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DEPARTMENT OF PLANT PATHOLOGY AND MICROBIOLOGY & BIOENVIRONMENTAL SCIENCES

College of Agriculture and Life Sciences Texas A&M University

NEWSLETTER

Fall Semester 2010

Contents

Texas A&M University
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STUDENT STORY: TEACHING IN THAILAND

Ceceilia Oberman (BESC '08) with her students in Nakhon Si Thammarat, Thailand

It is said that teachers cannot tell where their influence stops, which may be especially true for Ceceilia Oberman, who spent a year sharing her knowledge abroad. In April of 2009, Oberman, BESC '06, left Texas bound for Nakhon Si Thammarat, a province of southern Thailand. Although she missed her family and friends, the rewards of teaching young Thai students far outweighed the challenges of living abroad, she says.

"Little adjustments in my way of life, like living without hot water or Mexican food and learning to speak Thai, became welcomed enrichments in my life," Oberman says. "Not to mention other perks like exploring gorgeous beaches, jungles, mountains and waterfalls."

Oberman, who taught health to students in grades one through six, decided on this career path while finishing her Master's in Public Health at Texas A&M ('08). The one-year adventure turned into an experience she refers to as "truly amazing."

All About the Students"

My students were incredibly respectful and intelligent," Oberman says. One of her favorite experiences, however, was substitute teaching a third grade class during their unit on caring for the environment.

"I felt so passionate about sharing my own knowledge with the students," Oberman says. "I was grateful that I could use my degree in Bioenvironmental Sciences to truly give them an environmental education I could feel proud of."

A Word from Our Department Head

- *Leland S. (Sandy) Pierson III, Professor*

I am pleased to announce that George Hale has taken on the responsibility of editing the newsletter, which will occur quarterly. Like years before, 2010 was a busy year for the department. Over the spring and summer, faculty and students attended and presented their work at meetings, like the Asilomar Mycological Meeting and the American Phytopathology Society Annual meeting held in Charlotte, NC. Several of our faculty, students and post-doctoral students gave excellent presentations or posters at these meetings. Additionally, several of our Extension faculty spoke at the recent Texas Plant Protection Conference held in Bryan in early December. As always, plant disease issues continue to cause problems in the state. Bacterial panicle blight has once again emerged to cause severe problems for rice producers. In this issue Dr. Young Ki Jo and Dr. Shane Zhou discuss several approaches to control this disease, including exciting new techniques using silver nanoparticles or cold plasma. Plant Pathologists in the department continue to work on current and emerging plant issues including Sudden Orange Scab and Citrus Greening on citrus, and Zebra Chip on potatoes and tomatoes. This issue also covers the developing field of using plants to produce medicines and other products. Dr. Herman Scholthof describes an approach his laboratory is working on to improve this process by maximizing foreign gene expression in plants. This issue also includes two examples of foreign experiences by our students: one in Thailand and the second in Taiwan. Last year was very successful for our undergraduate BESC major, now with 229 majors. Page 9 lists the 62 BESC seniors who have graduated and are now pursuing careers or graduate school, and the five graduate students who completed their advanced degrees in Plant Pathology and Microbiology. The graduate program continues to attract and train top students in the theory and performance of the latest research and extension skills.

Teaching In Thailand

Students learned about topics such as preserving the Thai rainforest, protecting endangered species and conserving natural resources to name a few. Oberman found that the students were very responsive to these topics and interested in caring for the planet.

"Watching their faces and listening to their enthusiastic responses about living environmentally responsible lives was one of my most memorable and emotional moments in Thailand," Oberman says.

Advice on Applying

Oberman found that the Internet played a key role in finding a teaching job. Two Websites she found useful were Ajarn.com and Ajarnjobspace.com, where she applied for her teaching position. "Ajarn is a respectful way to say teacher in Thai," she explains.

Schools in Thailand use websites to post job openings and such websites are places where applicants can search for jobs by school, region, or even concentration, like science or health. In addition, one can upload a resume and wait to be contacted by various schools.

While these sites are specific to Thailand, there are a few others on which one can find job opportunities all over the world, such as DavesESLcafe.com. "I recommend using the type of sites where you can contact the schools directly," Oberman says. "Avoid using organizations or services that place you in a school of their choosing after charging you a fee."

What's Next?

