Greetings from the Department of Entomology and Plant Pathology

Dr. Phil Mulder, Department Head

Welcome to the fifth edition of our annual newsletter. In spite of the ongoing pandemic, we experienced another great year in the Department of Entomology and Plant Pathology at Oklahoma State University. I want to continue to focus on annual highlights and other activities within the department. In this section, I would like to provide you with some 2020 highlights from our department. As always, we had a number of awards and honors gathered by our faculty, students, and staff. In addition, our faculty and students were highly productive in the number of refereed publications and grants awarded.

We continued growth in our entomology undergraduate major, with over 70 majors (which includes about 8 double majors). We are still one of only 16 entomology majors in the country and currently stand at first or second in the nation for undergraduate enrollment. I should point out that we are doing this with less entomology faculty members compared to other institutions with a major in entomology (Nationwide average 23.3, we have 10 tenure track faculty in entomology). This fall, we experienced the 8th consecutive year of double-digit enrollment (13 Freshmen and 11 transfer students) in our undergraduate major. All of our options in the entomology major have attracted many students, but there seems to be an awakening of interest in Insect Biology and Ecology, most likely attributed to many successful years of the Insect Adventure, directed by Dr. Andrine Shufran. Many of the attendees of Grandparent University that were very young when she began her efforts are now showing up in our department. In addition, Drs. Hoback and Shufran continue to tell the story about the many job opportunities with an entomology degree. Some of our students successfully graduated and entered veterinary school or medical school. Two of these students, Haley Hahn and Molly Drakeley, who are now third-year students in the OSU veterinary school, continue to visit with our new students for the third year in a row. They have inspired many of our students to focus, and do well enough to be successful in entering vet school. In addition, at least four of our graduates ended up in Graduate School either at OSU or elsewhere across the country. In the 2019/20 academic year, we graduated five undergraduate majors and anticipate many more in the next academic year. Since students who graduated in the spring or summer of 2020 did not get to walk across a stage (due to the pandemic) and receive recognition, we are recognizing them in this newsletter with a special pictorial section.

Dr. Hoback continues to mentor several undergraduate students, teaching nearly 900 students in “Insects and Society”, producing his online textbook (generating scholarship funds to further support students), and teaches an online offering of Insects and Society to around 100 students each summer. This fall, with the Pandemic, his student contact hours are still high, but thanks to our ability to hire Ms. Melissa Reed, we are offering an online version of Insects and Society and two sections with face-to-face instruction by Drs. Hoback and Giles. Dr. Justin Talley is also offering an online version of “Livestock Entomology” to over 115 students this fall. We are very grateful to Dr. Cynda Clary for providing support for maintaining our student contact hours, and in spite of the Pandemic, enrollment is up at OSU.

This fall, we are honored to have Dr. Kenneth Pinkston as a Distinguished Alumnus. He received this award from the Division of Agricultural Sciences and Natural Resources (DASNR). Ken, affectionately known to some as “Pinkz,” was the heart and soul of the Entomology and Plant Pathology department for over 25 years and was a major force and impetus in developing and soliciting support for our Endowed Professorship in Structural and Urban Entomology (Now an Endowed Chair position). More on this distinction will be provided later in this newsletter.
Our graduate student numbers are down slightly this year, likely indicative of our lower faculty numbers and the inability to bring in international students during the pandemic. In spite of fewer faculty our curriculum has continued to evolve, thanks in large part to our very dedicated team of faculty. Obviously, the budget often dictates these situations, but the faculty have stepped up and filled gaps in order to provide a diverse number of courses throughout the department. We continue to seek ways to build in flexibility to our degree programs, particularly for graduate education. Our faculty are extremely creative and innovative in developing alternate ways of addressing curriculum issues and I am optimistic and very excited for the future developments that will arise.

A special thank you is extended to Dr. Stephen Marek, who in spite of his predominant research appointment, has taken on more than his fair share of teaching, due to the loss of two key plant pathology faculty that have moved on over the last few years. We were also able to permanently modify Dr. Marek’s teaching assignment to accommodate the changes that have occurred and to take advantage of his skills, talents, and abilities in student instruction.

In the arena of research, we continue to emphasize the land-grant mission with very active programs in:

- biochemistry
- molecular biology
- human and animal health
- microbial forensics
- food safety
- insect-borne transmission of diseases
- diagnostics development
- IPM
- invasive species monitoring
- resistance management
- cultivar development and screening
- soil-borne plant diseases
- mycology
- bacteriology
- plant disease epidemiology
- efficacy trials
- insect and plant disease biology and ecology
- biological control
- alternative pest control
- stored product management
- worker safety
- conservation entomology
- endangered species
- termite pre- and post-treatment strategies
- bed bug management/demonstration
- pesticide safety education and certification

This year, I asked Dr. Li Maria Ma, Dr. Francisco Ochoa Corona, Dr. Wyatt Hoback, Dr. George Opit, and Mr. Kelly Seuhs to provide some highlights from their various areas of research, extension, teaching, and outreach. In the “Where are they Now” segment I had the opportunity to interview one of our graduates in entomology and one from plant pathology. Dr. Michael Gates from entomology and Dr. Stephanie Rogers, from the plant pathology discipline. We are so proud of our graduates and their tremendous accomplishments and certainly want to highlight their continuing success.

For 2020, a big congratulations to Dr. Li Maria Ma who was promoted to Professor. In addition, another big congratulations to Dr. Wyatt Hoback who has garnered another national award, the 2020 Excellence in Teaching and Student Engagement Award from the USDA-APLU for his teaching in Food and Agricultural Sciences, one of only two awards provided nationally each year. In addition, BIG CONGRATULATIONS to Dr. Haobo Jiang who received the OSU Distinguished Regents Research Award. One more BIG CONGRATULATIONS to Dr. Tom Royer, who will receive the 2021 International IPM Lifetime Achievement Award of Recognition. Great Job by these very valuable faculty members and so very well deserved!

Research and Teaching Highlights

**Dr. George Opit**

Professor

I was hired as the Stored Product/Post-Harvest Pest Management Entomologist in the Department of Entomology and Plant Pathology (EPP) in April 2008. In the last 12 years, I have developed an externally funded research program focused on the management of arthropods in post-harvest situations. Currently, I have a split appointment with a focus on research (80%) and in teaching (20%).

