

## **Field testing of CRISPR-based dengue and Zika virus diagnostics in Honduras**

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### *Purpose*

A significant portion of my Virology PhD thesis research involves the development and testing of CRISPR-based diagnostics for infectious diseases. Thanks to the Spirit of Life Foundation and this award, I was able to travel to Tegucigalpa, Honduras, specifically to the infectious disease diagnostic laboratory of Dr. Ivette Lorenzana at the Universidad Nacional Autónoma de Honduras, to test these diagnostics.

### *First impressions*

My first introduction to Honduras and Tegucigalpa was the complex, adventurous landing into the Tegucigalpa International airport. The pilot weaved through clouds, hillsides, and directly overhead many of the hilltop homes to land us safely on the ground, and this landing resulted in a round of applause from the native Hondurans returning home. I was in awe of the surroundings of Tegucigalpa and how green the hillsides were even though the rainy season had just started in Honduras.

After grabbing our giant duffels filled with diagnostic reagents and laboratory plastics, we headed to our accommodations for the week. From the flight in, I really got a sense of the hilly surroundings, but on the streets, I got an entirely different view. We passed small homes, restaurants, and street-side food stands, but most striking was the design of some of the streets in Tegucigalpa. There were crazy merges and raised roads that I can best describe as part highway overpass and part bridge that made me very pleased I did not have to drive or navigate. Overall, I had a feeling of excitement of what was in store for the week and could not wait to meet our collaborators.

### *Time in the laboratory*

We started first thing on Monday morning transporting our supplies to the laboratory, organizing them in the space, and moving reagents from our cold boxes to the appropriate freezers. I was surprised by how well organized and equipped the laboratory was, and this organization enabled us to dive right into outlining the plan for the week and doing an initial test our Zika and dengue virus diagnostics.

One of the major trip goals was to test the sensitivity, specificity, and user ease of our CRISPR-based diagnostics in this setting. Although our diagnostics work seamlessly in Boston, the lack of ice in the laboratory forced us to troubleshoot ways to keep our samples and reagents cool because increased temperatures can cause certain reagents to lose activity over time or the reactions to start prematurely. Despite this challenge, we found creative ways to keep reagents cold by repurposing enzyme

boxes and ice blocks, and by the end of Monday, we successfully replicated our Boston results. This initial success enabled us to build from testing control samples to testing patient samples by mid-week. Our CRISPR-based diagnostics have both a readout that requires a machine as well as one that is visual similar to a pregnancy test. During the week, we were able to do multiple tests of this version with a visual readout which particularly excited our collaborators because the tests are easier to perform and interpret.

During the week, we also placed a large focus on training. Our overall goal was to give our collaborators the understanding and confidence to run these diagnostic tests even after we return to Boston. This focus on training is my favorite part of how my thesis laboratory approaches international collaborations. There is a benefit from bringing technologies to the sites of endemic disease, but the benefit will only be lasting if we build the capacity for our collaborators to independently carry out the work. However, the training was also the most challenging part of the trip for me. Most of our collaborator's English is limited, and Spanish was needed to fully grasp the technology and protocols. I was fortunate that my laboratory members who traveled with me are fluent or advanced Spanish speakers, so they tackled the more complicated aspects of training while my Spanish continued to improve.

#### *Visit to the university hospital and local urgent clinic*

In addition to performing experiments and training our collaborators, we took a trip to the university hospital and a local urgent clinic to speak with infectious disease doctors about their diagnostic needs. This was a highlight and humbling part of the trip. The hospital was almost overflowing with Honduran people waiting to be treated whether they were seated in the emergency room or on the hallway floors. An infectious disease physician spoke of the numerous infectious diseases that they see in Honduras but how often diagnoses are based on symptoms alone because molecular diagnostics are cost prohibitive. For the urgent clinic, cost is one factor but so are space constraints. They have a small diagnostic laboratory space mostly for processing samples, so any new technology would need to be compact and easy to use.

#### *Reflection*

This opportunity to travel to Honduras and bring a piece of my thesis work to our Honduran collaborators was an unforgettable experience. I was able to grow scientifically because I needed to troubleshoot our diagnostics in the moment while also effectively communicate the work. Beyond the lab work, I gained a concrete perspective on what the present challenges are in Honduras for providing infectious disease diagnoses and gained a great respect for our collaborators' willingness to adopt new diagnostic technologies. I left Honduras grateful for this experience, and thankful to be able to work with such motivated, intelligent, and caring Honduran scientists.

## *Pictures*

