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CIMMYT, Mexico

Last October I attended the World Food Prize Youth Institute where the chosen topic for discussion was the safety of genetically modified organisms (GMO's). This subject was of particular interest to me because I have always been interested in genetics. I had taken some classes previously, but had only minimally discussed the effect that the field of genetics played in food security. Writing the paper for the conference introduced me to a new aspect of genetics—one with its purpose being to alleviate human suffering.

The Youth Institute itself was educational and inspiring. It was also an eye opener. Before attending the Youth Institute I knew little of the extent of our world's problems of food security. After participating in the Institute and hearing the experiences of previous interns, I became very interested in getting the experience of what an internship would offer.

The International Maize and Wheat Improvement Center (CIMMYT) in Mexico sounded like a research center doing serious, state of the art work to alleviate world hunger. The Applied Biotechnology Center (ABC) offered much to learn about genetic engineering of maize and wheat, two of our world's major food sources. The chance to practice my Spanish wasn't a bad perk, either. Before I left for Mexico, other than what I had heard about CIMMYT, I knew very little of this place that would win my heart and would be remembered forever.

On the flight to Mexico City I had a few ideas about what to anticipate when I arrived. Mostly though, I was hoping that I would be able to find the CIMMYT driver who was supposed to pick me up at the airport. After I arrived and found the driver with no

problems, I was less anxious, that is until we started driving. The first thought that went through my head during the drive to CIMMYT was “how on earth do people manage to drive around here!” That was the first of many differences I noticed between Mexico and the United States. Forty minutes later, CIMMYT appeared in a beautiful, gated, community where three young people greeted me. I was shown to the dormitory and given a welcome packet. The brochures about CIMMYT presented a helpful picture of the Center, its purpose and its routines.

CIMMYT has seventeen centers throughout the world with its headquarters in Mexico. It is a non-profit organization working to improving agriculture for developing countries and to develop and distribute varieties of maize and wheat that are resistant to disease, drought, and insects. In addition, the aim is to create varieties of these crops that are higher in yield. Furthermore, CIMMYT is concerned with protecting the environment and optimizing the use of the natural resources of each country effectively to benefit the farming systems that are in place in the various cultures. CIMMYT’s research is focused solely on the crops of maize and wheat, which are accountable for 25% of the food eaten in underdeveloped countries.

The goal of CIMMYT is to better the lives of the poor by alleviating world hunger while protecting our environment. Although we may already have the needed quantity of food to feed our world’s population, the task of securing and solving world hunger has not yet been accomplished. Focusing on this goal, CIMMYT is working to improve agriculture for the poor by offering training to researchers from all over the globe, developing techniques to protect the natural resources used for maize and wheat production, and by developing resistant and disease tolerant maize and wheat.

CIMMYT has already made inroads to wipe out hunger through research. Because of research done at these research sites, hunger, malnutrition, and famine have been reduced in developing countries. In low-income countries, CIMMYT-related wheat varieties have been planted, and account for more than 75% of the area planted to modern wheat varieties. Since 1987 CIMMYT has sent more than 60,000 shipments of maize and wheat seed to low-income countries. CIMMYT has five research programs that work in collaboration to educate, to develop and to distribute the results of this technology. The programs involved include maize, wheat, economics, natural resources, and biotechnology.

Founded in 1990, the Applied Biotechnology Center (ABC) where I worked has been helping maize and wheat farmers in developing countries to use applied biotechnology to improve and conserve their crops. Biotechnology has been effective in fighting challenges such as drought, insect pests, infertile soils, and diseases. Through training and partnerships, ABC hopes to establish biotech programs all around the world to improve the productivity of maize and wheat.

In regard to my particular assignment here at CIMMYT, it was on day two that I was scheduled for a meeting with Dr. Alessandro Pellegrineschi to discuss what I would be researching in the lab. On my first walk to ABC I was a bit nervous, wondering what I would be doing and what they would expect from me. When I met with Dr. Pellegrineschi I was able to relax a little. He told me that for the first week I would be working with maize and wheat in the tissue culture laboratory and I would also be working in the Applied Molecular Genetics Lab. After experiencing a little of each type of research, I was to choose where I wanted to work for the remainder of my time at CIMMYT. I spent my second week at

biotech working in the genetics laboratory and then decided that I wanted to work in the tissue culture lab.

Tissue culture is a technique for growing cells from multi-cellular organisms in a media. In the case of genetic engineering, tissue culture is used to develop an organism, which has been genetically transformed by transferring desired genes from another organism into the maize or wheat. By genetically altering these crops, new varieties can be created which will resist targeted insects, diseases, or drought.