Now back in Texas, Oberman is looking forward to her next adventure. "I can't wait to learn about a totally new culture in whichever country I call home next." However, no matter where she ends up, Oberman says she will carry with her lessons from teaching in Thailand. "The experience has inspired me to live in a more simplistic way, which happens to tie in well with the values I try to follow as an environmentalist."

Interested in working abroad? Take a look at Texas A&M's Work Abroad Program at http://bit.ly/euPBVq.

Some of Oberman's students mugging for the camera

Rice plants infected with panicle blight. The disease results in empty, or blanked, rice grains.

When it comes to controlling rice diseases, it seems as if chemicals are the only option farmers have. For fungal diseases, farmers have several fungicides to choose from, but when facing a bacterial disease, options are limited. Bacterial rice diseases, particularly those spread by seed, are what Texas A&M plant pathology and microbiology assistant professor Dr. Young-Ki Jo is interested in.

Seed borne diseases present a unique challenge because what you see isn't always what you get. "The seed may look really clean, but there may be microbes growing on the surface," Jo says. Because you can't just look at a seed and tell if it's carrying a disease, treating the rice seed before planting it is especially important.

One such seed borne disease that has gotten a lot of attention lately is panicle blight. This disease has caused large monetary losses for Texas rice growers recent years, Jo says. "I don't exactly know a money value, but it's getting more attention." The main problem, Jo says, is that there is no antibiotic available that growers can use to treat the disease.

> ***"The seed may look really clean, but there may be microbes growing on the surface."***

Panicle blight seems to be worse in hotter years, but Texas rice growers can't simply plant and harvest early. In Texas, growing two rice crops each year is getting popular, Jo says. The first crop is harvested in late July or early August at the latest. Farmers cut the top of the rice plant off, leaving the stem and then reflooding the field for the second crop, called ratooning. The second harvest takes place in October, during which Jo says growers typically get about half of the main crop's yield from the ratoon crop, barring a hurricane in the late season.

Because of the lack of viable antibiotics, starting with clean rice seed is important. But Jo says it's hard to clean large volumes of rice seed. One cleaning method is hot water treatment, where rice is soaked in hot water. The problem is using water that is hot enough to clean the seed without damaging it. "You don't want to cook the rice," Jo says. "More effective and safer methods are needed."

Hi-ho silver

One such method is treating rice seed with silver nanoparticles, bits of silver ranging from 1 nm to 100 nm in diameter. For a size comparison, *Escherichia coli* bacteria are typically around 2000 nm in length. Silver nanoparticles also show high levels of antimicrobial activity and are considered safe for humans. "They are used everywhere," Jo says. In fact, it seems that store shelves are full of items containing these particles ranging from socks to bandages.

The idea is to clean and coat rice seeds with silver nanoparticles, thus killing any bacteria or fungi living on the seeds. As a precious metal, silver is fairly expensive. But because silver nanoparticles are so small, a little goes a long way. Jo says this technology shows potential use for control of disease in many kinds of food crops, ornamental plants and turfgrass.

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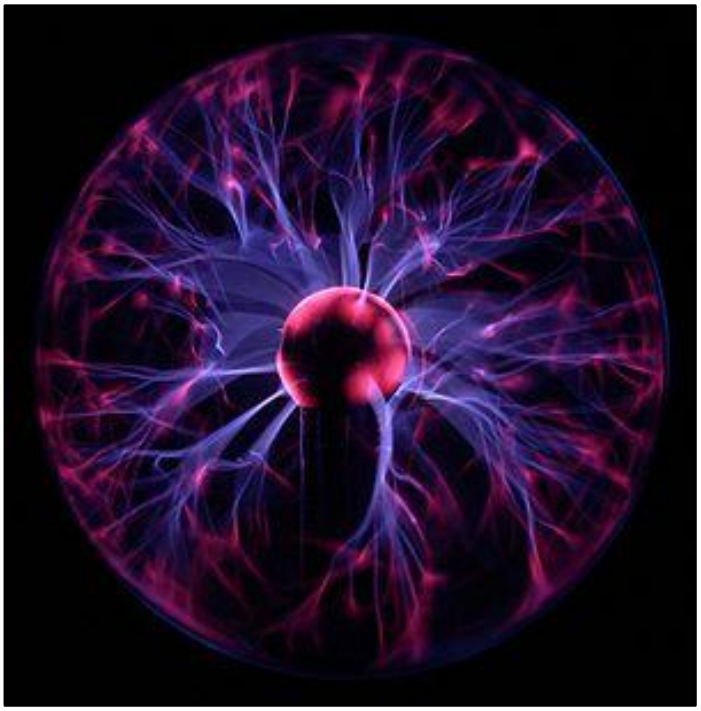
Not just for televisions anymore



