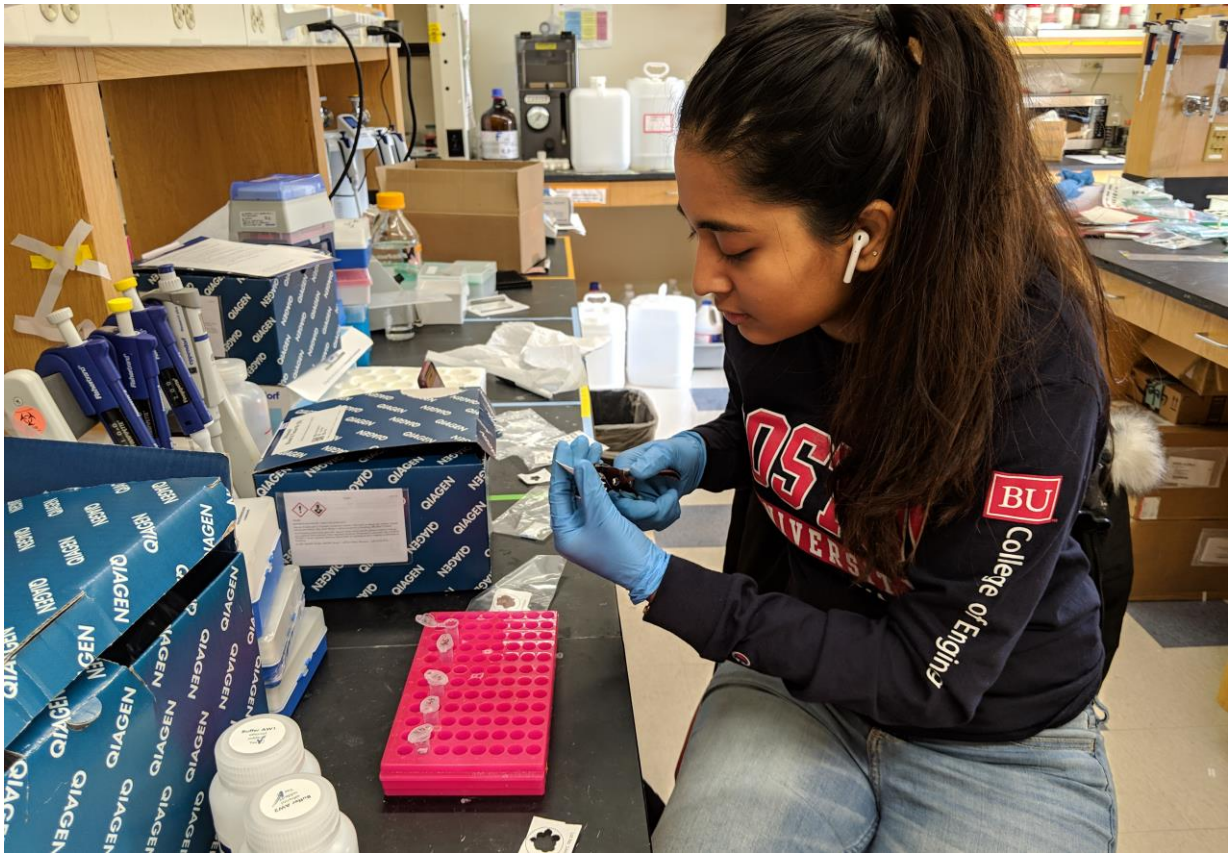
February 2019, Issue 11

OUR VISION

The Partnership for Global Health Technologies (PGHT) is a collaboration between the State University of Zanzibar (SUZA), Mnazi Mmoja Hospital, Muhimbili University, and Boston University students. PGHT aims to improve the quality of health care in Zanzibar by applying biomedical engineering principles within a public health context. We use an interdisciplinary approach to address the most pressing issues in healthcare delivery in East Africa.

Zanzibar, Summer 2018



Quality Control of Malaria Rapid Diagnostic Tests

The quality control of malaria rapid diagnostics team has been working diligently to extract DNA from every dried blood spot (DBS) sample collected from hospitals in Zanzibar over summer 2018. PCR will then be run on the extracted DNA to confirm malaria diagnosis, and determine if there is a discordant diagnosis between corresponding microscopy and rapid test results. The team is also working on optimizing DNA extraction protocols for samples collected from mainland Tanzania, whereby DBS was sampled on non EDTA-treated filter paper.

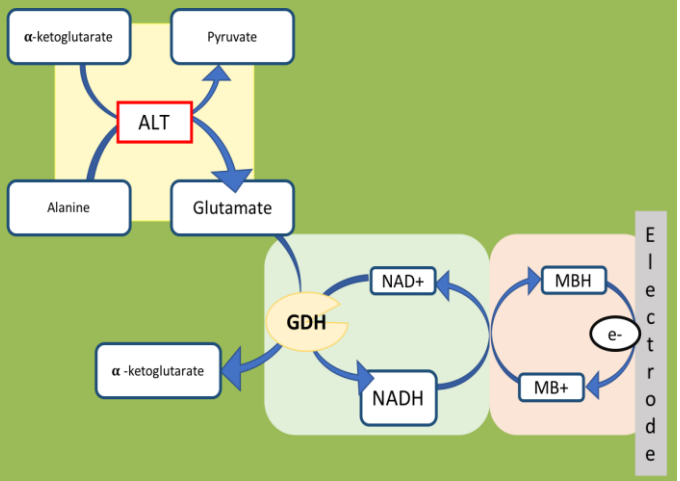
In parallel, the project team is testing a hypothesis that high temperatures can deteriorate the quality of malaria rapid diagnostics (mRDT). mRDTs are being incubated at high temperatures often seen in the field for varying lengths of time. A positive control will then be run on these incubated tests, and the test will be imaged using our custom-made imaging device. The project team has created an algorithm to automatically process each image taken of the mRDT, detect the testing region, and analyze blood flow rate, blood flow front and intensity of positive and control bands.

