Department of Entomology Newsletter

Events from 2021

The Merge Marches Forward

Dr. Steven Harris *writes:* I am pleased to announce that on September 1, 2022, the Department of Entomology will officially merge with the Department of Plant Pathology and Microbiology to become the Department of Plant Pathology, Entomology, and Microbiology (PPEM). The merger has been in the works for a couple of years and reflects the committed efforts of faculty in both departments to create a joint unit that will be greater than the sum of its parts. In the near future, you can look forward to the appearance of new research and teaching programs that combine the best of our disciplines (this includes new faculty hires!). At the same time, it is important to know that the merged department will still retain its strength in entomology. Our graduate program and seminar series will remain as is and will be well-supported. Our research, teaching, extension, and outreach activities will continue to excel in discovering and conveying the impacts of insects on our lives and well-being. As a merged Department, we look forward to our future and invite you to stay in touch. Moreover, in the fall, we plan to celebrate the merger with an on-campus event that will feature alumni and other guests. We will provide an update on this soon, and in the meantime, I want to thank you for your support of the Department.

Steven Harris

7th Edition of Entomology Textbook is Here

Dr. Rayda Krell *writes*: When I started my M.S. in entomology at ISU in 1997, I had never taken an entomology class. I knew I liked insects and being outside, which led me to pursue research with the "insect ecology professor," **Dr. Larry Pedigo**. At the time, I didn't even realize I was asking to work with one of the philosophical fathers of IPM! I researched the goldenrod gall fly as an undergrad and wrote a thesis, which provided enough evidence of basic capability that Larry took me on as a student.

Given my limited formal training, one of the first things Dr. Larry Pedigo did was give me a copy of the 2nd edition of his textbook *Entomology and Pest Management*. I read it from cover to cover in those early months and I was impressed that it was so well written...with moments that

Continued on page 21

Marlin Rice, Rayda Krell, and Larry Pedigo

Coats Retires from ISU

Dr. Joel Coats retired after 43 years at ISU. He is a Distinguished Professor of Entomology and Toxicology in the Department of Entomology at ISU. He is originally from Ohio and received his B.S. in zoology (chemistry minor) from Arizona State University. His graduate training was at the University of Illinois at Urbana-Champaign, receiving his M.S. and Ph.D. in entomology (chemistry minor), with specialization in insecticide toxicology and environmental toxicology.

Joel started at ISU in 1978 with a research program in two areas: insect toxicology, and environmental toxicology and environmental chemistry of agrochemicals. His research in insect toxicology is focused on natural products as insecticides and insect repellents, including investigations of their spectrum of activity, mechanisms of action, metabolism, synthesis of biorational derivatives and analogs, quantitative structure-activity relationships. His scientific publications include 10 books, 7 review articles, 41 book chapters, and 142 peer-reviewed journal articles, and he holds 9 patents.

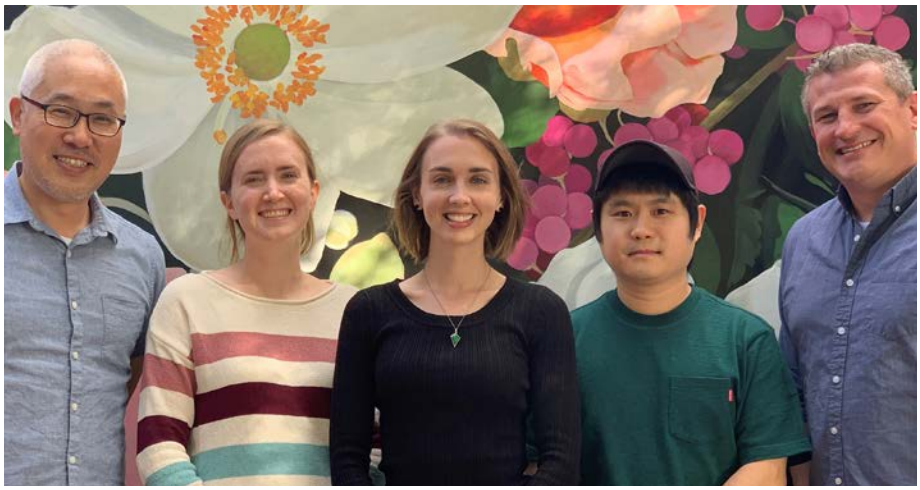
He received the International Award for Research in Agrochemicals from the American Chemical Society Agrochemical Division, and he is a Fellow of the American Association for the Advancement of Science, and a Fellow of the Entomological Society of America and the Agrochemicals Division of ACS. In October 2013 he received the Alumni Achievement Award from the University of Illinois College of Liberal Arts and Sciences.

Larry Pedigo, Mike Gray, and Joel Coats

Von Kaster and Joel Coats

Smith Promoted to Associate Professor

Dr. Ryan Smith *writes:* We make decisions every day that can ultimately impact our lives, but few resonate and are as clear in their outcomes as a decision that I made as an undergraduate in an Advanced Molecular Biology course. We were tasked with writing a report on a new technology or emerging field in molecular biology. At the suggestion of a friend, I decided on writing a summary on mosquito transgenesis and its applications to curb mosquito-borne disease. Little did I know that this decision would have such a profound impact on the next two decades of my life.



Left to right: Hyeogsun Kwon, Marie Russell, Ellie Field, Chris Lee, and Ryan Smith

Ultimately this led to receiving my Ph.D. working on mosquito transgenesis from the University of California-Riverside, and continuing these interests in a post-doc at the Johns Hopkins Bloomberg School of Public Health, where I also became interested in mosquito immunity and its influence in shaping malaria parasite infection. These research questions eventually became the foundation of my research program when I started at ISU in 2015.

In what seems like a short time, challenged by how big my two daughters have grown and the reluctant spread of my graying hair, the last six years have flown by. Expanding on my previous research questions, we have continued to dissect the roles on the mosquito immune system, most notably that of immune cells known as hemocytes, in mediating malaria parasite killing responses in the mosquito host. Using similar approaches, we have more recently expanded our work to other mosquito systems, where we are also interested in virus infection (such as dengue and Zika virus) and dissemination in the mosquito host.

My position also includes leading mosquito and tick surveillance for the state of Iowa. Working with the Iowa Department of Public Health and county public health partners throughout the state, we have closely examined mosquito populations to aid in mosquito control efforts, to determine the annual risks of West Nile virus transmission, and to follow the spread of A*edes albopictus* (an invasive mosquito species) in Iowa. Moreover, we have relied on public submissions and active field collections to examine the abundance of tick species in the state and the occurrence of tick-borne disease.

Arguably the best part of this job is in leading and working with an amazing team of people, whose contributions to this work are immeasurable. **Dr. Hyeogsun Kwon** has been there since the beginning and continues to have a tremendous impact on the success of the lab. Several others, past and present, have also left lasting impressions and have built a wonderful foundation and environment for the lab moving forward. As such, it has also been incredibly gratifying and rewarding to see the accomplishments of those that have passed through our research program at Iowa State!

While this time offers the opportunity to reflect on our achievements of the last six years, I view this promotion as a validation for the promise of the future. With the training wheels off and the building blocks in place, I couldn't be more excited about the research questions and opportunities for the lab that the future will bring!

See page 20 for Smith Lab Olympics!

O'Neal Recognized as ISU Faculty Innovator

Dr. Matt O'Neal was nominated as a Faculty Innovator in Residence by the ISU Student Innovation Center (SIC). His recognition came with a $5,000 professional development stipend. Matt has advised two student groups who were funded through the SIC, "Insect-Decide" and "Honey-Do." The former is exploring if sound signatures of flying insects can identify them in the field, the latter is determining if prairie strips are an economically viable location for honey beekeeping.