A common example of plasma. The plasma globe

Another technology that Jo says shows some potential sounds like something out of a science fiction novel: cold plasma. Plasma is a state of matter that is essentially an excited gas, often generated by electrical fields. Plasma is divided into two main types: thermal plasma, like you'd see in a bolt of lightning, and non-thermal plasma. "You can touch non-thermal plasma," Jo says. And from preliminary experiments, non-thermal plasma seems to have antimicrobial effects are safe to human and plant tissues.

There are a few different ways of generating non-thermal plasma such as dielectric barrier discharge (DBD) and corona discharge, but preliminary findings show that DBD plasma generation is effective and that as little as three minutes of exposure can reduce microbes on any surface. Plasma streams also seem to be an effective way to apply coatings to rice seed, which could lead to a process that applies antifungal agents while cleaning microbes from seed surfaces.

This research is a great example of international and multidisciplinary collaboration, Jo says. He has been working with Dr. David Staack, assistant professor of mechanical engineering at Texas A&M. Staack specializes in plasma and constructed the plasma generating equipment Jo has used in his research. Jo has also been working with South Korea's Rural Development Administration, the South Korean equivalent of the U.S. Department of Agriculture.

Jo cautions that his findings with cold plasma are preliminary and that more funding is needed to improve plasma generating machines and protocol for their use. Both silver nanoparticles and cold plasma show promise as ways to prevent disease and improve rice growers' yields. "Both methods are safe and easy to handle and could be cost effective," Jo says. "We are on top of the game."

For more information contact Dr. Young-Ki Jo at 979.962-1758 or ykjo@ag.tamu.edu

Rice panicles

Imagine a future where we use cultures of plant cells to make useful medicines safely and inexpensively. The idea isn't all that far-fetched; for example we already use bacteria to make insulin. But using plants instead of bacteria has a number of advantages says plant pathology and microbiology professor Dr. Herman Scholthof. "Plants are cheap and safe to work with," he says. "And bacteria lack mechanisms to properly produce some proteins."

The way we get bacteria and plants to make proteins they normally wouldn't is with a little scientific trick called foreign gene expression. On its face, foreign gene expression looks quite simple: find the gene responsible for producing your desired protein and insert that strand of genetic material into a host organism, directing [fooling] it into making something new. The problem is that plants have a defense mechanism called RNA silencing that keeps this from working, and Scholthof, a virologist by training, is working on ways to get around this mechanism using modified plant virus materials.

In Self Defense

RNA silencing is the way plant cells protect themselves from viruses. The cell monitors for the presence of a double-stranded type of RNA called dsRNA that viruses use to reproduce. The dsRNA string is then cut into shorter segments of 21 to 24 nucleotides by an enzyme called Dicer. Those short segments are then moved to the cell's RNA-induced silencing complex where they are destroyed "It's a very elegant mechanism," Scholthof says.

Although useful for stopping viruses, RNA silencing is also good at seeking and destroying RNA made by genes inserted by researchers. In fact it was attempts to create a deep purple variety of petunia that led to the accidental discovery of RNA silencing in the late 1990s. Researchers inserted an extra copy of the gene responsible for purple pigment and instead of getting dark purple flowers they got petunias with white petals. The petunias mistook the extra RNA produced by of the purple genes for virus RNA and destroyed all copies of it.