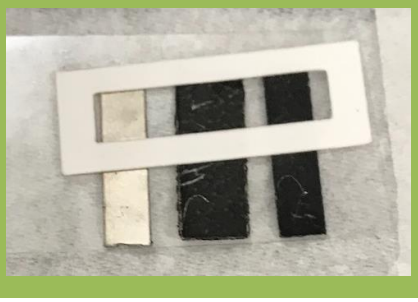
Water Quality Testing

The Water Quality team has analyzed the data collected during the needs assessment that we conducted over the summer and new data collected through literature and we have decided to focus on heling the Zanzibar water authority (ZAWA) to remotely monitor publically-owned boreholes for fecal-coliform contamination. We have decided to monitor bacterial contamination in these water sources because one of ZAWA's most pressing concerns was that they do not have enough staff to regularly test their water sources; a remote monitoring system would provide ZAWA with the information they need to know which boreholes they should treat and to identify contaminants before they cause an outbreak. An early warning system could reduce the prevalence of cholera in Zanzibar and could improve ZAWA's ability to use their resources effectively because they would be aware of what sources are contaminated. This could also help provide a more evidence-based understanding of the water quality in Zanzibar; typically, ZAWA and locals are assuming that water is clean and that there are only problems in the rainy season. However, cholera is happening throughout the year. We are currently considering multiple systems for remote monitoring of fecal-coliform, such as pH change and gas production, and we are starting detection experimentation with E.coli to aid in our prototyping of the instrument.

Point-of-Care Liver Function Monitoring

The point-of-care liver function project has focused on engineering and optimizing an electrode design that can accurately detect a current signal that corresponds to ALT and AST biomarker concentrations at physiological levels – both normal and elevated in patients with liver dysfunction. Electrode optimization primarily consists of manipulating the size and shape of the electrode as well as the materials used to create them. The team is also developing a methodology to produce the electrodes more efficiently and accurately; currently each electrode is hand painted by PGHT researchers. In order to test the effectiveness of our design modifications, we observe the current electrochemical signal obtained from these electrodes when varying levels of hydrogen peroxide are applied onto them during the assay process.





ALT assay schematic (above); updated electrode design (below)

Mathematical Modeling of Maternal Health at Mnazi Mmoja Hospital

The ultimate goal for the modeling project is to simulate the workflow and patient treatment process at the maternity ward at Mnazi Mmoja Hospital's Maternity Ward. The first iteration of the dynamic model addressed many aspects of the structure and processes of the maternity ward, but there remain gaps,

namely as it concerns blood-related and surgeries-related information. Over summer 2018, the team collected large amounts of those data from hospital files at MMH from blood request forms, blood delivery logbooks, and maternity department patient records. Over the past three months, we've worked to digitize, organize and compile these data in preparation for inputting it into the model. Currently, we are entering the exciting stage of incorporating this new information into the existing model and building upon it to make it as accurate and complete a representation of MMH's maternity ward as possible.

Student Voices

Being a part of the Partnership for Global Health Technologies has completely shaped and dramatically enhanced my college experience. As an aspiring physician, with a passion for global health, PGHT has allowed me to expand my interests and develop a true understanding for why I desire to pursue a career helping others. Over the past two years, I have had the opportunity to work on challenging and pressing global health issues and collaborate with students and professionals in an effort to create a tangible, realistic solution. I have had the privilege to travel to Zanzibar, Tanzania and work directly in the field with others who share my passions. I have worked on projects addressing the issues of maternal mortality and the burden of malaria in East Africa. These experiences have shaped my outlook on global healthcare and the meaning of medicine - I will be forever grateful for the opportunities that PGHT has given me and am excited to continue working to address the world's most pressing issues with the PGHT team. – **Madison Calvert**

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Recent student publications

Predicting resource-dependent maternal health outcomes at a referral hospital in Zanzibar using patient trajectories and mathematical modeling

Nadkarni et al.

PLOS ONE (*in press, February 2019*)

Message from the Director

Dear Friends of the program,

Over the years, the most important lesson I have learned is that our success depends on building trust and strong partnerships. We have been extremely fortunate that our students, through their efforts, have built strong bridges of trust and friendship with their peers at universities, hospitals and workplace in Zanzibar and other places where we work. The students continue to inspire me, and everyone around them, not through their exceptional work and diligence, but their humanity, dignity and commitment to global equity. The last few months have seen a surge in activity as we gear towards our summer program. In addition, existing students have taken on additional roles as mentors to the new group of students, as they pass the baton of creating positive change and impact to the next cohort.

Our publications and presentations generated by this work continue to increase our reach in policy and impact in the global health space. Our new programs in Lebanon and Uganda, focusing on addressing the challenges of refugee health have brought in new partners, new energy and new sense of urgency to use innovation to create a better world. I could not be more proud of the efforts of the students, not just in doing exceptional work in the lab, and in the field, but in inspiring their peers in their classrooms and social spheres.

As always, I am deeply grateful to all of you for your support, advice and mentorship and look forward to staying in touch.

Yours,
Muhammad H. Zaman
Howard Hughes Medical Institute Professor

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