I have taught “Introduction to Entomology” since 2011 and have seen class sizes in the fall semester grow from 32 to 68. In this course, students gain an understanding of basic animal biology, using the insect model and a comparative view of physiological systems in insects and those in other animals, including vertebrates. A really great aspect of the course is that it enables students to gain familiarity with the tremendous diversity of insect life and how it is organized and classified based on phylogenetics (evolutionary relatedness of taxa). Students also gain an understanding of the important roles insects play in the ecosystem, including pollination, decomposition, pest suppression, herbivory, and pathogen transmission, and ultimately, how these roles impact human society. Last but not least, students are taught the importance of sustainable pest management practices, using ecologically-based measures, and its application to the larger realm of environmental sustainability and sustainable human development.

In relation to my research in the last 12 years, I have worked on investigating the ecology, management, and potential economic impact of emergent stored-product pests, now
recognized as pests of substance, called psocids. My lab is one of only two labs in the United States, and one of a handful worldwide that conducts research on psocids, with expertise in identifying these tiny insects. Psocid species respond differently to control methods targeted at them, and hence effective management depends on correctly identifying species that comprise infestations. I also actively research phosphine resistance in stored-product insect pests in the United States. My phosphine resistance research includes detection and determination of levels of phosphine resistance in key stored-product insect pests from Oklahoma, California, and other parts of the United States, then developing management tools and phosphine resistance management strategies for Oklahoma and the United States. In my research, I have also investigated mechanisms responsible for tolerance to fumigants in stored-product insect eggs, and have assessed propylene oxide as a potential fumigant to blend with sulfuryl fluoride (SF) to overcome the ovicidal deficiencies of the latter, as part of finding a replacement for methyl bromide (MeBr) for control of stored product insect pests in dried fruits and nuts produced in the Central Valley of California.

Post-harvest loss remains an under-researched, high-priority problem across developing countries and value chains. Therefore, post-harvest is an area of high opportunity for short-term gains in development outcomes such as improved food security and increased resilience. Therefore, since 2009, I have worked on identifying and scaling simple, cost-effective, and readily implementable technologies and tactics that can be used to mitigate post-harvest losses caused by grain fungal infection (mycotoxins) and stored-product insect pests in Ghana and Nigeria.
Dr. Wyatt Hoback  
Associate Professor

I have been with OSU for seven years and was promoted to Associate Professor with tenure in 2018. In addition to receiving tenure, my appointment was adjusted to include Research which focuses on beneficial insects in Oklahoma. In both research and teaching, I also conduct a lot of recruiting and outreach as many people have questions about insects.

"Murder hornets" she wrote, a concerned citizen contacted Oklahoma State University fearing that she had discovered an Asian giant hornet on her property. I have responded to 14 such emails in the past few months and have been featured on Oklahoma State University's homepage, in newspapers and in television interviews. I became the authority on the species because I allow myself to be stung by various bees, wasps, ants and even scorpions as part of teaching my non-majors Entomology class “Insects and Society” to nearly 1,000 undergraduate students per year. I also teach four majors classes per year and have helped to increase our enrollment to 70 full-time students pursuing undergraduate degrees in Entomology. A recently funded grant from the USDA allowed us to add four Native American students to pursue dual degrees in Entomology and Plant and Soil Sciences.

My teaching has been nationally recognized by the North American Colleges and Teachers of Agriculture and more recently by the United States Department of Agriculture 2020 Student Engagement Award for excellence in teaching.

In research, I advise graduate students who investigate a range of topics from sugarcane aphids on sorghum, to surveys of grasshoppers in all 77 Oklahoma counties to burying beetles using carcasses from animals caught in fires. The research focuses on how insects benefit agricultural and natural communities.

Dr. Hoback teaching class during COVID-19
We created a fact sheet about Oklahoma grasshoppers as part of our surveys in the state.

Our continuing research on sorghum and sugarcane aphids examines plant resistance as an effective management strategy that protects both grower profit and the environment.

The research on burying beetle reproductive behavior revealed how these beetles improve soil fertility helping pasture lands produce more grasses for cattle and wildlife. We are also investigating how the beetles preserve the carcasses to use for their offspring which could lead to new antibiotics or preservation techniques for meat.
Biosecurity and microbial forensics research in Entomology and Plant Pathology is a vibrant research program contributing scientific input to diagnostic sciences. This research program looks at methods for regulatory plant health emergencies, forensic plant pathology, agriculture, and water biosecurity. The program started in 2008 when Dr. Francisco Ochoa Corona joined OSU from Biosecurity New Zealand. His research focuses mainly on the development and innovation of technologies for sampling, molecular identification of genomic landmarks of value for detection and discrimination of viruses and other phytopathogens. This research also explores the implication of genetic data on taxonomic relationships, host-pathogen associations, dynamics, global tracking, dispersal routes, and bio-geographic distribution. Dr. Ochoa Corona’s team (The Virus Chasers) also focuses on studying rapid and easy-to-use detection methods for non-skilled operators and is seeking a better understanding of how detection and diagnostic methods work and can be improved for faster and sensitive detection and monitoring of plant pathogens and pests in general.

The program conceptualizes ‘invention’ as the idea (strictly theoretical) and ‘innovation’ as the process that makes the idea a reality. For students and postdocs joining the program, innovation is not about inventing since both of these concepts are different, but equally dynamic, overlapping, and involve complementary processes. In practice, the biosecurity and microbial forensics research program uses invention to solve given problems and innovates our own or given ideas. This perception of the creative method makes this team an effective and flexible science provider. Although the research focuses mainly on plant viruses, it is not limited to these organisms, and research about fungi, bacteria, and insect vectors are also conducted. Plant viruses serve as convenient research models as they are non-infectious to humans and can be easily manipulated. Plant viruses exist in complex populations in both plants and water. Plant viruses may also pollute waterways and reservoirs naturally or be introduced intentionally. Detection of such viruses is complex due to water dynamics and dilution factors, therefore, maximum sensitivity and specificity are serious considerations for the Biosecurity and Microbial Forensics Research program in its pursuit of reliable detection-diagnostic and remediation methods.