The Faculty and Staff Professional Practices Innovator Program is designed to invest in advancing collaboration and professional development between faculty and staff and the Student Innovation Center. The goal is to design and deliver opportunities that promote interdisciplinary, university-wide innovation.

Matt O'Neal

Coates Organizes Virtual Symposium

Dr. Brad Coates writes: In 2021, I co-organized an international virtual symposium, the Arthropod Genomics Symposium x (AGSx). The symposium was composed of four sessions once a month from February thru May, highlighting various aspects of insect genomics research. Video recordings of each session are available on the i5K YouTube channel https://www.youtube.com/c/i5k_community.

If you use genomics to study arthropods, you are an i5k member! The i5k initiative has a broad and inclusive mandate. They provide guidelines for genome projects, hold webinars, and maintain an up-to-date list of sequenced arthropod genome. Goals of i5K are to: 1) Organize the sequencing and analysis of the genomes of 5,000 arthropod species, 2) Provide guidelines and best practices for arthropod genome projects and their data management, 3) Help existing and new arthropod genome projects to find the most appropriate repository for their needs, and 4) Grow a community around arthropod genomes that works towards improved sequencing, assembly, annotation, and data management standards.

Rove beetle (Coleoptera: Staphylinidae: *Platydracus cinnamopterus*), Ames, Iowa, 10 September 2021.
Photo by Greg Courtney.

Gassmann Elected AAAS Fellow

Dr. Aaron Gassmann, professor in the Department of Entomology, was elected an AAAS Fellow, "for distinguished contributions to the field of entomology, particularly for advances in understanding the evolution of resistance by insect pests and approaches to delay pest resistance to transgenic crops."

Much of his career has focused on interactions between the western corn rootworm and transgenic crops that incorporate insecticidal toxins like *Bacillus thuringiensis*, or Bt. His research uses principles of evolutionary biology and ecology to enhance the sustainability of agriculture. Gassmann uses lab and field-based studies to explore factors that affect the risk of western corn rootworm evolving Bt resistance and approaches farmers can take to delay resistance. He developed the standard assay, or test, used across the Corn Belt to measure levels of Bt resistance by western corn rootworm.

Gassmann came to ISU in 2008, after completing postdoctoral work at the University of Arizona and the University of California-Riverside. He earned his Ph.D. in ecology and evolution from the State University of New York at Stony Brook and has a B.S. in biology from the University of St. Thomas in Minnesota.

Aaron Gassmann

Among career accomplishments he's especially proud of starting a collaborative effort to develop recommendations on managing pest resistance for farmers within the corn-growing states. The effort has involved working with a number of other scientists who are part of a U.S. Department of Agriculture Multi-State Research project focused on managing insect pests of corn. Much of his work has been funded through USDA National Institute of Food and Agriculture Biotechnology Risk Assessment grants.

Toth Receives Mossmann Manatt Award

The 2021 Rossmann Manatt Faculty Development Award has been presented to **Dr. Amy Toth**, associate professor of ecology, evolution and organismal biology and entomology at ISU. The award recognizes a tenured faculty member who has demonstrated an exceptional level of creativity and productivity in scholarship, teaching, and service.

Toth is a leading scientist in the field of social insect biology, with research focusing on the genetic and genomic basis of sociality in bees and wasps, and the effects of environmental stressors on bee health. Her work has garnered 24 research grants totaling more than $6.5 million. Toth's highly-cited publications, long award list, success in obtaining extramural research funding, leading roles in the professional community, national and international invitations received and the productive research team she has built all testify to her outstanding work.

Included with the Rossmann Manatt award is a monetary gift that can range from $5,000 to $10,000. Toth will use the funds from the award to initiate a new traineeship, the "ISU BEE SQUAD." The project will benefit diverse undergraduates in the College of Agriculture and Life Sciences and those in STEM fields by providing them training in bee biology and hands-on beekeeping and honey production experience. She envisions this project as a stepping-stone to a long-term, recurring, revenue-generating and potentially self-maintaining training opportunity.

Amy Toth

A Tribute to Dr. Jean Laffoon

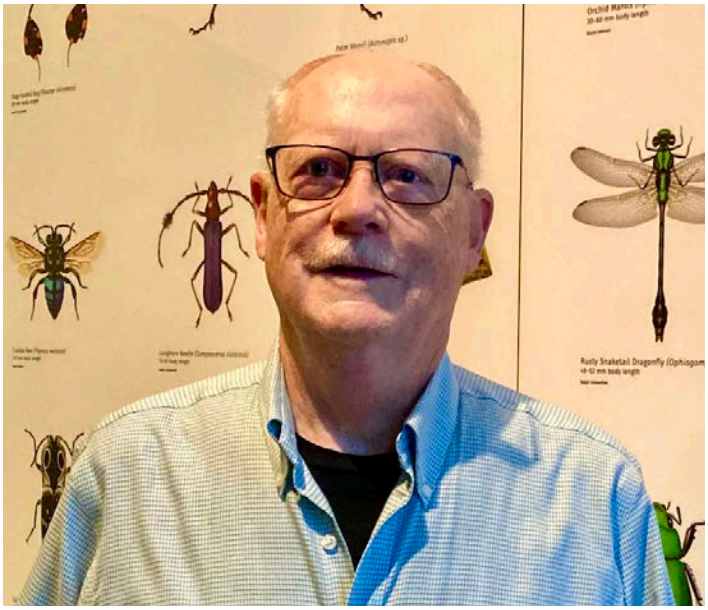
Jean Laffoon

Dr. David E. Maschwitz *writes:* The article about the history of entomology at Iowa State in the 2021 Entomology Newsletter inspired me to write this article about Dr. Jean Laffoon (Professor of Zoology and Entomology from 1946-1973). I knew from the time I was in grade school, growing up in a suburb of Chicago, that I wanted to be a zoologist. Fresh out of high school in 1958, I was accepted at ISU as a zoology major. As a new freshman I met with my advisor. In perfect innocence I asked him, what sort of job might I expect to get with a bachelor's degree in zoology? I will never forget his straight-faced answer - I could be an accountant or a gas station attendant. I was speechless. What happened to working with animals? Besides, I knew accounting was out, math was not my strong suit, and working at a gas station didn't sound promising either given my lack of interest in mechanical things.

In my sophomore year, still a zoology major, I took introductory entomology taught by Dr. Laffoon. This was the beginning of my love affair with bugs. Dr. Laffoon was a dynamic and captivating teacher. More importantly, on the bulletin board outside his office, he had posted actual job openings for entomologists, mostly in federal government, but real jobs! Food for thought. In my conversations with Dr. Laffoon, given my interest in insects, he suggested that I switch my major to entomology, which I did. My relationship with Dr. Laffoon turned my academic career from less than mediocre to more than respectable. He offered encouragement and inspiration.

His tutelage was a strong motivator to get better grades. He was also a friend. I loved hearing his stories about working on malaria control in the South Pacific jungles during WWII under the direction of Dr. Ken Knight (who joined the ISU entomology faculty in 1962). He described sometimes humorous encounters with the more bizarre tropical insects, an experience that piqued his interest in entomology, which he pursued in graduate school at ISU. I took Dr. Laffoon's three-quarter advanced insect systematics class as a senior. Without a doubt this was the best, most comprehensive and rigorous entomology class I ever took.

Dr. Laffoon was a mentor to me at a time when that role was missing in my life. He was the reason I received a monetary scholarship from an Iowa agricultural organization. I don't know this for a fact but I suspect that his letters of recommendation were instrumental in my being considered for graduate school. I accepted an offer from the University of Minnesota where I earned M.S. and Ph.D. degrees in entomology. I can't say enough about how important Dr. Laffoon was in my early life. I owe him so much and was devastated when he died much too early of a heart attack in 1973. He was just 51 years old. Thank you, Dr. Laffoon.