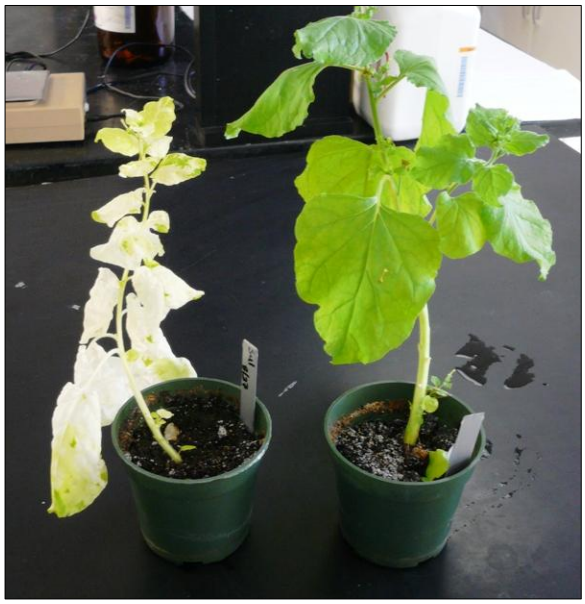
This sort of gene deactivation throws a monkey wrench in expressing foreign proteins, but the way RNA silencing deactivates repeated sequences also gives researchers a helpful tool for identifying gene function. By inserting a copy of a gene into a plant virus and after inoculation, waiting, not to see what happens but what doesn't happen researchers can figure out what that gene does.

For instance, Scholthof's team uses a virus to express a portion of a gene responsible for chlorophyll synthesis in *Nicotiana benthamiana,* a variety of tobacco plant. When the plants detect and deactivate this gene in the virus, it also silences this same gene in the plant and thus the plant's chlorophyll production is turned off, turning it white.

Doing an End Around

As effective as it is, RNA silencing isn't foolproof. Some viruses produce proteins that suppress silencing, making it easier for them to infect plants. "Viruses are very successful," Scholthof says. "They are good at blocking immune responses." Scholthof and his team are currently using a protein (P19) from a modified version of *Tomato bushy stunt virus* (TBSV).

"[Viruses] are good at blocking immune responses."



***N. benthamiana* with (left) and without (right) silenced chlorophyll gene.**

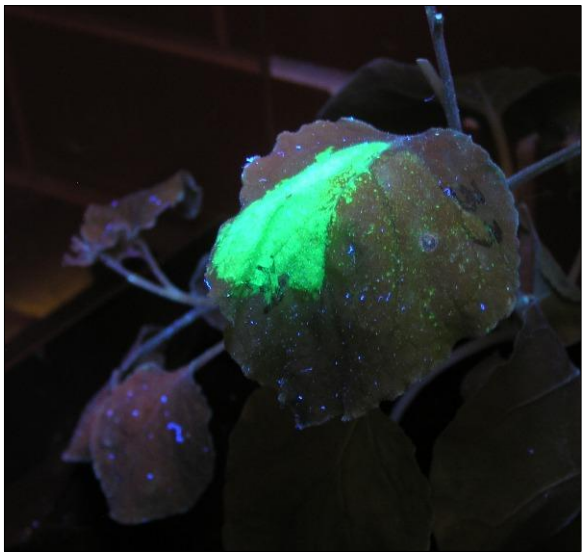
By using this protein, they are able to introduce a jellyfish gene into *N. benthamiana* plants or cell cultures and get them to express green fluorescent protein, which glows green under ultraviolet light. This expression occurs at higher levels than in absence of P19 because silencing is suppressed.

GFP expressed in silenced *N. benthamiana* under ultraviolet light.

Scholthof says that this work is promising, but still in its early stages. Industry is interested in using bioreactors made of plant cell cultures infected with a virus engineered to produce a wide variety of proteins with pharmaceutical uses, but we're nowhere near that yet, Scholthof says, calling his current work a proof of principle.

He also says that in addition to the obvious medical uses, high expression of novel genes in plants could also have tremendous effects on agriculture and biotechnology. "I grew up in agriculture, so I know plants are important."

For more information, contact Dr. Hermann Scholthof at herscho@tamu.edu.



GFP expressed in unsilenced *N. benthamiana* under ultraviolet light. Note how the patch of GFP is brighter.

If you want to know more about RNA silencing, check out a segment from the PBS program *Nova* at http://www.pbs.org/wgbh/nova/body/rnai.html.

Zhou checking a rice crop for blight

The summer of 2010 was a bad season for rice farmers in Texas, Arkansas and Louisiana. Low crop yields caused major economic losses in all three states, and a relatively new disease called bacterial panicle blight is one of the major culprits. Following an outbreak in 1995, bacterial panicle blight had been only a minor annoyance until this year in Texas. This year was the second major outbreak of the disease and outbreaks of bacterial panicle blight are hard to predict and even harder to control says Beaumont-based Texas Agrilife Research Plant Pathologist Dr. Shane Zhou. "We're not sure when it will come back again."