My first week in the Tissue Culture Lab I learned about microprojectile bombardment and how to excise immature embryos from both maize and wheat. Bombardment is a process where a gene gun is used to shoot the desired gene into the immature embryos. After a week of learning and practicing how to excise the embryos I began my own project working with maize.

In my experiment I tested maize in adverse conditions to determine what the optimum temperature is for immature zygotic embryos to develop and maintain callus formation. To perform the first part of my experiment, I harvested ears of maize from the greenhouse incubating the ears in triplicates at 5°C for one day. During incubation I prepared the tissue culture media for the embryos. The type of media I used was N6C1 media. Following incubation I husked the ears of maize, sterilized them with a Clorox solution for twenty minutes, and rinsed the ears with sterile water to remove the bleach. Then I excised the embryos by slicing off the top half of each kernel and separating the embryo from the endosperm. The next step was to place the embryos, with the embryo axis facing down, into petri dishes containing the N6C1 media. Following this procedure, the petris were stored in

the dark at room temperature for development. This process was repeated for the duration of two days and then three days of incubation and 5°C. A control was harvested from the greenhouse (20-22°C) and stored in the dark at room temperature for comparison. The process was repeated for ears that had been incubated at 45°C for a duration of one, two, and three days as well.

After all three treatments were completed and stored, they were observed and compared. All of the embryos developed for every treatment. While observing the embryos I was looking at the callus formation. The desired callus was friable type II callus. After a few weeks the embryogenic calli formed shoots. I separated the shoots from the calli and transferred the calli to new petris containing N6C1 media.

After observation, comparison, and recording, it was learned that the embryos that had been incubated at 5°C seemed to be slightly larger than those from the control. The embryos that had come from the maize, which had been incubated at 45°C, were large as well. But judging from the way the ears of maize looked after incubation at this temperature, it is doubtful that they would have survived incubation at 45°C much longer than three days. Following my departure from CIMMYT, these samples were going to be further tested to determine which temperature is best for regeneration.

Apart from my research, living in another culture was an enriching experience. Because CIMMYT is an international research center I not only got the chance to experience the Mexican culture, but other cultures as well. I met people from all over the world. All of the people I met made the summer of 2001 one of the most memorable experiences of my life.

When I left for Mexico I expected to come back as a slightly changed person, but I had no idea how much it was really going to change the way I view life. I knew that I would be living in another culture, but I did not know that being there would have as much of an effect on me as it did. I experienced a reversal of some of my paradigms

During my first two weeks of learning my way around the lab, the majority of my time was spent with two technicians. One of them spoke only minimal English, while the other spoke no English at all. This made communication somewhat difficult because, although I had taken four years of Spanish in high school, I did not know enough of the language to have a full conversation, and I did not know any scientific terminology in Spanish. I knew that I would have to learn more Spanish quickly. The two of them gave me two sheets of Spanish verbs with their meanings in English. This helped a great deal. Little by little, my Spanish was improving. After those two weeks the girl I had been working with invited me to stay at her house one night. I would have to say that this was my favorite experience I had while in Mexico. Having stayed with her family, I feel that I know a little more of what the Mexican culture entails.

The bus ride to her house was about twenty minutes long. We talked as much as we could in Spanish, and she told me that none of her family members spoke any English either. I knew that this was a good opportunity for me to practice more of my Spanish. When we arrived in her village it was about a ten-minute walk to her house. The ten minute walk to her house was an education. It was most interesting because it gave me the chance to see a typical Mexican village. After we got to her house she introduced me to her sister, father, brother, her son, and her nephew. Everyone was warm and friendly. Her sister was cooking dinner and she kept asking me if I wanted something else to eat or if I wanted more to eat,

and what kind of food I liked. When I told her what I liked to eat she tried to make it all. When dinner was over she asked what I wanted to eat for breakfast. They did everything they could to make sure I had had enough to eat and that I was comfortable. These people are some of the most generous people I have ever met. I am still touched by the way that they welcomed me, a stranger, into their home and were so kind. Having met them helped me to realize that this is the type of person that I hope I can be.

Those two months in Mexico changed my outlook on life and it changed me as a person. I feel fortunate and grateful to have had this opportunity to learn a great deal about food security, genetic engineering, as well as having the opportunity to improve my lab techniques. Because of this experience, I think that I understand some facets of the importance of food security around the world. And, in addition to the knowledge I gained from my work, I learned about a new culture and I learned some surprising things about my own culture. Before leaving the United States, I knew that other cultures were different, but I did not understand just how different until I actually got the chance to experience a new culture first-hand. Not only did I get to spend time with Mexicans, but I also made friends from Scotland, France, Kenya, Brazil, and several other countries. Living in another country was one of the most valuable and character-enhancing experiences I have ever had. The trip made me a more open-minded person, and helped me to think less about myself and more about the total picture of humanity.

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