David Maschwitz

We Miss You, Tolly

Dr. Jon Tollefson, "Tolly", passed away this last year on August 1, 2021. He was an ISU Entomology faculty member for 35 years before retiring in 2010. Jon was born in Minneapolis, MN and attended Gustavus Adolphus College earning a bachelors degree. After college, he joined the Army and was stationed in Korea during the Vietnam war achieving the rank of Second Lieutenant. Returning to the U.S., he was accepted into graduate school at ISU earning his Ph.D. in 1975. His thesis was titled, "Corn rootworm adult- and egg-sampling techniques as predictors of larval damage" and he was co-advised by **Drs. John Owens** and **Larry Pedigo**.

Joel Coats and Jon Tollefson (2010)

Jon was hired by the newly formed Entomology department (split from Entomology and Zoology in 1975) to conduct research and extension on corn pests and teach integrated pest management courses. He served on many ISU committees and was department chair from 2004-2007. He also served as President of the North Central Branch of the Entomological Society of America in 2001-2002. He was a frequent volunteer for commencement and served for many years on Faculty Senate representing entomology. A special symposium honoring Jon was held at the Entomological Society of America National meeting in 2010 and many of his former graduate students were present to give personal accounts of working with Jon.

During his career Jon became a world-wide expert on the management of corn rootworms, *Diabrotica* spp. Of many notable studies was his involvement in the area wide management of the corn rootworm. Jon gave many extension presentations on corn pests and it was on a trip to Serbia and Croatia that Jon was giving an extension presentation when he suddenly collapsed and was later diagnosed with a brain tumor. Jon was able to continue working for several more years in the Insectary before he officially retired. He will be missed by many colleagues and students with whom he interacted at Iowa State.

Mlke Gray, Carla Tollefson, Ken Ostlie, and Jon Tollefson (2015)

Bud Guthrie was Mr. Corn Borer

Gary Guthrie writes: On October 23, 2021 **Dr. W. D. (Bud) Guthrie** passed due to a failing, broken heart. At age 97 he would often say, "This ol' cowboy has had a good ride." Ironically, the day he passed, the Cyclones played and won against his alma mater Oklahoma State. Did he tip the scales in ISU's favor? An odd coincidence? Perhaps not! The following review of my father's professional life was written by Dad for his extended obituary. But first I would like to make a few personal comments about Dad's professional career.

Bud Guthrie

I was the only one of his five children (Justine, Yvonne, Larry (LB), Scott), to follow him into agriculture working on corn rootworm with **Dr. Jon Tollefson** for 7 years in high school and college. Though I did not pursue college, one of Dad's gifts to me was his deep passion for helping the world's farmers to reduce famine. His was from a generation of scientists impacting the world. Dad had a great intellect for host plant resistance. He emphasized the importance of having an inter-disciplinary approach to research. While Dad's degree was in entomology, he had enough course work to have Ph.D.'s in corn breeding, plant pathology, and genetics. Many of his graduate students can attest to his insistence on taking a broad approach to their degrees and they were the better for it. He also was very empathetic to graduate students from other countries. He became known globally for this, thus, we were treated to many cultures in our home. By treating students and visiting scientists like family, he made all of our lives richer.

Dad, world-wide, was known as Mr. Corn Borer because of his single-minded dedication to rid this pest from farms. European corn borers (ECB) caused utter devastation to corn crops in the 1930's. Colleague Dr. Arnel Hallauer wrote in a personal note after his death, "Your father came to work every single day dedicated yet thoroughly happy in his work!" Yes, he did love his work and though it has been 31 years since he retired at age 66 due to blindness, he will be remembered in this way as his last graduate student shared at his remembrance of life, "I stand on the shoulders of Bud Guthrie's life. Everything I do is built on the foundation that he and other great scientists did before me."

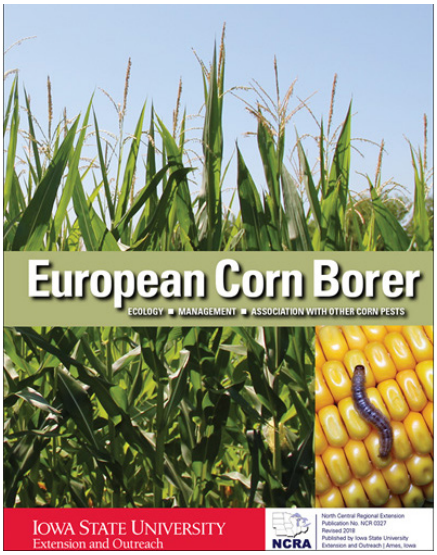
Bud was **Dr. Dahm's** research assistant from 1950-1989. He evaluated wheat varieties for resistance to green bugs and sorghum varieties resistant to chinch bugs. With co-workers, he evaluated 1,000,000 corn genotypes and 10,000 sorghum genotypes for resistance to the ECB, and generated over 220 publications! Many corn genotypes were also evaluated for resistance to corn pathogens. For accurate evaluation, plants were infested with 50,000,000 ECB egg masses (about one billion eggs) and were inoculated with northern corn leaf blight and stock rot organisms. He used corn chromosome reciprocal translocations to determine number of genes conditioning resistance to the ECB. He also evaluated corn chromosome genetic molecular markers to determine genes conditioning resistance to corn borers. He used a recurrent

Back row: Elva Olson, Mary Ludholz, Edwin Berry, Gary Reed. Middle row: William Showers, Bud Guthrie, Marian McIntosh, Robert Lynch, Hassan Maghrabi, Les Lewis. Front row: Jerome Klun, Siamak Eghlidi, Somporn Patanakamjorn, Stan Carter. (date unknown)

Photos courtesy of Gary Guthrie

selection breeding technique to increase ECB resistance in corn genotypes. He also used a recurrent selection breeding technique to increase resistance to three organisms (ECB, northern corn leaf blight, stock rot) in two corn synthetic varieties. He evaluated the Ds-Ac mutable system (jumping genes) to induce resistance in two ECB-stock rot susceptible inbreds.

In summary, Bud's research significantly improved hybrid resistance to ECB. He received research awards from USDA-ARS and ISU. He was a consultant for the Rockefeller and Ford Foundations in entomology, plant breeding, and genetics. For 15 years (1974-1989), he was Research Leader for 6 corn insect projects (biology-ecology, chemical-ecology, control with parasites and pathogens, economic thresholds, insecticidal control and breeding for ECB resistance in corn and sorghum). His lab was routinely recognized in the north-central region for doing the most high-quality research with the least amount of funds. He was professor of many M.S. and Ph.D. students at ISU. His students often said they received a lot of information from Dr. Guthrie outside the classroom because he was constantly teaching. In retirement, he was Professor Emeritus at ISU.



European corn borer is still considered an important economic pest. In the Midwest, corn borers affect corn production (i.e., field corn, popcorn, seed corn, and sweet corn), as well as sorghum, wheat, and many vegetables. Caterpillars can feed on almost any part of the corn plant, except roots, and cause severe economic injury.

In 2018, a regional publication was published to review the ecology and management of European corn borer and other corn pests. One of the many co-authors was **Dr. Marlin Rice**. Hard copies and an electronic version are available for sale here: https://store.extension.iastate.edu/product/3067.

PSEP Changes Guard

***Dr. Carol Pilcher** writes*: In 2021, I became the newest manager of the Pesticide Safety Education Program (PSEP) with ISU Extension and Outreach. **Dr. Kristine Schaefer**, PSEP manager, retired earlier that year. I accepted this position because I am passionate about pesticide applicator safety. If our programs influence farmers and commercial applicators to read the pesticide label and wear all the listed personal protective equipment, then I have made a difference.