The teaching component of this program started in 2009 with PLP/ENTO 2143 “Global Issues in Agricultural Biosecurity and Forensics” which was structured from scratch to address undergraduate students and has been taught since 2010. Two sections are regularly offered as PLP 2143 or ENTO 2143. The enrollment of students has progressively improved and the course is offered spring semesters of odd years. The aim of this course is to introduce undergraduate students to key definitions, the technical and professional vocabulary used in biosecurity and microbial forensics, and the fundamental components of an effective agricultural biosecurity system. Also, it introduces students to critical insights and a practical understanding of the components of a biosecurity system and its functioning. Biosecurity system components are illustrated by visiting selected case studies, short readings, and videos showing relationships among overlapping areas in biosecurity and microbial forensics and how these two disciplines operate and integrate, facilitating the understanding, relevance, and application of these two sciences. From 2009 to 2019 PLP/ENTO 2143 enrolled 107 students. PLP/ENTO 2143 has no pre-requisites.

The contribution made in biosecurity and microbial forensics research related to Entomology and Plant Pathology is described in 33 scientific articles published since 2009. The microbial forensics research program also contributed one patent in 2016 and two patent applications in 2019.

Dr. Maria Li Ma
Professor

Developing New Technology for Food Decontamination

With increasing numbers of foodborne outbreaks associated with the consumption of produce in recent years, the presence of foodborne pathogens on produce, such as fresh vegetables, fruits, and tree nuts, is a worldwide food safety and human health concern. Decontamination of produce during processing is an essential step in reducing such risk. However, current decontamination technologies are mostly based on chemical sanitizers (such as chlorine) or physical treatments that often show a limited efficiency in eliminating/reducing such risk. Furthermore, the widely used chlorine wash in the produce industry consumes large amounts of water, creating tremendous stress on this limited natural resource. New decontamination technologies that can overcome these limitations are critically needed.

In the past several years, Dr. Ma’s research team has been working on a new food decontamination technology, atmospheric cold plasma (ACP). ACP is a partially ionized air formed when high energy, such as high-voltage electric discharge, is applied to the air under atmospheric pressure. It consists of free electrons, ions (charged particles), reactive oxygen and nitrogen species (such as ozone, nitric oxide, hydroxyl, hydrogen peroxide, etc.), and UV photons. These charged particles and reactive species are capable of inducing a wide range of chemical and biochemical reactions that directly affect microbial inactivation. Therefore, ACP, as an emerging technology, has been investigated for food decontamination and other applications. As only air and electricity are needed for its generation/application, this new technology has several advantages over the current commonly used decontamination methods in the food industry: minimum water consumption (as a dry process), non-thermal, short treatment time, low operational cost, and it is scalable.

A uniquely designed ACP device was constructed by Dr. Ma’s research team. Over the years, her research program was able to obtain continuous grants from various funding agencies for ACP development. For food decontamination applications, the device has been refined from its original prototype several times. Validation studies using artificially contaminated produce, including pecans, tomatoes, and black pepper (spice), have demonstrated that four log reductions of the pathogens within 10 minutes of treatment could be achieved. Furthermore, using next-generation sequencing technology (RNA-seq), her research team was able to elucidate the underlying molecular mechanisms of foodborne pathogen inactivation by ACP. Their research results have revealed that rapid lipid peroxidation, cytosolic leakage, and cell lysis play important roles in the inactivation of the pathogen. Additionally, after treating a population of ACP-injured Salmonella cells in succession, no significant differences in pathogen inactivation rates or differential gene expressed were identified, indicating the pathogen is unlikely to develop resistance to ACP treatment over time. These results confirm that the unique ACP device has potential applications in food decontamination. Currently, Dr. Ma’s team is extending the ACP application to include aflatoxin-producing fungi and scaling up device design for large scale applications.
ACP Device (closed)

ACP Device (opened)

ACP treatment of pecans

ACP treatment of black peppers
Kelly Seuhs, M.S.
Associate Extension Specialist

Kelly joined the department in 2000 as an Extension Assistant, working with Dr. Jim Criswell and later Dr. Phil Mulder. In 2007, he received an M.S. degree in Agriculture Education at Oklahoma State University. In 2013, he was appointed to a non-tenure-track faculty position with responsibilities of 50% research and 50% extension. In his current position as Associate Extension Specialist, he serves as an extension state specialist in alfalfa. Over the past 20 years, his primary responsibilities have centered on alfalfa insect pest management. He has also been responsible for coordinating and conducting research on insecticide efficacy and management strategies for alfalfa weevil and aphids as well as numerous extension programs in alfalfa insect management. Recently, Dr. Alex Rocatelli, OSU Forage Specialist (PSS), and Kelly collaborated in the development of an Oklahoma Alfalfa Workgroup consisting of campus and area specialists as well as county educators providing timely reports on current issues facing alfalfa producers, continued program development for educators and stakeholders, initiation of several new research endeavors, and updates in management practices to increase Oklahoma alfalfa production.

In addition to alfalfa, he continues to be involved in various projects related to pecan, peanut, fruit trees, and more recently, sorghum pest management. In 2013, sugarcane aphid (SCA) was discovered in Oklahoma. He was asked to be part of a research collaboration consisting of departmental scientists and USDA scientists working with cooperators to develop a management program for SCA control in sorghum. While working in sorghum, he was also asked to be a part of the field crops team providing support for efficacy and insect management programs for corn, soybean, canola, and pasture.

In his primary research, he conducts yearly field trials on insecticide efficacy searching for new products and management strategies for alfalfa insect pest management. Monitoring weather events and degree day accumulation through the Oklahoma Mesonet, he is able to see how weather can play a key role in insect development and timing of control measures. He has also been involved in growth chamber projects screening for host-plant resistance to spotted alfalfa aphids. He is in the process of expanding the growth chamber work to include insecticide resistance testing for aphids in alfalfa. Recent developments in alfalfa weevil insecticide resistance have also opened the door to new opportunities not only in research but also in extension program development.

