Undergraduate biomedical engineering teams win NIH competition

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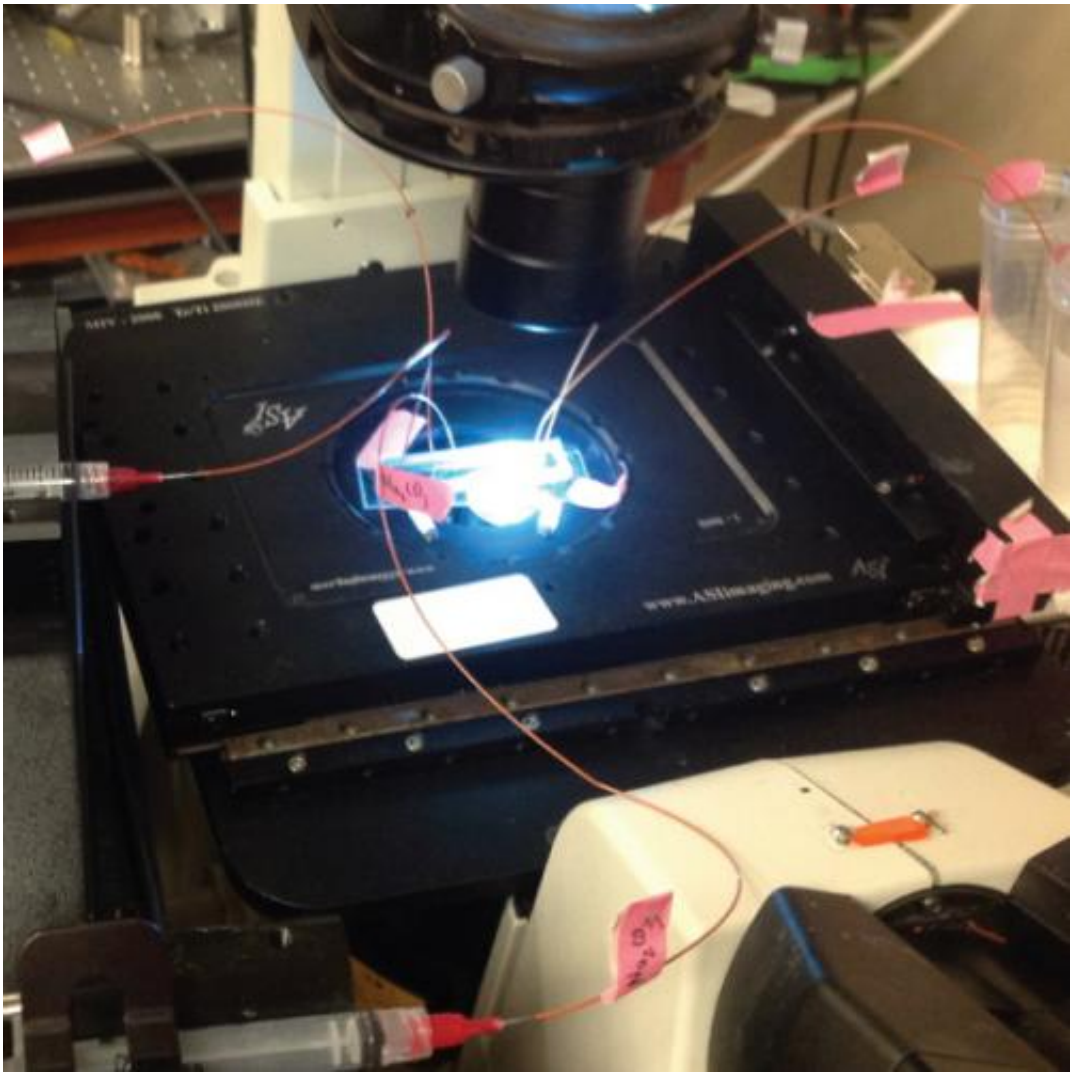

The P-MED system uses microfluidic technology to automatically analyze samples. Credit: Source: University of California, Los Angeles

Three teams were announced as winners in the Design by Biomedical Undergraduate Teams (DEBUT) challenge, a biomedical engineering design competition for teams of undergraduate students. The three categories addressed the critical needs in biomedical technology, focusing on devices for diagnostics, therapeutics, and technology that can aid underserved populations and individuals with disabilities. The challenge was managed by the National Institute of Biomedical Imaging and Bioengineering (NIBIB), which is a part of the National Institutes of Health.

