A Brief Summary of My Work and Experiences at the International Rice Research Institute in Los Baños, the Philippines

Everly Slawson

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I have always considered myself an adventurous soul. My self-concept was tested the summer of 2001, when I traveled to spend two months in the Philippines at the International Rice Research Institute.

Previously, I had never been out of the country in my life. My life experiences were limited, so I decided to explore my life through pursuits of the mind while remaining open to any new experiences that would enrich my life, whether it be through meeting new people, traveling, or simply trying things I'd never experienced before. Throughout middle and high school, I participated in summer programs at Iowa State University. These programs gave me experience in lab work, particularly in biochemistry and genetics. I naturally became interested in biotechnology.

During the fall of 2000, I learned about the World Food Prize Youth Institute from one of my teachers at school, Jan Myers. The 2000 conference was about genetically modified organisms, and based on my background in genetics, I was selected as my school's representative for the Youth Institute. At the institute, I learned that the conference was not only focused on genetics, but also the issue of world hunger as a whole. I was intrigued by I could pursue my interest in genetics while working to help world poverty and hunger. When I heard about the opportunity to intern abroad, I became interested immediately and decided to pursue the prospect of spending my summer in another country.

By the next spring, the possibility became reality and I was making plans to travel to the Philippines. Due to my interest in genetics, I was placed in the Genetics Resource Center (GRC) at the International Rice Research Institute (IRRI) in Los Baños, the Philippines. IRRI functions as a non-profit organization as part of the Consultative

Group on International Agricultural Research (CGIAR). Working alongside other CGIAR centers, IRRI serves to further rice research as a part of a larger goal to reduce poverty, increase and improve the world's food supply, and protect the environment. IRRI is comprised of many divisions, each dedicated to a different area of rice research, including plant breeding, social sciences, and entomology, among others.

The Genetics Resource Center has two main components: the International Rice Genebank Collection and International Network for Genetic Evaluation of Rice. The gene bank exists to collect, conserve, and characterize the germplasm of rice. Conservation of rice is important because various traditional and wild rice species are being lost as farmers cease to grow and nurture them in favor of easier to cultivate varieties. Also, human activity disturbs the environment, leading to the possible extinction of many rice varieties. Rice diversity can lessen with excessive crossbreeding. It is important for the genebank to conserve rice diversity to improve future rice crops with useful traits from traditional and wild varieties. The International Network for Genetic Evaluation of Rice (INGER) serves to facilitate safe exchange of the germplasm and genebank information worldwide.

My Work at IRRI

When I came to IRRI, I was told that I would be involved in all parts of the GRC, so I could understand and appreciate all sides of the research that took place. I came with a pretty open mind, so I was ready for whatever they wanted to teach me. You could say that I started from "the ground up".

I spent my first weeks at IRRI in the screenhouses and field. These facilities are sponsored by the GRC for the multiplication and rejuvenation of the over 86,800

accessions in the rice genebank. In addition, the fields are used for routine characterization of the germplasm. Alongside the head of field operations, Ato, I experienced a morning of seeding rice. I waded around in the mud between plots, spreading the seeds of one accession of rice into each planting row. Later on I worked on the same field, pulling and transplanting the seedlings. It was tiring and tedious work, but I realized that characterization was an essential part to the building of an accurate collection in the genebank.

Here I am pulling rice that I previously seeded in the field.

Characterization occurs at three main growth stages of the rice crop: vegetative, reproductive, and post-harvest. The rice wasn't flowering when I was at IRRI, so I could only experience two stages of the characterization process. In the screenhouses, I

observed and recorded the vegetative characteristics of the rice plant. During the vegetative stage, I recorded thing such as leaf color, seedling height, and ligule color and shape. For post-harvest characterization, I examined samples of the harvest in the lab, to record characteristics such as grain length, thickness, and color. Measuring qualities like grain thickness proved to be another long and arduous task, but it gave me an appreciation for the unglamorous (yet important) sides of research.

Another function of the fields and screenhouses is for seed multiplication. If an accession in the germplasm is in low quantity, samples of the seed are planted and grown so that the genebank can be replenished. The fields and screenhouses are cared for and managed by responsible workers to ensure that the rice is properly protected against pests. Also, cross-pollination is avoided in order to maintain the genetic integrity of each rice accession.

Before rice seeds are entered into the genebank, they have to be cleaned and selected to ensure that only the best samples of each accession are stored in the collection. After the harvested sample is pre-cleaned, the seeds are compared to the seed file, for verification. The seeds then go through a hand-selection process, to remove any immature or diseased samples. Once the best sample of a rice accession is obtained, it is packaged and entered into either the active (shorter-term storage) or the base (long-term storage) collection of the genebank.

Seed quality in the genebank is also highly dependent on seed viability. Seed viability is seeds' ability to grow and develop into mature plants. Viability testing is usually done through germination tests. Some rice varieties with particularly low

viability must go through a dormancy-breaking process before they can germinate. Dormancy can be broken through temperature change, chemical treatment, or simply by dehulling the rice. Rice viability in the genebank, over time, can be affected by temperature and humidity levels. To demonstrate this, I conducted an experiment to test the affect of high heat and humidity on rice viability. First, I prepared a set of seeds that were exposed to the standard conditions kept inside the base collection (-20 C, 15 percent relative humidity). Then, I exposed another set of seeds to a high temperature and humidity environment for a series of days. Observing the seeds from both normal and stressed conditions, I was able to compare the number of seeds that would germinate over a seven-day period. This displayed how optimal conditions are important for keeping the genebank collection as viable as possible.