In field crops, Kelly has collaborated with Dr. Zarrabi, Dr. Royer, and Dr. Giles in numerous research trials (field and growth chamber) for two-spotted spider mite, aphids, and stinkbugs in soybean, banks grass mite in corn, grasshoppers in pastures, and fall armyworm in corn, sorghum and wheat. Over the past three years, he also has increased collaborative efforts with Dr. Mulder in conducting insecticide efficacy trials for pecan weevil, hickory shuckworm and aphids in pecan.
Planting Sorghum Plots at Lane, Oklahoma

Spraying Sorghum Plots
Graduate Students

Carrie Pratt
Master’s Poster Presentation- 1st Place
Entomological Society of America-
2020 Southwestern Branch Meeting

Leo Santos
Master’s Poster Presentation- 2nd Place
Entomological Society of America-
2020 Southwestern Branch Meeting

Melissa Reed
Ph.D. Oral Presentation- 3rd Place
Entomological Society of America
2020 Southwestern Branch Meeting
ESA 2020 National Meeting - Oral Presentation 1st Place

Salome Suarez
Otto S. Cox graduate Fellowship
for Genetics Research

Undergraduate Students

Joel DuBoise
Undergraduate Research Scholar

Zach Royko
Percival Scientific Undergraduate Entomology
2020 Student Activity Award -
2020 Southwestern Branch Meeting

Bailee Posey
Undergraduate Oral Presentation- 2nd Place
Entomological Society of America-
2020 Southwestern Branch Meeting

Ethan Shaw
Undergraduate Research Scholar

Faculty

Dr. Haobo Jiang
Oklahoma State University
Regents Research Award

Dr. Tom Royer
Awarded the International IPM
Lifetime Achievement Award of Recognition
Outstanding Team Award for OSU Extension Biennial Conference
Pesticide Safety Education Program and Structural and Urban Entomology Endowed Program

Dr. Bradford Kard

Mr. Charles Konemann

Mr. Charles Luper

Mr. Kevin Shelton

Dr. Justin Talley, Brian Freking, Dana Zook, Tommy Puffinbarger, Chad Webb
Gerrit W. Cuperus Integrated Pest Management (IPM)
Professional Achievement Team Award Extension
Horn Fly Resistance Management in Cattle Systems

Dr. Wyatt Hoback
The USDA-APLU Excellence in College & University Teaching in Food & Agricultural Sciences- Excellence in Teaching & Student Engagement Award
In February of this year, Noah Dunagan started his Financial Assistant position with the Department of Entomology and Plant Pathology. His responsibilities include preparing travel for faculty, staff and students. He also works with the Pesticide Safety Program, where he answers questions about licensing, testing dates, and locations, as well as testing manuals. Another role Noah covers is the purchasing aspect for the department. He handles P-card receipts and questions regarding rules for purchases. Noah also processes OK Corral purchases.

Noah grew up in many different places in Oklahoma and Southeast Texas where he graduated from Sweeny High School ISD Sweeny Texas, in 1999. After high school, Noah began attending OSU, where he was a part of the OSU marching band and worked on his degree in theater until 2001 when he joined the United States Marine Corps around the time of 9/11. During his time in the USMC, he earned his AC flight wings on C-130’s for Loadmaster/Jumpmaster/IF refueling observer/IF radio operator and switched jobs to Combat Photography/Videography when the need arrived for this position. He served from 2001 to 2007 and served two tours in Afghanistan, one tour in Iraq, and one tour in Djibouti, Africa.

After completing his contract with an Honorable Discharge, he moved back to Oklahoma. From 2007 to 2020 Noah worked in landscape design, retail, manufacturing, sales, and graphic arts. Noah currently resides in Glencoe with his parents and his three children - two boys and a girl. All three go to Glencoe elementary. His hobbies include a wide range of activities from the outdoors to cyberspace and many things in between.

In late June, Robin started her career as an Accounting Specialist Assistant in the Entomology and Plant Pathology Department. Robin’s responsibilities include maintaining Foundation accounts, Station accounts, and general office operations.

Robin grew up in Blackwell, a small town north of Stillwater. She attended Blackwell schools. After graduation, she attended Northern Oklahoma College in Tonkawa, Oklahoma. After NOC, Robin moved to Stillwater, OK where she worked as a bookkeeper for MerCruiser for 13 years and Field Electric for 12 years.

Robin married her husband Rick in 1996 and together they have two sophomores. Allison is a sophomore here at OSU majoring in Speech Pathology and Jacob is a sophomore at Stillwater High School. Rick is also employed at OSU at the Power Plant. Robin has lived in Stillwater for over 29 years and enjoys working outside in the yard, watching movies, and playing hand and foot with friends and family.
Featured Graduate Students

Salome Suarez

Hometown: Quito, Ecuador

Future Career Plans: After graduation, I would like to continue building my career by obtaining a job with industry and continue doing research. My ultimate goal would be to conduct research on fungal diseases.

What led you to study Plant Pathology?
My interest in plant pathology started when I came to OSU in 2014 for an internship at the Institute of Biosecurity and Microbial Forensics (IBMF) to do research. During this experience, I became fascinated about plant diseases and decided to continue on to graduate school.

What or who inspired your interest in Plant Pathology?
I believe that my two biggest inspirations in pursuing my degree in Plant Pathology have been my two advisors Dr. Robert Hunger and Dr. Stephen Marek, from whom I have learned so much about fungal diseases, especially in wheat.

What is your favorite activity or responsibility as part of your graduate studies?
As graduate students we are exposed to many different activities, I think one of my favorites is being involved in student associations since I have met many people from different majors and cultures while having fun at the same time. Likewise, I really enjoy attending national meetings and networking.

What advice do you have for someone interested in your major?
I think the best advice I can give to someone interested in Plant Pathology is to discover his or her passion by doing an internship or being exposed to the field itself. Plant Pathology is a fascinating field of science, which involves multiple areas of study such as microbiology, molecular biology, bioinformatics, biotechnology and genetics. Therefore, going through an internship or working alongside plant pathologists will give you the opportunity to decide if this field is right for you.

Outside of the major, what is your favorite activity/way to spend time?
Outside school, I love going hiking and taking pictures of nature, plants, and mushrooms. Also, one of my favorite things to do is to travel. I love visiting new places, trying different foods, meeting people from other cultures, and taking pictures of landscapes. In my free time, I like listening to music and dancing.

Salome attended the Cereal Genomics Workshop at Cold Spring Harbor, New York, which aided in her research.

Salome was awarded the Graduate Research Excellence Award in the Spring of 2019.
James K. Danso

**Hometown:** Obuasi, Ghana. West-Africa.

**Future Career plans:** In the short term, I hope to be part of a dynamic institution that provides opportunities for teaching, research, and/or extension work to examine novel solutions to global food and feed security challenges. Working in such an institution will build my capacity to fulfill my long-term goal of being part of global food security agencies to address gender disparities that fuel, food, and nutrition insecurity across the sub-Saharan African region.

**What led you to study entomology?**
Growing up in an agricultural-complex (CRI-CSIR) in Ejura-Sekyedumasi, Ghana where my Father works as a Crop Scientist (Crop-Breeder/ Agronomist) I had the opportunity to explore research fields and storage complexes where I frequently encountered different pest arthropods; however, insect pests were their major challenge with virtually no trained personnel to provide expert recommendations for insect pest management, as a result, I developed an interest in Entomology to fill this gap.