I spent the majority of my career working on pest management and agricultural regulatory policy. I earned an M.S. degree in entomology from ISU in 1997 and Ph.D. from ISU in 2001.

As manager of the PSEP, I will oversee the training administered to private and commercial pesticide applicators across Iowa. By partnering with the Iowa Department of Agriculture and Land Stewardship, the program provides applicators the required education for certification and re-certification, on a three-year cycle that covers pesticide laws and regulations, safety, application and new and emerging issues.

Carol Pilcher

Last year the private pesticide programs trained 12,351 farmers (private applicators). The commercial programs trained 10,596 applicators in 2020. I understand extension's role and its relationship with the farmers. The field agronomists really respect the relationship they have with the farmers in their area. Our entire program respects this relationship and we want to help farmers with pesticide safety.

Beekeeping Course Offered Again

For the second year in a row, **Dr. Amy Toth** and Bee Extension Specialist **Randall Paul Cass** offered a beekeeping class for ISU undergraduates. BIO/ENT 358X is the first beekeeping class to be offered at ISU in many years. This fall 50 students enrolled. The goals of the course include educating students on bee biology and ecology, providing scientifically-based recommendations for best hive management practices, highlighting current bee research being conducted at ISU, and offering hands-on experience with bee hives. In order to provide a broad perspective, multiple guest lecturers were invited to share their work with students. **Dr. Matt O'Neal** discussed his lab's research on honey bees in agricultural landscapes, **Dr. Maura Hall** shared her findings on field-level pesticide exposure for Iowa's pollinators, and local beekeeper Jamie Beyer gave his perspective on beekeeping as a business.

Students checking hives

In addition to classroom lectures, students attended multiple hands-on field days at live honey bee hives. The class apiary was located on the north end of campus near the Extension 4-H building. During these field days, students gained experience conducting hive inspections, identifying pests and disease, treating colonies for varroa mites, and preparing hives for overwintering. Students also participated in a field day focused on harvesting and extracting honey in the Food Science building's pilot plant.

The course instructors received enthusiastic and positive feedback. Interested students will have the opportunity to continue learning about bees directly by participating in an unofficial ISU bee club that assists Cass with hive inspections throughout the year. Due to its popularity, the class will be offered in 2022!

The Great Fall Armyworm Migration of 2021

Ashley Dean *writes:* 2021 was a strange year for field crop entomology. The usual suspects were not as prevalent (soybean aphid, caterpillars in soybean), with the exception of corn rootworm, which had an excellent year. Alfalfa weevil hit farmers hard this spring, and then in the fall came the surprise visitor: fall armyworm.

Fall armyworm only overwinters in the southern-most areas of Texas and Florida in the United States, but it migrates north with southern storms each year, similar to other migratory moths (e.g., black cutworm and true armyworm). I've had the pleasure of seeing one or two feeding on non-Bt corn ears in our research plot a few years ago, but this isn't a pest most people think about in Iowa. Which is why farmers, agronomists, and entomologists were all shocked when we started to see and hear about fall armyworm caterpillars destroying alfalfa, grass pastures, and lawns late this summer and into the fall.

Widespead injury to many Iowa Farms. Photo by Meaghan Anderson.

Downed corn. Photo by Meaghan Anderson.

These generalist caterpillars strip away leaf material, leaving behind only the tough stems. Healthy stands are rarely killed, but the sudden and swift feeding can cause concerns and may even result in farmers losing an entire cutting of their crop nearly overnight. In just four days, the sixth and final instar eats over 75% of the total amount consumed throughout its lifetime. Typically, fall armyworm feeding in hayfields, pastures, and lawns resembles the symptoms of drought, including a thinned appearance and brown spots that rapidly increase in size. Resembling drought may be part of the reason farmers did not catch the invasion early: much of Iowa has been in a drought for the last two summers, so the symptoms didn't immediately alert them to the problem.

So, what happened this year? According to anecdotes, we haven't seen fall armyworm populations like this in the United States since the late 1970s – nearly 50 years ago. Entomologists in the south have helped educate us on what exactly happened. The perfect recipe for this magnitude of fall armyworm to reach Iowa is a mild winter + ample rainfall in their overwintering habitats to promote lush, healthy bermudagrass stands (their favorite meal) + rapid population growth + hurricanes (or even less dramatic storms) that push these huge numbers of moths northward. Once they arrived here in late summer to early fall, they found Iowa receiving rainfall following a long drought period (also something they like). In addition, we had a warmer than average fall, which produced multiple generations of fall armyworm in Iowa that fed for an extended period of time.

The good news is that all the fall armyworm caterpillars that were feeding on hayfields, pastures, and lawns in Iowa this fall would have died with the first frost. The bad news is that entomologists suspect that these events are likely to become more frequent with rising temperatures (and more mild winters). Insects always keep us on our toes!

Scharf Gives Dahm Lecture

Michael Scharf

Dr. Michael Scharf presented the Paul A. Dahm Memorial Lecture in Insect Toxicology to the Department of Entomology in April. He is Professor and O.W. Rollins/Orkin Chair, Department of Entomology, Purdue University, West Lafayette, IN. He is a native of Indiana and received his B.S., M.S. and Ph.D. degrees at Purdue; he was then a Visiting Scholar at the University of Cardiff in Wales, and he had postdoctoral research appointments at the University of Nebraska and Cornell University. Mike then returned to Purdue for six years, and he then accepted a position on the faculty at the University of Florida. After six years there, he returned to Purdue to accept the Rollins/Orkin Chair in Urban Entomology in the Department of Entomology.

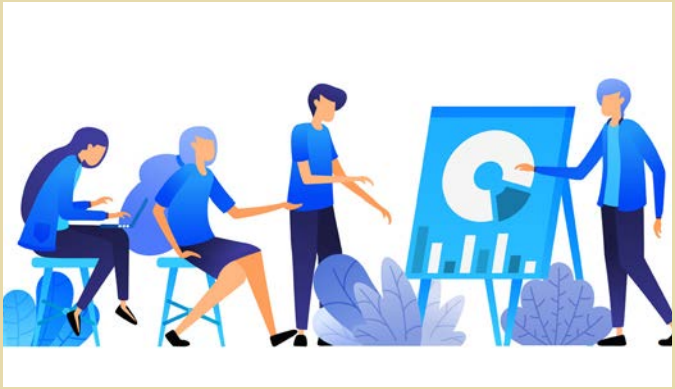
Dr. Scharf's lecture was titled "Addressing the problem of insecticide resistance in urban pests." In that presentation, he talked about his many years of experience focused on urban pest management, especially cockroaches. He specifically discussed the continuing problem of insecticide-resistance in roaches in urban settings. The consistent and repeated applications of insecticides in urban situations has contributed to many nearly intractable challenges, and Dr. Scharf talked about the mechanisms of resistance to different classes of insecticides. He also focused on the rigorous pest management strategies that are necessary to overcome the resistance; he also presented, better yet, strategies for preventing the development of insecticide resistance in the first place. Michael also has several publications and patents related to termite physiology, digestion, and immune functions.

Eastern subterranean termite.
Photo by Gary Alpert, www.ipmimages.org.

Want to attend our departmental seminars?

The department seminar series is now maintained by the EGSO, where the virtual platform has allowed for speakers to present from across the country. Seminars are presented in hybrid format, where staff and students can meet in a watch-party setting or live-stream remotely. Everyone is able to ask questions at the end.

The 2022 spring semester schedule is now available, including a mix of invited speakers and student presentations. See the schedule here: *https://www.ent.iastate.edu/events/seminars.%20*.