Bacterial panicle blight is caused by bacteria and is identified by the damage it causes to growing rice grains. Rice grains grown on the top part of the plant's stem, known as the panicle. The disease causes rice grains from forming, leading to empty or blanked hulls.

The bacteria responsible is thought to be carried by rice seeds and once planted, the bacteria can contaminate a rice field's soil and water. While the bacteria can multiply very fast and can infect large areas, panicle blight symptoms only seem to surface when the weather is unusually hot. This means that the hotter the summer, the more likely a severe outbreak is. Unfortunately, Zhou says, there's no way for Texas rice growers to avoid the heat.

A Chemical Solution?

What growers need is a way to either prevent bacterial panicle blight or treat it before an outbreak becomes severe. Zhou says this is difficult because there are no chemical treatments for the disease. "We have lots of choices in fungicide, but few in bactericides," Zhou says. "If we had a chemical, we could at least have a weapon to control the disease."

Although no labeled antibiotics exist to control bacterial panicle blight, some researchers have expressed interest in using oxolinic acid. Zhou says oxolinic acid has been tested in Japan and the United States with promising results, but its widespread use would pose environmental concerns that make it unlikely the Environmental Protection Agency would approve it. "I don't think it will be approved any time soon," Zhou says. "So farmers don't have any choice."

As farmers search for an effective chemical treatment, Zhou says there may be other ways to manage this devastating disease. One that Zhou finds particularly promising is host resistance. Some varieties of rice are more resistant to the bacteria than others, Zhou says. Certain hybrid varieties show moderate resistance, he says, but unfortunately none are highly resistant.

Another method being tested is the use of different strains of bacteria as a biocontrol agent. The idea, Zhou says, is to introduce a non-pathogenic strain that competes with the bacteria responsible for crop losses. In addition to host resistance and biocontrol, other researchers such as Dr. Jo, a researcher in the plant pathology and microbiology department at Texas A&M, are investigating novel methods of fighting the disease through rice seed treatment.

It is Zhou's work with rice diseases like bacterial panicle blight that led him to be invited to speak at the 22nd annual Texas Plant Protection Association Conference this December in Bryan, Texas. Zhou hopes that through this talk he can draw more attention to the hazard bacterial panicle blight, which poses a threat to Texas agricultural production. "We need a big project across all southern rice-producing states to develop effective methods for management of the disease," Zhou says. "We need funds to support these kinds of studies."

Students at a geothermal spring in Taiwan

There's an old saying that goes, "it's hard to keep them on the farm after they've seen Paris." The good thing about agriculture, however, is that it's practiced all over the world. Dr. Daniel Ebbole, professor in the department of plant pathology and microbiology, knows this first hand and coordinated a program last summer introducing students to agriculture and environmental issues in Taiwan.

The program titled "Biodiversity, Agriculture and Culture of Taiwan" took place from June 26 through July 24, 2010 at various sites in Taiwan. BESC students Rosa Alvarado, John Ballou and Almon Price traveled for last year's Taiwan experience. The program includes lectures and field activities at the National Taiwan University and throughout northern Taiwan and is broken into three sections.

Town and country

Once in Taipei, students from the United States and around the world begin the first section in the low elevation forest in Yangmingshan National Park near Taipei, the home of National Taiwan University (NTU). During this two-week-long section, students hear lectures on the geography, flora and fauna of Taiwan, tour museums devoted to such diverse subjects as ceramics and the animals of Taiwan, and even have to opportunity to try their hands at calligraphy.

After two intense weeks, students then packed their bags to head to the highlands of Taroko National Park, south of Taipei. While there, students attended lectures on orchid production, the alpine flora and the biodiversity of Taiwan, as well as an introduction to the aboriginal people of Taiwan.

Students also got to tour the Highland Experimental Farm, Earthquake Museum of Taiwan and Taiwan's Agricultural Research Institute, and had the opportunity to do a nighttime observation of insects.

Fifteen days later students return to Taipei for a few days where they attended a lecture on rice-based agriculture in Taiwan and toured the Taipei City zoo before preparing to deliver their final group presentations.

At the Taipei City zoo

Plans for next year

Dr. Ebbole plans to coordinate another group of students in the 2011 Taiwan summer program. Program costs will include 1 to 3 hours of study abroad tuition, a roughly $2,450 program fee that covers medical insurance, room and board, cultural fees, airfare of anywhere from $1,200 to $2,500 and miscellaneous expenses. Students who don't already have a passport will need to get one and, while the program is about 28 days, any students staying beyond 30 days will need a visa. Both of these items cost in the neighborhood of $130.