**Who inspired your interest in entomology?**
Dr. Enoch A. Osekre (Entomologist and Senior Lecturer, KNUST, Ghana) who was my undergraduate (BSc. Agriculture) and graduate (MPhil. Crop Protection, Entomology) advisor inspired my interest in Entomology. Dr. Osekre taught me various courses in Entomology during both my undergraduate and graduate-level education at KNUST-Kumasi, Ghana. Also, Dr. George P. Opit (Professor of Stored Product Pest Management, OSU) has inspired, guided, encouraged, and supported me during my master's degree as a co-advisor and project PI (USAID FtF PHL) in Ghana and currently, my advisor (Ph.D.) at OSU.

**As part of your graduate studies, what is your favorite activity or responsibility?**
As a graduate associate with both teaching and research responsibilities, I really enjoy both assignments since teaching and research fit perfectly in my career goals, and provide me the opportunity for building my capacity to meet such goals.

**What sage advice do you have for someone interested in your major?**
The advice I would give to someone interested in Entomology is to be prepared to work hard. While Entomology can be a fun and a lucrative career, it requires dedication and perseverance to obtain a graduate degree in Entomology.

**Outside of the major, what is your favorite activity/way to spend time?**
Outside of my course work, teaching, and research responsibilities I enjoy playing soccer and volleyball.
Featured Undergraduate Student

Alexis Coles

Hometown: Norman, Oklahoma

Future Career Plans: My professional aspirations are to become a Doctor of Osteopathic Medicine and work with the rural tribal nations of Oklahoma.

What led you to study Entomology?
I pursued Entomology as my major with the encouragement of Dr. Wyatt Hoback and Dr. Elizabeth Payne (Director of the Center for Sovereign Nations on OSU Campus).

Who inspired your interest in Entomology?
Dr. George Opit inspired my passion and drive toward Entomology when I took his “Introduction to Entomology” class. I was intrigued with the amount of impact arthropods have in the medical and veterinary fields. It made my pursuit of becoming a doctor much more compelling.

As part of your undergraduate studies, what is your favorite activity or responsibility?
As an undergraduate pursuing Entomology, I always looked forward to the camping trips held for lab. I got to meet most of the other Entomology students and learn more about my field of study.

What sage advice do you have for someone interested in your major?
The advice I would give to someone interested in Entomology would be have a positive attitude, participate in the various activities, and do not be afraid to get your hands dirty.

Outside of the major, what is your favorite activity/way to spend time?
Outside of class work and research, my favorite things to do are planting, cooking, running, traveling and hiking/camping.

Study abroad in England with the Cambridge Scholar Program in August 2019

Writer’s Workshop at the Doel Reed Center for the Arts in Taos, New Mexico in January 2020
Graduates
Spring 2020

Nick Godfroid
B.S.

Lizbeth Pena
Plant Path Ph.D.

Brett Johnson
M.S.

Shane Sellers
B.S.

Liam Whiteman
B.S.

Riley Yates
B.S.

Summer 2020

Michael Caballero
M.S.

Grace Levy
M.S.

Andrea Salazar
M.S.
Fall 2020

Haider Ibrahim
B.S.

Connor Martinson
B.S.

Maddy Moore
B.S.

Chase Singleton
B.S.

Leonardo Santos
M.S.

Mason Taylor
B.S.

Hollie Thorne
B.S.

Fernanda Proano
Ph.D.

Annabelle Yoder
B.S.

Viviana Freire Zapata
M.S.
Where Are They Now?

Interview with Dr. Michael Gates

Mulder – How many degrees do you hold from OSU and when was your last graduation date?

Gates – Only one degree from OSU, an M.S. in Entomology and I graduated in 1995.

Mulder - What was your major emphasis and who was your advisor?

Gates - My major emphasis was on stored product pests and how they immigrate into commercial storages of hard red winter wheat. My advisor was Dr. Gerrit Cuperus and also co-advised by the late Dr. Scott Fargo.

Mulder - Do you feel our department prepared you well for your first job or next degree program?

Gates - Yes. I tried to take as many rigorous classes as possible within the department and even took some independent study classes with Dr. Berberet. His classes in insect morphology and also in taxonomy, along with the insect biochemistry class with Dr. Dillwith were a challenge, rigorous and very much enjoyable. Rick Grantham and I actually took an independent study class from Dr. Berberet on immature insects and I believe we each had to collect about 150 different families of immatures. This was a real challenge and allowed me to explore minute characteristics of some very small insects.

Mulder – What was your next position after your M.S. degree, and how long did your first job last?

Gates - My next degree program was working on a Ph.D. with Dr. John Heraty at the University of California – Riverside. This was a systematics project working with parasitic Hymenoptera. I graduated in 2000 and went on to a post-doctoral position at the University of Maryland funded by the Systematic Entomology Laboratory, working with Dr. Mike Schauff.

Mulder - Why did you choose this area to work in for your career?

Gates – What led me to my interest in parasitic Hymenoptera during my M.S. degree program was that we discovered parasitoids deep within the grain mass (20 feet or more) where their hosts were located. They were challenging to identify!

Mulder - How much mentoring did you feel you needed after completing our program and moving into your first 2 positions?

Gates – OSU prepared me quite well in the area of basic entomology, but I did need some mentoring in specific areas of systematics and parasitic Hymenoptera and this was accomplished quite well with Dr. Heraty and Dr. John Pinto at Riverside. After the doctoral program, I went to work with the USDA Systematic Entomology Laboratory in Beltsville, Maryland as a support scientist, and about one year later as a Research Entomologist in that same laboratory.

Mulder - What is the emphasis of all your current position?

Gates – Recently, I was appointed as the Research Leader for the same laboratory, so about ¾ of my time is consumed in administrative duties, and about ¼ of my time I still get to work on parasitic Hymenoptera.

Mulder - Was the salary associated with your positions after graduate school in-line with your expectations?

Gates – The post-doc was right in line with my expectations. My current salary, as a GS-15, allows my family to live quite comfortably in the Washington, D.C., area.

Mulder - Looking back, would you have taken a different direction or taken additional classes or pursued other studies to prepare for the job market?

Gates – Not really at OSU, as I took the directed studies I wanted to take and challenged myself sufficiently with those independent, special problems classes. At Riverside, I might have taken advantage of more classwork in advanced molecular evolution, to learn techniques and methods that could have been useful.

