

"Genetics of Ecological Divergence in *Anopheles gambiae*"

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This past summer, I was awarded the Kellogg Institute Undergraduate Summer Research Grant, to be used for travel to and accommodations in Bamako, Mali. I would study and work for two weeks at the Malaria Research and Training Center (MRTC) at the University of Bamako. The purpose of my travel was to transfer newly developed lab technology, as well as further my understanding of the genetics of ecological divergence in *Anopheles gambiae*, the mosquito which is the primary vector of malaria in West Africa.

Malaria is a devastating disease, one of the top three infectious disease killers. Infectious diseases account for 25% of the world's deaths and 50% of deaths in developing nations. Malaria hits especially hard in sub-Saharan Africa, where 90% of the world's malaria-specific mortality occurs. Its victims are often under the age of five, as those who live through childhood have usually contracted a kind of immunity. To give an idea of the disease's toll on children, a child dies from malaria every 40 seconds.

In addition to loss of life, malaria takes a harsh toll on the economy of nations where the disease is endemic. Macroeconomic studies have shown that the per capita gross domestic product (GDP) in countries where malaria is endemic to be one-fifth that of non-endemic nations. With such high stakes, any steps taken towards the eradication of malaria are positive steps in the direction of development for these countries.

For the past year and a half, I have been working under Dr. Nora Besansky at

Notre Dame's Center for Tropical Disease Research and Training (CTDRT), in the Biology Department. Part of the work of the CTDRT involves developing and evaluating methods of vector control in endemic regions.

Anopheles gambiae, with its complex population structure, genetic plasticity, and strong anthropilicity, has proven to be a difficult mosquito to control. The species has diverged into several distinct forms with different environmental adaptations, although they display no physical differences. In order to track characters, such as insecticide resistance, through the species, it is necessary to determine the makeup of the species. With this aim in mind, the lab began to develop a quick and easy DNA assay to distinguish form, for use in the labs at the University of Bamako. It would be my responsibility to test and troubleshoot the assay on field specimens in Bamako. In addition, I would travel out to the collection sites and observe the natural ecology of *Anopheles gambiae*.

A few weeks before my departure in August, it became clear that the development of this particular assay would be much more difficult than anticipated. The prevalence of repetitive DNA surrounding the areas of focus was slowing our progress. I boarded the plane with instructions to familiarize myself with a different series of assays, testing for insecticide resistance, and to troubleshoot those instead.

Arriving in Bamako, I encountered another obstacle: the language barrier. Although I had done my best to learn basic French before arriving, my efforts were all for naught. French was spoken mostly in the labs, but otherwise Bambara was the language of choice. The languages were often mixed in the university setting, providing an even

greater challenge to my understanding.

Despite these setbacks, I would have to classify the two weeks that I spent with the MRTC as two of the most memorable weeks in my life. I learned to adapt to change quickly, developed my communication skills, and gained a first-hand insight into a world far different from the one in which I had been brought up.

The necessity of adapting to change seems fairly obvious, given the circumstances surrounding my project. Luckily, lab protocols are similar across international borders, and my familiarity with them helped a great deal in the new environment. Nevertheless, in a country where work stops early every Friday and water stops randomly every week, there was still a great deal of adjustment. I learned to take some problems in stride, apply my skill to fix what I could, and ask questions when I needed help.

In order to get my questions across, I needed to work on my communication skills. In Mali, I had to concentrate much more closely on facial expression and tone than I ever had before. Additionally, I learned to listen more intently. I noticed that, as I tried harder to learn Bambara, the staff at the University became more enthused about teaching me. The fun came partly from watching me struggle, I know, but they also celebrated with me when I mastered the elaborate greeting structure. It seemed that our level of communication was able to go beyond the actual words that were exchanged.

My most powerful memories of Mali are not from the lab, but from my trips out to the collection sites. The statistics I mentioned before became real, live people. One million children dying from malaria per year took on a new significance when I met a little boy who was still recuperating, or when I looked into the one-room mud hut where

twelve boys spent the night with 250 Anopheline visitors. Even 250 mosquitoes was hard to grasp, until the night I ate dinner in a room with mosquitoes so thick on the walls and windows that they looked like a slightly fluttering wallpaper pattern. In Mali, the reality and urgency of the situation became startlingly clear. These statistics are no longer just numbers to me.

I am still working in Dr. Besansky's lab, developing the diagnostic assay that I originally intended to bring to Bamako. The work that I did in the labs at the MRTC was absorbed into projects there that are tracking insecticide resistance. In the end, my time in Mali may not have achieved its original intent, but it did provide me with a new perspective on the work I have been doing, and with a renewed sense of what is truly important in the academic discussion on tropical disease. Mali presented me with a challenge: to use what I have seen and what I now know in the fight against malaria and other diseases of poverty. It is a challenge that I intend to meet.