These costs might seem onerous to students, people who aren't exactly made of money, but Ebbole says financial assistance is available. A number of scholarships are available for honors students and through study abroad programs. In addition, there are $500 scholarships for up to three students participating in the Taiwan program this summer.

To learn more about the BACT program contact Dr. Daniel Ebbole at d-ebbole@tamu.edu

Or visit their website at: http://ciaeae.bioagri.ntu.edu.tw
Applications for the 2011 program are due by March 15, 2011

CONGRATULATIONS GRADUATES!

The past year saw the graduation of 62 BESC seniors and 5 PLPM graduate students. We wish them the best of luck as they pursue their careers and further study. Congratulations!

Graduated BESC majors:

Spring 2010

BOOK, MICHAEL JOHN
BURNS, STEPHANIE LYNN
CHERRY, LAURA CAMPBELL
DE LA GARZA, LAURA ANDREA
FLORENCE, JADE ASHLEY
GUENTHER, LACIE LYNN
HOLTON, STEPHANIE DOMINIQUE
HUMPHREY, MELISSA JORDAN
JONES, MATTHEW EVANS
KUBIC, TAYLOR JOSEPH
LINDLEY, LAUREN NICOLE
NGUYEN, HONG-HANH THI
PURNELL, ELIZABETH LEE
RAMSEY, STANLEY WAYNE
REA, JORDAN BLAKE
ROLAND, STEVEN KANE
SKEELS, AMANDA GAYLE
SMALL, JESSIKA LEE
TAYLOR, KYLE BENJAMIN
WRIGHT, MEGAN TANUNYEAKE
ZAVALA, SILVIA EUGENIA

Summer 2010:

BALLOU, JOHN ROLLIN
ENGLISH, ERIC HARRY
MAKI, ARTEMIS ALEXANDER
NAUMANN, BRANDON WILLIAM
NORMAN, WHITNEY DANIELLE
REGMI, SHAMA
RHODES, STEPHEN MARSHALL
TESSEM, CHAD RICHARD

Fall 2010:

BARGE, JONATHAN THOMAS
BLUDAU, CHRISTA RAE
ESPONDA, CISCERON JORDANO
FLORES, JENNIFER RENEE
GARCIA, KAMRYN ALYSE
GONZALEZ, MANUEL ESTEVAN
GREENIDGE, CHRISTOPHER DAVID
HOLT, CALEB
KANOJIA, SUNAINA HARICHAND
LAWSON, VALERIE ALEXANDRA
LIGHTNER, JESSICA CAREY
LYNDERSAY, MEGAN CLARE
MANCINI, MATTHEW
MILLIGAN, SPENCER
NEBGEN, WESLEY
NORTHUP, ASHLEY
ONEILL, KIMBERLY
PUENTES, CARLOS ALBERTO
QUINTERO, KORD
RAFIQUE, UMMER
RODRIGUEZ, KRISTY MARIE
SMITH, ALTRICIA BREANNA
TERRELL, MINDY LAUREN
THIBODEAUX, ZAMARA CHAKELIA
THORNTON, OMESHIA LYNNETTE
TORRES, RICHARD
TREVINO, ALEJANDRA
TURNER, LUKE
VALADEZ, CARLOS
WITHERS, CODY

Graduate students:

Spring 2010:
Joon-Hee Shin

Fall 2010:

Charles Greenwald
Chestley Miller
Yulan Zhang
Hyo-Jin Kim

President's Scholarship Endowment: BESC Information Table

The BESC department hosted an information table at this year's President's Scholarship Endowment reception.

From left: BESC senior Heather Solomon, Dr. Pierson and BESC student Altricia Smith at the BESC gameday table.

Altricia Smith (BESC Senior and NAEP President) holds the world in her hands

Introduction to the Editor

Howdy! My name is George Hale and I'm a master's student in the Science and Technology Journalism program here at Texas A&M. I've taken the newsletter editing reins and will be producing the newsletter on a roughly quarterly basis. I look forward to writing about the great things going on in the Plant Pathology and Microbiology and Bioenvironmental Sciences programs, so if you know of any new and exciting research, events or honors, feel free to let me know by email at halegr@gmail.com.

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