Mulder - Has your career choice blended well with your family and personal time?

Gates - Yes. My wife is very understanding and I have always sought work/life balance when my two sons were younger. In addition, they all have a keen appreciation and literacy when it comes to entomology. My oldest boy is now a biology major at George Mason University and my youngest is a high school junior. We still enjoy exploring nature and they tolerate Dad’s incessant focus on entomology.
Mulder – Looking back, what other roles would you have explored on campus?

Gates – Maybe I would have taken the time to explore more graduate student activities. However, I was busy enough with my research and classwork.

Mulder – Michael, do you remember a time when we may have been in the field together?

Gates – Were we collecting insects off of dead animal carcasses with other students?

Mulder – No, we were in the Wichita Mountains Wildlife Refuge and were successfully capturing many large tarantula hawk wasps.

Gates – Oh yes, now I remember and I believe I still have some of those specimens.

Mulder – The final question, and I think I know the answer to this one, but you have strayed to other institutions; do you still cheer for the Cowboys?

Gates – YES! Whenever we can see a televised game for OSU we tune in and cheer them on. We still talk about the 1994 final four basketball team and Big Country.

Mulder - Michael, in light of that response, I would suggest that you might fit well into the student section; however, you will have to stand during the entire game. By the way, OSU Football is playing Tulsa this weekend on ESPN, so tune in. Thank you Michael for sharing some memories and time with me. I hope you have a wonderful year and enjoy your new promotion to Research Leader.

Dr. Gates with his son, Warner (left), wife, Lynette and son Landon (far right).

Fieldwork in the American Chestnut Land Trust in Maryland.
Where Are They Now?

Interview with Dr. Stephanie Rogers

Mulder – How many degrees do you hold from OSU and when was your last graduation date?
Rogers – Two degrees from OSU, a B.S. in Biochemistry and Molecular Biology in 2006, and a Ph.D. in Plant Pathology in 2011.

Mulder - What was your major emphasis and who was your advisor?
Rogers - My major emphasis was on forensic plant pathology, specifically looking at wheat streak mosaic virus and determining if we could trace a nefarious inoculation event on hard red winter wheat. My advisor was Dr. Jacque Fletcher, retired Emeritus, but I also worked closely with Dr. Bob Hunger.

Mulder - Do you feel our department prepared you well for your first job or next degree program?
Rogers - Yes. One of the attributes of the department that was very helpful in my career was the interdisciplinary nature of the two majors and having faculty that had a keen appreciation for applied aspects of what growers and industry folks face in making decisions on the farm.

Mulder – What was your next position after your Ph.D. degree, and how long did your first job last? What happened after that?
Rogers - My first job after graduation was a post-doctoral research scientist at Quantico, Virginia with the Federal Bureau of Investigation (FBI) to research and evaluate new approaches to microbial forensics for case investigations, such as the Amerithrax investigation in the early 2000s. Seven months later, I was recruited by In-Q-Tel, Inc. (IQT), the private, not-for-profit strategic investment firm that bridges the gap between start-up technology companies and the national security community, such as the Intelligence Community, Department of Defense (DOD), Department of Homeland Security (DHS), FBI, and others.

We worked very closely with our federal government partners to understand their mission and identify technologies that would help them refine and develop their technology and innovation strategies to improve the security of our nation. I started as a Program Manager for all of the life science investments. That included technologies for DNA sequencing and synthesis, biological sample preparations, bioinformatics, rapid human identification, advanced analytics using machine learning and others. In that role, I managed the multi-million dollar portfolio of life science investments, working alongside each technology company and the government agencies to ensure the developed product had a commercial market, while also serving the needs of the government. In 2015, I assumed the role of Deputy Director of B.Next which is IQT’s strategic initiative focused on applying technology to improve the nation’s ability to detect and stop infectious disease epidemics. IQT had four other strategic initiatives at the time, focused in other technology areas strategic to national security. In 2018, I assumed the role of VP of Operations for all five of those initiatives combined, known as IQT Labs. I also maintained a principal investigator role on applied research projects exploring how AI/ML could be applied to biology to improve biodefense capabilities and medical countermeasure development. All of this knowledge and experience I gained through my PhD and various roles at IQT is what led me to reach my current position at the Pentagon. As of August 2020, I am serving as a Senior Biotechnology Advisor in the Office of the Undersecretary of Defense (Research and Engineering), where I get the honor of helping develop the technology roadmap needed to modernize biotechnology for the DoD.

Mulder - Why did you choose this area to work in for your career?
Rogers – I knew I eventually wanted to focus on biodefense or forensic science and seriously thought about the FBI track, since I did an internship with them. My primary reason for switching to technology development and innovation was because I wanted to apply my knowledge of science to innovate new ways to protect our nation. These include defending against threats but also, and possibly more importantly, enabling a thriving bioeconomy and biotechnology industry that will enable our nations ultimate ability to protect the health and well-being of our people. Dr. Fletcher was tied in well with the national security community at a federal level and was well-established in biodefense through the American Phytopathological Society (APS), so mentoring under her and gaining those connections was invaluable to where I wanted to end up.

Mulder - How much mentoring did you feel you needed after completing our program and moving into your first 2 positions?
Rogers – I love this question because I believe mentorship is a must-have for everyone. I have always sought out a mentor in every position I have assumed. In fact, I still call Jacque from time to time. Mentors do not just help you navigate your current position, but they become advocates for your career and future. Especially in the federal government arena, your network is what opens up doors for more and better opportunities. Since I have taken on many leadership roles, I continue to pay it forward by mentoring others.

Mulder - What is the emphasis of your current position?
Rogers – There is so much research and development happening in biotechnology that it is nearly impossible to keep up with the latest developments. My teammates and I help to assess the innovation happening and identify what approaches and technologies will make a difference to the mission of the DoD. With that knowledge, we work with components of the DoD to establish the strategic roadmap and integrate these technologies into their operations. Microorganisms are nature’s best manufacturers. They
produce all sorts of compounds that enable their survival in a variety of different environments. We can leverage what nature already gives us to make more protective materials, growable infrastructure, more sustainable energy, on-demand therapeutics and much more. The field of biotechnology and biological engineering has just scratched the surface on what is possible. It is a really exciting time to be working in this domain.

Mulder – Was the salary associated with your positions after graduate school in-line with your expectations?