The judging was based on four criteria: the significance of the problem being addressed; the impact on clinical care; the innovation of the design; and the existence of a working prototype. Each winning team will receive a $10,000 prize to be shared among the team members and will be honored at an award ceremony during the September 2013 annual meeting of the Biomedical Engineering Society (BMES) in Seattle.

In the category of diagnostic devices the winning project was Personalized Monitoring of Enzyme Dynamics (P-MED), submitted by Jaideep Dudani, Derek Go, Ankit Gupta, Gayane Kocharyan, Roxanne Loo, and Nova Wang from the University of California, Los Angeles. The project focuses on increasing the ability of doctors to personalize cancer treatments by testing how an individual patient will respond to treatment before starting chemotherapy. P-MED consolidated many forms of technology to create a single device that is able to quickly and automatically measure the enzymatic activity in response to prodrugs, (inactive drugs that, when administered, become active through the metabolic processes of the body).

The Microflora Refinement System automatizes the preparation of donor feces, making the process faster and more standardized. Credit: Source: Dartmouth College

"We are excited to see the next generation of scientists focusing on precision medicine," said NIBIB's Zeynep Erim, Ph.D., who manages the DEBUT competition. "This device could potentially help doctors

determine the type of drug and dosages for a specific patient without the need to wait and see how the patient responds to treatment, saving valuable time and sparing the patient from the side effects of a drug that may prove ineffective in the end."

The winning team in the category of therapeutic devices was submitted by Alison Stace-Naughton, Pauline Schmit, Laura Taylor Gray, and Jen Freise from Dartmouth College, Hanover, N.H. They created an innovative Microflora Refinement System to help treat *Clostridium difficile* (*C. diff*), an infectious intestinal bacterium. *C. diff* is the number one cause of hospital-acquired diarrhea and can be highly drug resistant, virulent and deadly. The current treatment for this kind of infection is antibiotics, but they are often ineffective. Recently, fecal microbiota transplantation has been proposed as an effective alternative, but the treatment has not gained popularity due to the "ick" factor that comes from having to process the donor feces that is used to repopulate the gut microflora in the infected patient. The Microflora Refinement System designed by this team automates the process of separating the beneficial microbiota from the fecal matter and could potentially make transplantation more widely available. This project shows great promise in that it removes barriers for the acceptance of an otherwise effective treatment that has been underutilized due to factors that have nothing to do with medicine.

IV DRIP: Accurate, Low-cost, Mechanical Device to Regulate Intravenous (IV) Fluid Delivery for Children in the Developing World was the winner in the category of technology to aid underserved populations and individuals with disabilities. It addresses the dangerous problem of over-hydration when treating dehydrated children and elderly patients with IVs. Many clinics worldwide are understaffed and cannot closely monitor a patient's fluid intake. Infusion pumps that regulate the maximum volume of fluids in an IV, as often found in the U.S., cost between $1,000 and $3,500. The team from Rice University, Houston,

comprised of Bailey Flynn, Matthew Nojoomi, Michael Pan, Kamal Shah, and Erica Skerrett developed a mechanical, weight-based device that is able to regulate the volume of fluids given to the patient and costs only $80. While the design and construction are surprisingly simple, the project will eliminate the possibility of over-hydration in at-risk patients in an affordable way without placing additional burdens on hospital staff.

"The simple design of this device gives it the potential to have a widespread effect," said Dr. Erim. "The ability to look at a problem in healthcare and create an inexpensive and viable solution for worldwide distribution is the type of thinking we want to encourage with this program."

The IV DRIP, shown here, uses a system of weights to limit the maximum

amount of fluid given to the patient. Credit: Source: Rice University

There were 31 eligible entries received from 19 universities in 14 different states with a total of 136 students contributing to the projects. By holding a design competition open only to undergraduate students, NIBIB intended to encourage the students to compete to solve global problems.

"Undergraduates like those who participated in this competition are the future of biomedical research," said NIBIB Director Roderic I. Pettigrew, Ph.D., M.D. "Hopefully this program will challenge students early in their education to think about solving real world problems in healthcare and to consider a career in the biomedical sciences."

Provided by National Institutes of Health

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