Information about the rice accessions, including all characterization, planting, and storage information, is kept in the International Rice Genebank Collection Information System (IRGCIS). This system is used for both germplasm data storage and access, and for genebank management. The data management of IRGCIS works in cooperation with INGER to help researchers around the world access information and request seeds from the IRRI genebank.

After I had experienced work in the fields, the screenhouses, and the genebank, it was time for me to go to work in the lab. This was the kind of work I was most familiar with, so I spent approximately four weeks integrated into the GRC's Molecular Marker Lab.

Dr. Ken McNally was my supervisor in the lab. He had previously worked at IRRI, but he was new to the Genetics Resource Center. Dr. McNally took on his position

at the GRC as a molecular geneticist, with the intent of pursuing research in allele mining. This research would be to study the genetics of rice in efforts to explore the diversity between accessions in the genebank, and also to target useful genes for beneficial phenotypes in rice populations.

When I first came to IRRI, I thought I would be working in a field more related to genetic engineering. I was surprised to find that the GRC was not devoted to modification of rice species, but rather to the conservation and research of rice as a natural species. The GRC supplied an important crutch in the other research taking place at IRRI. Through my work with Dr. McNally, I learned of exciting research opportunities available if I chose to pursue genetics further.

In the lab, I worked on various techniques that the Molecular Marker Lab planned to implement in their genetic diversity studies. Starting with a set of approximately 30 different rice accessions, I prepared samples of each for the different types of analyses we would be performing. Since I had previous experience in a lab setting, I was familiar with many of the simpler techniques involved in genetic research. Even though some of the processes were a little boring and time-consuming, I was glad to be involved in a real research setting. I felt very deeply connected to the work when we were constantly questioning the protocol, making sure the process was designed and executed properly. *Good science takes patience*, I told myself on the slow days. One of the greatest lessons I learned during my internship was that research is truly a life-long endeavor, and that good research comes only from people who are passionate and genuinely concerned about their work.

After I germinated each accession of rice, extracted DNA from the samples, and standardized the concentrations of the DNA, I was ready to run the gels. The first type of reaction we performed was a RAPD PCR. This type of reaction identifies and amplifies a random sequence of DNA within a genome of rice. When put through an electrophoresis gel, each RAPD had a distinct banding pattern for the particular accession of rice.

Once the RAPD gels were run, I took the images and scanned them into the computer. By manipulating the images on PhotoShop, the irregularities in the gel could be accounted for and the banding patterns could be "scored". The matrix I obtained from scoring could be put into a computer program that would generate a tree that showed the relationship between the accessions analyzed. We found that the RAPD technique typically classified rice accessions based on variety and geographical location. On a basic genetic level, this makes sense, because rice species found close together in nature are more likely to share genetic similarities than are those that never naturally crossbreed.

Another type of genetic analysis we performed was the microsatellite pooling procedure. Pooling many types of DNA together and using the same microsatellite reaction, specific allelic associations and frequencies could be studied.

My work in the lab was only a small test of something the Molecular Marker Lab hoped to perform on over 10,000 accessions of rice. The information gathered from these studies would add valuable information to the genebank, and make significant contributions that would aid in further genetic studies with rice.

Travel

While I was in the Philippines, I had the opportunity to travel. Along with PhilRice, another rice research institute, I went with some of my officemates to visit a

nursery for cold-tolerant rice in the mountains at Banaue. Banuae and the surrounding areas are a source of pride for the Philippines. For miles in the mountains, you can see the work of the centuries and look at the terraces carved out of the mountainsides.

Emily, Connie, Ato, Vicky, and Vanji at Banaue

Going to Banaue not only gave me a chance to observe to see the terraces and observe rice agriculture in the mountains, but it also gave me special time to bond with my co-workers. Walking on the terrace paths together, we shared the adventure of exploring the mountains and admiring the beauty of the scenery. The experience helped me break some barriers and to become more confident in my relationship with the people at IRRI.

Also during my stay I visited the Pagsanjan Falls, the Taal Volcano, and many small communities around the area. Each place in the Philippines has a very specific flavor—some famous for their cooking style, other communities have beautiful weavings

and basketry. The people, no matter where they came from, were usually very proud of their community and eager to show a traveler something special.

Looking Back

Before I arrived in the Philippines, I promised myself that I would use the opportunity to its fullest and to experience as much as I could during my two-month stay. It was the simplest abstract goal I could create. When I arrived, I experienced some of the most intense emotions of my life. I was awestruck by the beauty of mountains and tropical trees, a little worried about the excessive heat and humidity, and nearly overwhelmed by the number of different cultures with which I was confronted.

I found that my best strategy for survival in the Philippines involved a combination of bravery and open-mindedness. I knew that there would always be times when I would be homesick, but I could alleviate these feelings by interacting with all the great people I met during my travels. I not only interacted with Filipino culture, but also with the wide variety of other cultures brought to the institute through international students and employees. By meeting people from around the world, I felt a strong responsibility to represent myself and my country as well as I could.

Day-to-day issues got easier as time went on. I learned that preparation for travel is only as important as a person's willingness to take things in stride. Cultural standards are relative, so it's best not to be judgmental when you're totally ignorant about someone else's situation. Compassion takes care of most cultural gaps and misunderstandings.

The Future

My experiences in the Philippines set my life on an upswing and have launched me into the future with much more confidence than I had before. Through my experiences the summer of 2001, I have become more articulate, culturally- and self-aware, and curious. Having such an intense experience has also helped me feel validated about my world concerns, and empowered to make a difference on whatever scale I can. As a student at Grinnell College, I now am inspired to further my studies so that I can thank the World Food Prize Foundation by making worthwhile contributions to the society, humanity, and the world.

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