Alumni Spotlight: Jacob Johnson

***Jacob Johnson** writes*: The Entomology Department was like a second home during my time at ISU – the people within it guided me personally and professionally. I developed a deep fondness for insects and my life in Ames, but I knew someday I would move elsewhere. Amidst the turbulence of 2020 I committed myself to continue a career in academia, with my sights set on a Fulbright scholarship.

I was lucky to find a perfect connection with Dr. Dušan Palic, a fellow ISU alum. Dr. Palic leads the Chair of Fish Diseases and Fisheries Biology at Ludwig Maximilian University in Munich, Germany. His research on immunotoxicology of aquatic organisms fit perfectly with my education history, my academic goals, and the Fulbright mission. I now study the effects of nanoplastics on fish and shrimp immune cells, working alongside an international team of scientists.

Germany currently faces its greatest spike in COVID-19 cases to date, complicating daily life and leading to the cancellation of major events. Thankfully, I have still managed to meet new friends and explore my new home to make the most of this incredible opportunity. Beyond pandemic-related complications, I find the greatest challenge here is the language barrier, but a two-month intensive German course helped considerably. Ich habe noch viel lernen!

Jacob Johnson

I plan to pursue a Ph.D. in Immunology at the University of Toronto after my Fulbright. I am often asked why someone studying entomology would transition to human immunology. It is an understandable question; however, I know that my training at ISU can be widely applied to many contexts. My entomology research also developed my interest in public health, which itself pointed me towards immunology.

I will always be thankful for my time in the Entomology Department, and I am proud to take my entomology background with me. I am especially thankful for the trust and guidance provided by my mentor, **Joel Coats**, and fellow department alumni **James Klimavicz**, **Maura Hall**, and **Rebekah Reynolds** – to name a few. I wish the best for everyone in the newly merged department!

Scholar Spotlight: Jonas Arnemann

Dr. Jonas Arnemann is from Federal University of Santa Maria (UFSM-Brazil) and is doing a Sabbatical at the Entomology Department, under the Capes PrInt Program-Brazil. His Lab Group at UFSM explores pest management on soybean and corn insect-pests. At ISU, he is working with **Drs. Matt O'Neal**, **Erin Hodgson**, **Brad Coates** USDA in a project using RNAi technology to understand the contribution of mutations, in the voltage-gated sodium channel gene, of soybean aphid resistance to pyrethroids. He and his wife, Cristiane Arnemann (also doing a sabbatical at ISU), are exploring ISU educational and research opportunities and are enjoying the U.S. culture. They have been enjoying Cyclone football and basketball games, and travel around the U.S.

Jonas Arnemann

Rice Retires

Dr. Marlin Rice will retire at the end of 2021 from his role as R&D Academic Engagement Leader at Corteva Agriscience, where he worked for over ten years. Previously, he was professor of entomology in the department from 1988—2009, and he currently holds an affiliate professor position within the department. See the cover page for details about Marlin's recent textbook release.

Marlin Rice

Two New Corteva Laureates

Corteva Agriscience recently announced that former Entomology Department members, **Drs. Denny Bruck** and **Marlin Rice**, were elected as Corteva Laureates. Formally known as Fellows, the Corteva Laureates are top scientists and engineers from across Corteva's Research & Development (R&D) organization. Being named a Corteva Laureate is a distinction granted to researchers by the R&D Leadership Team as a reflection of demonstrated exceptional scientific excellence, and for their significant contributions to Corteva R&D through their expertise, continuous pursuit of innovation and leadership to enrich the lives of farmers and consumers.

Denny is a three-time graduate of ISU with a B.S. in Animal Science (1995) and an M.S. and Ph.D. in Entomology (1997 and 2001, respectively). He is currently a Senior Research Manager at Corteva Agriscience with primary responsibilities to characterize and develop insect control traits in corn, soy and cotton. Prior to joining Corteva in 2012, he was a Research Entomologist with the USDA-ARS Horticultural Crops Research Unit in Corvallis, OR where he led a research program to improve the quality and marketability of Pacific Northwest small fruit and nursery crops.

Denny Bruck

Student Spotlight: Maura Hall

***Dr. Maura Hall** writes*: I grew up in Massachusetts and spent every summer on the beach. I have always had a passion for the outdoors and the environment – specifically the animals! I could always be found on the beach, from sunrise to sunset, searching for crabs and other wildlife. Some of my fondest memories growing up are lunches with my mom at the Stoney Brook Wildlife Sanctuary where we would have picnics, walk around and check out the wildlife. It is during this time that I fell in love with the outdoors.

For my undergraduate degree I made my way to the midwest for the first time, getting a B.S. degree in chemistry with a focus in environmental chemistry at the College of Wooster in Wooster, OH. There I furthered my love of science. After graduating I joined the Environmental Fate and Metabolism team at Smithers Viscient as a chemist. During my time at Smithers Viscient I had the opportunity to work on numerous research projects investigating the movement and break down of agrochemicals in the environment. I found this work extremely stimulating; however, I was interested in investigating research questions outside the scope of these studies.

It wasn't until I came to ISU in 2017, took the insect biology course (ENT 370) with **Dr. Russ Jurenka**, and had to make my own insect collection that I found my passion for insects and the study of entomology. Admittedly, my partner, family and some friends didn't always understand this new passion and thought I was kind of weird for collecting insects. One of my favorite party tricks was to pull collected insects out of my freezer when they came over! However, I think this passion is contagious because over the last four years I have seen the people in my life become entomology supporters. This includes pollinators gardens installed by parents, samples of interesting insects sent in the mail from my sister, and numerous discussions about my bee vacuuming amongst friends.

Reba Knopp and Maura Hall with their dogs, Monte and Wilson

My Ph.D. research in **Dr. Joel Coats**' lab has been focused on characterization of honey bee and monarch butterfly exposure to pesticides to better understand the risks and benefits of establishing pollinator habitat within Iowa's agricultural landscapes. Outside of work, my primary interests include getting beat by people substantially older than me at pickleball and chasing after my dogs, Wilson and Monte. I will be graduating this month (see page 16) and I can say with one hundred percent certainty that I would not be where I am today without ISU entomology.

Keep in Touch and Stay Connected!

We have more departmental news to share with our alumni and friends! Visit the ISU Entomology website, https://www.ent.iastate.edu, to see our seminar schedule, research news, and social events. Also, find updates and hear about fun entomological news by "liking" us on our departmental Facebook page, https://www.facebook.com/ISU.Entomology. Please let us know if you have information to share with Department of Entomology friends and alumni. Items could include job changes, honors and awards, and personal notes. Kindly direct information to the newsletter editor, Erin Hodgson, Iowa State University, Department of Entomology, 2005 ATRB, Ames, IA 50011-3140 or via email: ewh@iastate.edu.

The ISU Department of Entomology Newsletter is for alumni and friends, and is produced by ISU entomology faculty, staff, and students. This newsletter and previous issues are available online at https://www.ent.iastate.edu/alumni.

EGSO Busy as Bees

The Entomology Graduate Student Organization (EGSO) continues to meet regularly and plan several professional development and social activities. A new executive team was elected in the spring and two major public outreach events were back in action in 2021!

The new executive team of the EGSO was elected in the spring of 2021. President (**Eleanor Field**), Vice President (**Abigail Kropf**), Treasurer (**Devin Radosevich**), Secretary (**Maura Hall**), and GPSS Senator (**Ben Kolbe**) are working together to bridge the gap between returning to in-person events as well as managing the group's status during the department merger. The organization now has a Twitter account (@ISUentomology) to provide updates about events and seminars.