Rogers – The post-doc was a little light for the area of the country, but it only lasted seven months. The remaining positions were very much in line with my expectations.

Mulder – Looking back, would you have taken a different direction or taken additional classes or pursued other studies to prepare for the job market?

Rogers – I have thought about taking some business courses or pursuing an MBA because of the work I did with start-up companies. Some of that knowledge would have helped with the private sector position, particularly as I moved into a management role in organizing and road mapping a direction for the company. However, I was able to learn the knowledge I needed through colleagues and first-hand experience, so it wasn’t essential. The strong foundation I already have in science is the most important.

Mulder – Has your career choice blended well with your family and personal time?

Rogers – Yes, especially at IQT. They really understood and supported work/life balance. That was very helpful when my two boys, Logan, 7, and Alex, 4, were really young.

Mulder – Looking back, what other roles would you have explored on campus?

Rogers – None, because I was already extremely active as Vice President of the Graduate Student Association, Graduate Student Representative to the Faculty Council’s Campus Safety & Security committee and other leadership roles across campus and in the department. I had many opportunities to be a voice for students, which motivated me to take action on situations, which was good training for my career. I was a trial hire for IQT, the first Ph.D. to serve as a program manager. One of my first critiques was that I needed to become “more noisy”, meaning I should not be afraid to speak up and let people know that I had an opinion. The company valued my opinion, I just needed to let it be known. I had to prove that I deserved to be there because of my knowledge – not just to the company but also to myself! That was an important lesson at the time and because of my experiences at OSU, I had a base understanding of what that meant - to advocate for myself, for what I believed to be the right decision using the knowledge and expertise that I brought to the table, and always being sure to do so with respect, grace and compassion for my colleagues. channeled those OSU experiences and all the encouragement Dr. Fletcher and my committee gave me through graduate school. It paid off because it wasn’t long before IQT went from a company with 75 employees to over double the size and I was able to progress in my leadership roles along with that growth.

Mulder – Stephanie, that is a great story for many of our quieter students and, knowing how introverted you once were, it is also good to hear. I also know you took that in the right direction and did not just become opinionated or boisterous, but I assume just expressed yourself more often and did not hesitate to make your voice heard.

Rogers – That’s right, it took some conscientious effort on my part to be less introverted, but I think I have achieved it and done so in a positive way.

Mulder – The final question, and I think I know the answer to this one, do you still cheer for the Cowboys?

Rogers – YES! We don’t get to many OSU games in the D.C. area, but I catch them when I can. I will forever and always bleed orange!!

Dr. Rogers and Dr. Jacquelyn Fletcher

Dr. Rogers on her first day at the Department of Defense with the Pentagon in the background

Dr. Rogers’ two sons, Logan, 4, and Alex, 7
Where Are They Now?

*New displays in the department*

In the fall of 2020, we decided to recognize some of our more recent undergraduate and graduate students who have moved on to full-time employment, additional degree programs, or professional schools.

We would encourage anyone coming into the main office to take a few minutes to visit these glass display cases in the main hallway and read about the wonderful continued successes associated with many of our more recently graduated students.

We may be expanding this program next year, to include recognition of summer internships and other significant accomplishments of our graduates. We are so proud of all they have accomplished and I am sure will continue to accomplish!
Dr. Ken Pinkston received his B.S. degree in Entomology in 1966, and his Ph.D. also in entomology in 1973 from Oklahoma State University (OSU). While working on his B.S. degree, Ken worked summers with his father in the pest control business for Capitol Termite Company in Oklahoma City. During the academic years of 1964-1965, he served as a research assistant at the Chickasha Cotton Research Station and in the OSU Department of Entomology. After completing his B.S. degree, Ken was an electronic communications officer for the U.S. Air Force at Scott Air Force Base, Belleville, Illinois. From 1970 to 1973, he served as a graduate research assistant in the Department of Entomology at OSU while pursuing his Ph.D. degree and took his first job as Area Extension Entomologist for OSU in 1973 in Muskogee, OK. In 1975, he returned to Stillwater to assume the position of Professor and Extension State Entomologist at OSU, fulfilling these responsibilities until he retired in 2004. During the 1990’s he taught a course for horticulture majors and turf management students called “Horticultural Entomology”. Beginning in 1991 and ending in 2003, Dr. Pinkston was challenged with the task of building up what the administration thought should have been a very popular course, “Insects and Society”, but was faced with a student enrollment of around 14 the first semester he taught the course. By the time he retired, enrollment in Insects and Society averaged over 300 per year with two fall sections and one in the spring. Ken and the department had found his calling and his passion, teaching. Throughout his career, he taught many 4-H and FFA students in Oklahoma and provided support for exhibits and insect identification contests at the state fairs. He also became heavily involved in pest control operator (PCO) training with the Pesticide Safety Education Program at OSU teaching literally thousands of PCO’s the proper, safe, and effective use of pesticides. In 1985, while on sabbatical, Dr. Pinkston participated in a nine-month review of classes and extension programs similar to ones offered at OSU. He spent three months each at Texas A&M, Purdue, and North Carolina State. As a result of this review, the following were developed: (1) Training materials and manuals for state pest control operators, (2) a teaching manual for horticultural entomology, (3) a teaching booklet for non-entomology majors that became the primary text for Entomology 2003 - Insects and Society. Dr. Pinkston conducted chemical control tests for new products designed for the control of pests associated with peanuts, cotton, and soybeans as well as household and structural pests.

Dr. Ken Pinkston epitomizes all things OSU. He is a die-hard OSU Cowboy and Cowgirl fan and has been his entire life. His career highlights demonstrate his numerous accomplishments at several levels, especially in regard to every arm of OSU’s land-grant mission. Ken was an integral leader within the Division of Agricultural Sciences and Natural Resources and was often called upon by the department head to engage the troops (extension faculty, students, researchers and technicians) about better aligning our department for future success. He was a mentor to me shortly after my arrival on campus and genuinely had a profound effect on the conduct of my extension, research, and teaching roles within the department. Ken’s contributions to establishing and garnering financial support for the Endowed Professorship of Structural and Urban Pest Control and to our teaching program continue to play a pivotal role within the department. His connectivity to many donors across the state, particularly through the Oklahoma Pest Control Association, was instrumental in moving our Pesticide Safety Education and Urban and Structural Pest Control program forward in a positive and productive fashion. Dr. Pinkston was instrumental in establishing the Pinkston Education Facility for Structural and Urban Pest Control which continues to provide many opportunities for pesticide applicators to learn proper, safe, and effective approaches to controlling general household pests.
In Memoriam of Ms. Jill Wick

Age 50, Senior Financial Assistant for the Department of Entomology and Plant Pathology at Oklahoma State University, died on December 12, 2019, following a challenging period dealing with ovarian cancer. She was born on October 22, 1969, in Wautoma, Wisconsin, the daughter of Richard and Patricia Poulos. She spent her childhood in New Lenox, Illinois and later moved to Menifee, California where she met her husband, Randy Wick. They were married on April 27, 1991, in Redlands, California. They moved to Stillwater in 1992 where they raised three children. The love of her children was of the utmost importance in her life. She was a devoted mother and wife who enjoyed trips to the beach. She loved their lake home on Kaw Lake and it was termed “Jill’s Happy Place”.

