assist with travel to Houston, TX.**
- **Teams will make an oral presentation as part of the competition and present a poster at the meeting. The top 4 teams will receive recognition and awards.**

More information and registration for the 2012 Global Health Technologies Design Competition is available on the web at www.rice360.rice.edu.

Questions? Please email beyondtraditionalborders@rice.edu.

Creating Leaders Meeting Global Needs

BEYOND TRADITIONAL BORDERS

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HOWARD HUGHES MEDICAL INSTITUTE

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An initiative for the advancement of appropriate, high-value innovations in global health biotechnology

BEYOND TRADITIONAL BORDERS

RICE 360°
Institute for Global Health Technologies

Rice 360° works with communities to design and implement low-cost, high-performance technologies that prevent disease, improve health, and reduce poverty.

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.

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To learn more about Rice 360° and Beyond Traditional Borders, please visit www.rice360.rice.edu and www.btb.rice.edu.

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