Pollinator Fest was held at Reiman Gardens, with support from graduate students, faculty, and staff within the Entomology department as well as the Ecology, Evolution, & Organismal Biology department at ISU. The event brings many in to learn about native and maintained pollinators here in the United States, particularly Scouts looking to earn naturalist badges. In 2021, there were 18 stations and nearly 600 visitors!

Participants at Pollinator Fest in Reiman Gardens

Dr. Matt O'Neal provided a honey tasting station at Pollinator Fest

Pollinator Fest visitors

Additionally, the annual Insect Film Fest occurred on October 21 in Reiman Gardens with a showing of the 'Bee Movie.' Although turnout was low due to COVID-19 safety concerns, children who showed up enjoyed the insect craft table and a chance to meet some insects/spiders with the Insect Zoo.

Paige Hollenberg, ISU undergraduate, at the Insect Film Festival

2021 Graduations

Kelsey Fisher

Kelsey Fisher received her Ph.D. in entomology in the spring of 2021. Her dissertation was, "Investigating Monarch butterfly movement ecology to inform conservation strategies." She was advised by **Steve Bradbury**. Kelsey is working on a post-doc in the Bradbury Lab and hoping to work in academia.

Maura Hall

Maura Hall received her toxicology Ph.D. in the fall of 2021. She was mentored by **Joel Coats**. Her dissertation was titled, "Characterization of honey bee and Monarch butterfly exposure to pesticides: risks and benefits of establishing pollinator habitat within Iowa agricultural landscapes." Read more about Maura on page 16.

Mitch Helton

Mitchell Helton earned an M.S. degree in entomology in the spring of 2021. His thesis was titled, "Developing an injury severity to yield loss relationship for soybean gall midge." Mitch was advised by **Erin Hodgson**. He is currently the Operations Lead for Ag Ingenuity Partners in Champaign, IL.

Niranjana Krishnan

Niranjana Krishnan received her Ph.D. in the spring of 2021 with a double major in entomology and toxicology. She was co-advised by **Steve Bradbury** and **Joel Coats**. Her dissertation was, "Assessing the risk of insecticide exposures on Monarch butterflies. Niranjana is a Research Assistant Professor at Missouri University of Science and Technology.

Courtney Huerter

Courtney Huerter received her M.S. in toxicology in the spring of 2021. Her thesis was, "Biochemical and molecular impact of plant essential oils and their terpenoids on two arthropod pests." Courtney was advised by **Joel Coats**. Currently, Courtney is an Associate Scientist at MRIGlobal in Kansas City, MO.

Caleb Corona

Caleb Corona earned his Ph.D. in the fall of 2021 under the direction of **Joel Coats**. He got a double major in entomology and toxicology. His dissertation was titled, "Alternative pest control strategies using biorational products." After graduation, Caleb moved to Minnesota to work as an R&D Entomologist at MGK Insect Control Solutions.

More Graduations and Awards

Jacob Johnson got his M.S. degree in the spring of 2021 with major of toxicology. His thesis was titled, "Mechanism of action of natural and biorational insecticides." **Joel Coats** was his advisor. Read more about Jacob's Fulbright on page 14.

Jacob Johnson

Colin Wong got his Ph.D. in the fall of 2021 with a double major in entomology and toxicology. His dissertation was, "The essence of using plant essential oils for pest control." He was advised by **Joel Coats**. After graduation, Colin became a postdoc with the USDA with ISU alum **Dr. David Shapiro-Ilan**. He is using biocontrol to manage pests of peach and pecan trees. Colin also won first place at the North Central Branch ESA virtual student competition the summer of 2021. His presentation was, "Testing the longevity of biorational tick repellents against *Ixodes scapularis* and *Dermacentor variabilis*."

Colin Wong

The 2021 National ESA meeting was in Denver, CO. **Devin Radosevich** won first place for his paper, "Larval movement and survival for western corn rootworm and European corn borer in blended refuges of short-stature corn". Devin is a Ph.D. student in **Aaron Gassmann**'s Lab.

Devin Radosevich

Ellie Field won several scholarships at the department winter social in 2021. First, she was the recipient of the Larry Pedigo Graduate Scholarship in Entomology. This scholarship of $2,000, established to honor the many contributions of **Dr. Larry Pedigo** to the department and college, recognizes scholarly performance. Second, Ellie got the Entomology Alumni Scholarship for undergraduates or graduates in entomology. This $1,000 scholarship was awarded based on promise for a career in entomology. Lastly, she got the Entomology Alumni Scholarship for undergraduates or graduates in entomology. This $1,000 scholarship was awarded based on promise for a career in entomology. Ellie is advised by **Dr. Ryan Smith**.

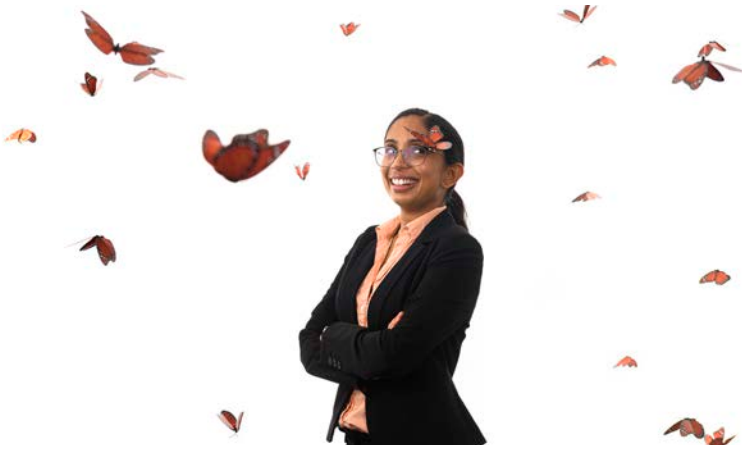
Ellie Field

Ivair Valmorbida was the recipient of the Jim Oleson Scholarship in Entomology, which provides $1,000 to students who demonstrate academic promise and initiative. He is co-advised by **Drs. Matt O'Neal** and **Erin Hodgson**.

Ivair Valmorbida

Krishnan Wins Best Paper in 2021

Dr. Niranjana Krishnan received a prestigious writing award in 2021. She was selected for the Best Paper of 2020 by the Journal of Environmental Toxicology and Chemistry. Awards are based on innovation, creativity, transparency, reproducibility, and rigorous and relevant science. Papers are nominated by the editorial board and evaluated by a panel of senior editors. In the article, she reviewed the toxicity of six insecticides commonly used in leaf and seed treatments in Iowa and how they impact Monarch butterfly larvae. See full manuscript citation for Krishnan et al. on page 25.



Niranjana Krishnan

Three ISU Dissertation Awards

Three recent Ph.D. graduates received high accolades at ISU in 2021. **Drs. Maura Hall**, **Kelsey Fisher**, and **Niranjana Krishnan** were all selected for the ISU Graduate College Dissertation Research Excellence Award. The purpose of this award is to recognize graduate students for outstanding research accomplishments as documented in their theses and dissertations. These students are also expected to be academically superior and able not only to do research, but also to develop a well written product. The intent of this program is to recognize "the best of the best" graduating students who have submitted theses and dissertations. **Kelsey Fisher** is in the field pictured on the right.

Lab Olympics Provides Pandemic Relief

The Smith Lab did a quick challenge to see who was able to come up with the best standard curve to measure relative concentration using qRT-PCR, but it was mostly just eating Olympic-themed sugar cookies. Pictured front (L to R): Cheryl Blackmer, Marie Russell, Ellie Field; back (L to R): Hyeogsun Kwon, Ryan Smith, David Hall).