Prior to joining our department, Jill worked as a medical assistant and conducted mobile insurance exams. She began working in our department as a Financial Assistant on March 10, 2014, handling P-card accounts, requisitions, campus vendor invoices, department deposits, etc. while also working on her degree in business. She received her bachelor’s degree in Business Administration from OSU in May 2016. On August 29, 2018, she began her new position as Senior Financial Assistant in the department. This position entailed data input of expenditures on grants and departmental accounts, reconciling accounts, processing requisitions for grant subcontracts and monthly cost share, etc.

Survivors include her husband Randy; daughter Megan Treanor and husband Jacob; son Matthew; and daughter Madison all of Stillwater; her mother Patricia Francher and husband Ray of Cushing; her father Richard Poulos of Tennessee; her sister Jean Solares and husband Brian Cahoon of Des Moines, Iowa, and their children; and brother Jay and Shae Poulous and children of Stillwater. Two brothers, Jimmy and John Poulos, preceded her in death.

as well as wood-destroying insects like termites. This program has ultimately resulted in nearly a 95% decrease in citizen complaints to the Oklahoma Department of Agriculture, Food, and Forestry concerning Oklahoma pest management professional services. By establishing the foundation for the training program, Dr. Pinkston facilitated others within the department (Dr. Jim Criswell, Dr. Brad Kard, Mr. Kevin Shelton) to continue and expand the teaching and training program emphasis. Dr. Pinkston was instrumental in finding the right person, to fill the Endowed Professorship position (Dr. Kard) to continue to pursue excellence in structural and urban pest management. Ken has always given credit to many people including: Denver Talley, Dick and Brad Parker, Dr. Ed King, Dr. Sterett Robertson (early program supporters), and many others associated with the OPCA over his career. In 1990, as part of their dedication and loyalty to OSU, Ken and Charlene took out a $50,000 life insurance policy to establish The Pinkston Entomology Endowment Fund. In addition to this fund, Ken was designated by OSU and the OPCA Committee to continue his work with the Foundation on this important account. Ken’s efforts were essential and instrumental in finding innovative ways to reach his goal of establishing an Endowed Professorship in Structural and Household Pest Control. Ultimately, he wanted to see that Professorship become upgraded to the Chair level, and in 2019 this became a reality. What better way to celebrate these accomplishments than to recognize the individual that started it all and saw the initial endowment phases through to fruition. I cannot think of a worthier and more dedicated alumnus than Dr. Ken Pinkston. Even at nearly 77 years of age, he still makes proud posts about OSU accomplishments on his Facebook page and continuously exemplifies the Cowboy Way. Ken is humble and proud to call himself an OSU Cowboy for Life.
2020 Publications


Espindola, A.S., K.F. Cardwell, Microbe Finder (MiFi®): An interactive pathogen detection tool in metagenomic sequence data. under review. MDPI Plants.


Seuhs, S.K. Fact Sheets:
New: EPP-7102 Managing Alfalfa Weevil Insecticide Resistance
New: EPP-7680 Oklahoma Management Calendar for Insects and Diseases

In publication: Oct 2020.

In publication: Oct 2020


Giving Toward the Department of Entomology and Plant Pathology

The Department of Entomology and Plant Pathology values and encourages our students in all aspects of their education. In addition, the department is grateful to our alumni, friends, and other supporters in the many ways they contribute toward the success of our students. The many financial contributions made on behalf of the department are essential in providing our students with top-quality research seminars each semester, educational and research opportunities for students, and a variety of Scholarships and scholar awards.

This year, I want to continue to focus on the same three funds from last year, all of which are essential in supporting both undergraduate and graduate students in both disciplines within our department.

D.E. Howell Scholarship Fund (Fund #21-34600) $________________

This endowed scholarship fund was established by the Oklahoma Pest Control Association and the Friends of “Mike” Howell. Dr. Howell was the Department Head of Entomology from 1952 to 1970. During his tenure as department head, many advanced degrees were awarded to military and civilian students, specifically in medical and veterinary entomology. The scholarship supports full-time students in the Department of Entomology who display high academic achievement (GPA 3.0 or higher) and outstanding leadership. Preference is given to incoming freshman but an upperclassman can be considered.

Plant Pathology (Fund #21-30300) $________________

Income received annually from this fund shall be used for program support of plant pathology. This is not an endowed fund and may be supported in nearly any fashion with gifts from donors. It provides programmatic support for plant pathology functions within the department or at regional and national meetings. This fund was established to support visiting scientist presentations on campus, travel, or other expenses associated with meetings, so that OSU plant pathology remains current and competitive within the discipline.

Entomology Program Development (Fund #21-27900) $________________

Income received annually from this fund shall be used for program support of entomology. This is not an endowed fund and may be supported in nearly any fashion with gifts from donors. It provides programmatic support for entomology functions within the department or at regional and national meetings. This fund was established to support visiting scientist presentations on campus, travel, or other expenses associated with meetings, so that OSU entomology remains current and competitive within the discipline.

Please complete this form and return to:

OKLAHOMA STATE UNIVERSITY FOUNDATION
400 S. Monroe, Stillwater, OK 74074
phone 800.622.4678
info@OSUgiving.com

You may also make checks payable to OSU Foundation and designate your desired area of support in the EPP Department. For further information on giving toward or endowing funds for recognition of a specific individual, please contact the department.

DEPARTMENT OF ENTOMOLOGY AND PLANT PATHOLOGY
127 Noble Research Center
Stillwater, Oklahoma 74078
Ph: (405) 744-5530
entopl@okstate.edu