2016 Design Showcase Projects

Undergraduate Engineering Design Projects

revIVe - An Infusion Pump for Low Resource Settings
Students: Joao Ascensao, William Zhu, Paulina Popek, Gabrielle Fatora, and Katie Powers
Project Sponsor: Sharon and Charles Fox, and HHMI
Faculty Advisor: Maria Oden, PhD

In the developing world, healthcare workers must choose between delivering IV fluids at an uncontrolled rate or withholding fluids from patients. If the IV fluid flow rate is too fast, the patient risks experiencing kidney failure and possible drug overdose. In turn, if the flow rate is too slow, the patient does not receive enough fluids. Our device aims to provide a solution to delivering large, exact volumes of fluid with a precise flow rate. We will work with Rice 360° Institute for Global Health and global health specialists in the field to design and test our device for use in developing countries.

BacWarmers - Diagnostic Blood Incubator
Students: Whitney Orji, Abigail Brooks, and Hongan Chen
Project Sponsor: Becton, Dickinson and Company
Faculty Advisor: Eric Richardson, PhD

Early detection and treatment of blood system infections is essential to preventing fatalities worldwide. In developed countries, testing is widely available in hospitals and labs, but developing countries lack the medical equipment and infrastructure required to perform these diagnostic tests. BD BactecTM has developed an assay platform capable of quickly and cheaply identifying bloodstream infections, but the current assay system lacks a proper incubator required for the blood samples. The goal of the project is to develop a robust, low-cost, low-power, easy-to-use blood culture incubator suitable for low-resource settings.

WombOx - Fetal Blood Oxygen Monitoring System
Students: Kathryn Wallace and Samir Saidi
Project Sponsor: Magdalena Sanz-Cortes, Texas Children’s Hospital
Faculty Advisor: Eric Richardson, PhD

Some fetal surgeries can carry a serious risk for fetal hypoxia due to potential intraoperative complications. There is currently no viable method to measure a fetus’s blood oxygen level during
pregnancy. Our challenge is to devise a system to monitor fetal blood oxygen during surgery that can be quickly and safely delivered and retrieved through a minimally invasive trocar. The ability to monitor intraoperative fetal oxygenation may have a great impact in clinical practice, could provide important insight into fetal wellbeing and prevent the occurrence of adverse intraoperative events.

**Tube Much - A Radially Collapsible Endotracheal Tube**
Students: Lisa Sampson, Erin Anderson, Corin Peterson, and Ronal Infante
Project Sponsor: Margie and Karl Schraer; Jonathon Jundt, DDS, MD, UT Health Science Center, Houston
Faculty Advisor: Eric Richardson, PhD

Endotracheal tubes (ETT) are used to administer general anesthesia and to ventilate the lungs during surgical procedures. An estimated 51.7 million intubations are performed yearly in the United States using endotracheal tubes. Current ETT designs must compromise between a diameter that allows visibility and provides sufficient airflow to the lungs. This compromise makes intubation difficult and leads to complications that ultimately become major medical and financial burdens to the patient. Our team has been tasked with designing an endotracheal tube that minimizes patient discomfort and eases the intubation process.

**Savvy Stent - Aortic Abdominal Aneurysm Stent**
Students: Nicholas Cho, Jennifer Walker, Beko Jang
Project Sponsor: Saranas
Faculty Advisor: Eric Richardson, PhD

Treating a high risk aortic abdominal aneurysm requires an AAA stent to seal off the affected section of the aorta. It is necessary for the stent to be tightly sealed to the aortic wall because the weakened section cannot withstand the pressure of blood and is likely to rupture. AAA stents have also been shown to penetrate the aortic wall, causing further bleeding and increasing the risk for rupture. Bioimpedence can be used to monitor for changes in the graft seal and stent penetration by detecting blood between the stent and the aortic wall. This team will design a monitoring device that will detect changes in bioimpedence while implanted near the aorta.

**Atriumph – D-CLOT**
Students: Erica Kim, Angela Li, Sam Vallagomesa, and Michael Williams-Hart
Project Sponsor: Texas Heart Institute
Faculty Advisor: Eric Richardson, PhD

Atrial fibrillation is a heart condition where the atria contracts irregularly, allowing blood to stagnate and form clots in the left atrial appendage. Our challenge is to design an intra-cardiac device that monitors and detects clot formation in the left atrial appendage to prevent embolic stroke in atrial fibrillation patients.
**NeuroNates – Neonatal EEG Monitor**  
Students: Yusi Ou and Momona Yamagami  
Project Sponsor: Lloyd Kirchner  
Faculty Advisor: Maria Oden, PhD

We are aiming to create a low cost, intuitive, reusable, and self-contained neonatal EEG monitor to address the lack of proper neurological care in low and middle income countries in Sub-Saharan Africa. It implements a combination of brain activity and video monitoring to increase the accuracy of seizure diagnoses. This device is the first of its kind to be designed specifically for use in low-resource settings to aid in the monitoring and detection of neonatal seizures. It is battery powered, requires no consumables, and maintains individual patient data storage for easy access. It provides a rechargeable, reusable, and intuitive solution that allows physicians in these low-resource settings to visualize EEG signals along with patient movements to verify seizure activity with confidence.

**Master of Bioengineering, Global Medical Innovation (GMI) projects**

**Push-Pulse**  
Student: Shannon Frazee  
Faculty Advisor: Eric Richardson, PhD

Over 2.5 million people suffer from pressure ulcers (PUs) annually, with a reported 60,000 dying due to PU related complications. Current detection methods include a subjective visual inspection of the skin performed by a nurse. The Push-Pulse Device is a safe, novel and quantifiable prototype for detecting PUs and is in the clinical testing phase.

**True Vent**  
Student: Hannelle Fares  
Faculty Advisor: Eric Richardson, PhD

Bag valve mask ventilation is an important skill that is difficult to perform properly, even for experienced providers. Ventilation does not occur if there is a leak between the mask and the face or if there is an obstruction in the airway. Current methods are unable to detect these issues, so team True Vent created a mask that includes barometric pressure, force, and wind sensors to help identify inadequate ventilation. Once this system is validated, a user interface will be created to guide users toward performing better ventilation.

**Nutriflow**  
Student: Anishaa Potnis  
Faculty Advisor: Eric Richardson, PhD

Neonates (premature infants) at risk for VLBW (very low birth weight) require high fat content and nutrients for adequate growth. Current neonate enteral feeding systems are unable to deliver the appropriate fat concentration due to the separation of fat from the milk and adherence of the fat to the tubing. Team Nutriflow is in the process of conducting benchmark analysis to validate this fat loss and test variables that can affect or minimize fat adherence.
Melacap
Student: Sherryar Siddiqui
Faculty Advisor: Eric Richardson, PhD

Team Melacap has created a teledermatology platform which allows nurses in rural areas of Brazil to capture images of potentially cancerous lesions and securely transmit those images to specialists at the Cancer Hospital of Barretos. The specialists can then diagnose the lesions remotely and send their diagnosis to the nurses through the same secure channel. This system is already in clinical trials to prove the accuracy of these off-site diagnosis.