Continued from cover page

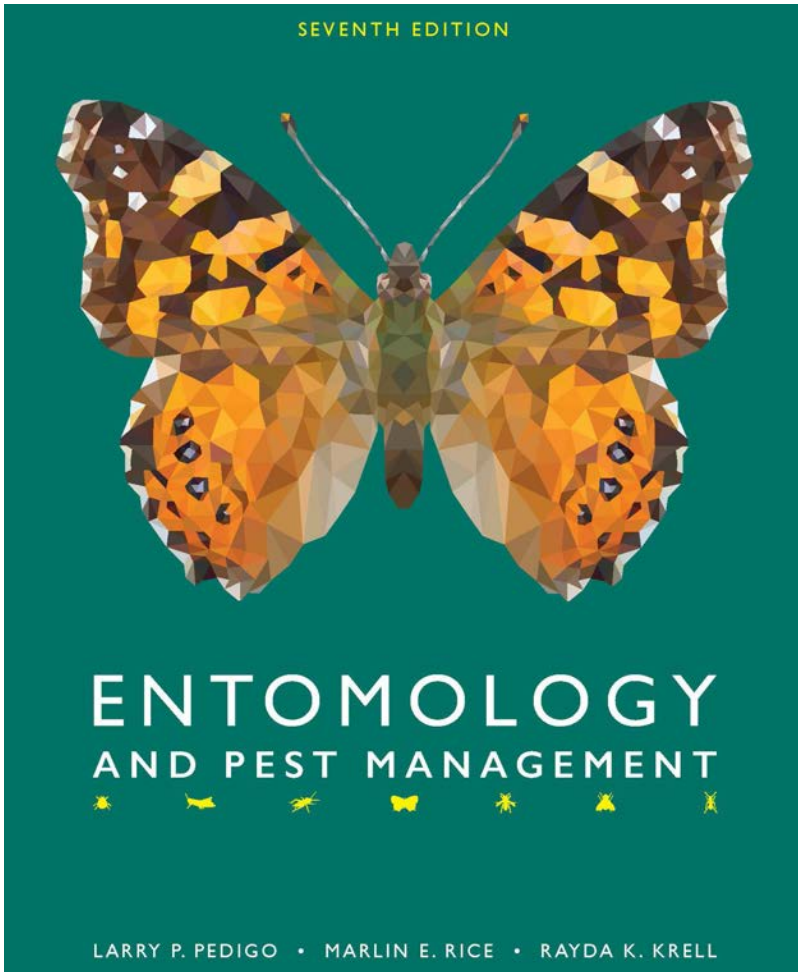
felt literary and engaging, not like a typical textbook. As someone new to entomology, I appreciated that the information was often put into a historical context. The textbook truly launched my path into applied entomology and my pride in being part of the "Pedigo Project," as his lab group was called. I certainly never dreamed that 21 years later, I would be invited to contribute in the 7th edition of his textbook.

Perhaps I should not have been too surprised because Larry had involved students from the first edition...you might recognize such names as **Drs. Paula Davis**, **Leon Higley**, and **Scott Hutchins** who were all credited in that first edition. In the second edition, you might recognize an additional credit to, then undergraduate student, **Dr. Robert Peterson**.

Another person who was credited for the first time in the second edition was **Dr. Marlin Rice**. Marlin later became a co-author for the 5th and 6th editions of the textbook, and he updated the new sections on transgenic crops and, of course, provided gorgeous new photographs. Marlin was also co-major professor for my Ph.D.

On February 8, 2018, I received an email from Larry. He let me know he had been contacted by his publisher, Waveland, to produce a 7th edition of the textbook. He indicated some hesitancy to take on the task and wrote, "Waveland wrote back asking if we might agree to adding another author, who would take the lead in a new edition. I thought of you." I was shocked and honored to receive the message and immediately wrote back to say yes!

Of course, I enjoyed the core work of researching, writing, and editing for the 7th edition, but it was also a treasured bonus to have the frequent excuse for meetings with Larry and Marlin, including summer in-person meetings for working on details and just catching up on life. In those early months of graduate school, you certainly never imagine that someday you will be collaborating as a colleague with your major professors.



Book cover of new textbook (see cover page)

We revisited every detail for the 7th edition of Entomology and Pest Management, and certainly made many updates and edits, but what struck me the most was how much did NOT need to be changed. The core of the book is as strong as ever and is a testament to the strong structural foundation of the first edition from 1989 when no other similar textbook existed. The new edition was published in March 2021, after some pandemic-induced delays, but it will always be a highlight of my career to have been involved.

The 7th edition of this textbook is available on Amazon and many other places. Look for ISBN: 978-1478639923.

Opportunities to Contribute to Entomology

The Department of Entomology at Iowa State University is increasingly dependent upon the generosity of alumni and friends. To support the department, please fill out this section and return it with your check or money order (made out to The ISU Foundation) to the Department of Entomology, Iowa State University, 1334 ATRB, Ames, IA 50011. Alternatively, donations can be made online at *www.foundation.iastate.edu/ent.*

My support this year is in the amount of _____

Please designate my gift to the area(s) in the amount(s) shown below:

_____ Biosystematics Travel Fund for travel costs associated with biosystematics research

_____ BugGuide: an online resource for insect identification

_____ Entomology Alumni Scholarship for scholarships

_____ Entomology General Account

_____ Entomology Memorial Fund for various expenses, including graduate student travel

_____ Iowa State University Insect Zoo

_____ Harold "Tiny" Gunderson Memorial Lectureship for Extension

_____ Fred Clute Memorial Entomology Fund for general support for the Department of Entomology, including The Entomology Student Scholarship for Student Excellence

_____ Jean L. Laffoon Memorial Scholarship for graduate students in Entomology

_____ Jim Oleson Scholarship in Entomology for students who demonstrate academic promise

_____ Larry Pedigo Graduate Scholarship in Entomology for scholarly performance

_____ Henry and Sylvia Richardson Research Incentive Grant provides funding for graduate research experiences beyond their degree program

_____ Wayne A. Rowley Scholarship in Entomology for graduate and undergraduate scholarships, with preference given to those with an interest in medical entomology

For more information about these funds, please contact us at the departmental address above or call 515.294.7400. For more information about other gift designations, please contact Sarah Roelfs via phone: 515.294.1031 or e-mail: sroelfs@iastate.edu.

Greetings from the Insect Zoo!

Ginny Mitchell *writes:* What a year! It felt so good to get back to in-person programming, which we started in May. We were super busy this summer with library programs all throughout the state. We met some amazing kids that watched our "Facebook lives" in 2020 after the COVID-19 shutdown. It was awesome hearing about how our virtual programming brought entertainment and fun-filled education into their homes during a difficult time. We heard so many stories about how we encouraged them to get outside and explore nature. Many became bug-keepers for the very first time!

Our collection of living arthropods continues to grow with several seasonal Bug Zoos sending us their animals after they closed for the season. It is so great to be able to add new species to the Insect Zoo, including a walkingstick, *Lonchodes brevipes* Grays Malayan Stick Insect.

Mattie Gose

Gym-N-Eat Cricket (https://www.gymneatcrickets.com/), owned and operated by Shelby Smith, had a bake sale during her customer appreciation event at her cricket castle. She donated the proceeds to the Insect Zoo! We also had an ISU Fundraiser through the foundation and raised $1,200. Thank you to all who donated!

We are excited to announce the return of the Bug Village on August 27, 2022 in the atrium of the ATRB building. The Bug Village is an open house that includes exhibits and displays of entomology graduate students, faculty and staff.

Ginny Mitchell

Congratulations to the Insect Zoo students who graduated in 2020. Emma Califf is now an entomologist at the Sonoran Desert Museum in Tucson, AZ and Avery Wickham is an outreach educator at the Conservancy of southwest Florida. Both Emma and Avery left a legacy at the IZ and we thank them very much!

Thank you to our current Insect Zoo students Joshua Woolfolk, Charles Luevano, Tiernen Edgar, Ashley Tieden, Daniel Kawamura, Jack Scordato, Rebe Jones, and Mattie Gose. Your dedication to the Insect Zoo and our mission to education the masses about the importance of arthropods is why we are successful.

You are all amazing and the Insect Zoo is what it is because of you! Check out our coloring pages (https://bit.ly/2IvChrM) and "like us" on Facebook, Twitter, and Instagram to keep connected (@isuinsectzoo).

Rebe Jones

Selected Publications and Photos from 2021

Ovipositing free-living caddisfly (Trichoptera: Rhyacophilidae: *Rhyacophila hyalinata* Group), Weeping Wall, Mary's Peak, Oregon, 17 April 2021. *Photo by Greg Courtney.*

Cheng, Sappington, Luo, Zhang, Jiang. 2021. Starvation on first or second day of adulthood reverses larval-stage decision to migrate in beet webworm. Environmental Entomology. DOI: 10.1093/ee/nvab015.

Coates, Delury, Gassmann, Hibbard, Meinke, Miller, Petzold-Maxwell, French, Sappington, Siegfried, Guillimaud. Up-regulation of apoptotic- and cell survival-related genes following exposures of western corn rootworm to maize roots expressing *Bacillus thuringiensis* crystalline toxins. BMC Genomics. DOI: 10.1186/s12864-021-07932-4. 2021.

Dean, Hodgson, Reick-Hinz, Anderson. 2021. Needs assessment for corn insect pest management in Iowa. Journal of Integrated Pest Management, DOI: 10.1093/jipm/pmab021.

Fisher, Bradbury. 2021. Influence of habitat quality and resource density on breeding-season female monarch butterfly movement and space use in north-central USA agroecosystem landscapes. Journal of Applied Ecology. DOI: 10.1111/1365-2664.14061.

Fisher, Bradbury. 2021. Estimating perceptual range of female monarch butterflies to potted vegetative common milkweed and blooming nectar resources. Environmental Entomology. DOI: 10.1093/ee/nvab058.

Gassmann. 2021. Resistance to Bt maize by western corn rootworm: effects of pest biology, the pest-crop interaction and the agricultural landscape on resistance. Insects. DOI: 10.3390/insects12020136.

Gonzalez-Karlsson, Golov, Steinitz, Goldenberg, Gurka, Liberzon, Soroker, Jurenka, Harari. 2021. Males perceive honest information from female released sex pheromone in a moth. Behavioral Ecology. DOI: 10.1093/beheco/arab073.

Grant, Krishnan, Bradbury. 2021. Conservation risks and benefits of establishing monarch butterfly breeding habitat in close proximity to maize and soybean fields in the North Central US: A landscape-scale analysis of foliar insecticide impacts on non-migratory monarch butterfly populations. Integrated Environmental Assessment and Management. DOI: 10.1002/ieam.4402.

Hall, Zhang, O'Neal, Bradbury, Coats. 2021. Quantifying neonicotinoid insecticide residues in wildflowers sampled from prairie strips established in corn and soybean fields planted with treated seeds. Agriculture, Ecosystems and Environment. DOI: 10.1016/j.agee.2021.107723.

Hall, Krishnan, Coats, Bradbury. 2021. Estimating screening-level risks of insecticide exposure to lepidopteran species of conservation concern in agroecosystems. Crop Protection Products for Sustainable Agriculture. DOI: 10.1021/bk-2021-1390.ch008.

Hodgson, Koch, Davis, Reisig, Paula-Moraes. 2021. Identification and biology of common caterpillars in U.S. soybean. Journal of Integrated Pest Management. DOI: 10.1093/jipm/pmab006.

Krishnan, Hall, Hellmich, Coats, Bradbury. 2021. Evaluating toxicity of Varroa mite-active dsRNA to monarch butterfly larvae. PLOS ONE. DOI: 10.1371/journal.pone.0251884.

Krishnan, Jurenka, Bradbury. 2021. Neonicotinoids can cause arrested pupal ecdysis in Lepidoptera. Scientific Reports. DOI: 10.1038/s41598-021-95284-0.

Krishnan, Zhang, Aust, Hellmich, Coats, Bradbury. 2021. Monarch butterfly life cycle risks from foliar and seed-treatment insecticides. Environmental Toxicology and Chemistry. DOI: https://doi.org/10.1002/etc.5016.

Drunella grandis (Ephemerellidae), South Santiam River, Oregon, 17 April 2021. *Photo by Greg Courtney.*

Kwon, Mohammed, Franzén, Ankarklev, Smith. 2021. Single-cell analysis of mosquito hemocytes identifies signatures of immune cell sub-types and cell differentiation. eLife. DOI: 10.7554/eLife.66192.

Kwon, Hall, Smith, 2021. Prostaglandin E2 signaling mediates oenocytoid immune cell function and lysis, limiting bacteria and *Plasmodium* oocyst survival in *An. gambiae*. Frontiers in Immunology. DOI: 10.3389/fimmu.2021.680020.

McMechan, Hodgson, Varenhorst, Hunt, Wright, Potter. 2021. Soybean gall midge: a new species causing injury to soybean in the United States. Journal of Integrated Pest Management. DOI: 10.1093.jipm/pmab001.

Mullins, Bradbury, Sappington, Adelman. 2021. Oviposition response of monarch butterfly to imidacloprid-treated milkweed. Environmental Entomology. DOI: 10.1093/ee/nvab024.

Pritchard, Hendriksma, St. Clair, Stein, Dolezal, O'Neal, Toth. 2021. Do viruses from managed honey bees endanger wild bees in native prairies? Environmental Entomology. DOI: 10.1093/ee/nvaa18.

St. Clair, Gassmann. 2021. Linking land use patterns and pest outbreaks in Bt maize. Ecological Applications. DOI: 10.1002/eap.2295.

Tilmon, Michel, O'Neal. 2021. Aphid resistance is the future of soybean production, and has been since 2004: efforts towards a wider use of host plant resistance in soybean. Current Opinion in Insect Science. DOI: 10.1016/j.cois.2021.01.003.

Unbehend, Koutroumpa, Kozak, Coates, Dekker, Groot, David, Dopman. 2021. Bric à brac controls sex pheromone choice by male European corn borer moths. Nature Communications. DOI: 10.1038/s41467-021-23026-x.

Whitmore, Gaimari, Nihei, Evenhuis, Kurina, Borkent, Sinclair, O'Hara, Zhang, Moulton, Ribeiro, Bickel, Gilka, Andersen, Rossaro, Whittington, Lamas, Heller, Kehlmeier, Courtney, Kerr, Blagoderov. 2021. Twenty years of Dipterology through the pages of Zootaxa. Zootaxa. DOI: 10.11646/zootaxa.4979.1.

Four NextGen Entomologists Arrive

Some graduate students have children during their time at ISU, but the Entomology Department must have set a record in 2021. Like graduate school isn't hard enough! The department welcomed four, healthy "first instars" last year.

John McCulloch (advised by Dr. Aaron Gassmann) and his wife, Maia, had baby Adele Claire in June.

Adele McCulloch

Braymond Adams (advised by ISU president Wendy Wintersteen) and his partner, Angela Alzheimer, had baby Ava Jarrell in August.

Ava Adams

Ivair Valmorbida (co-advised by Drs. Matt O'Neal and Erin Hodgson) and his wife, Tanise Copetti, had Theodoro Coppetti in September.

Theo Valmorbida

Abigail Knopf (advised by Dr. Aaron Gassmann) and her partner, Carver Stokes, had baby Murphy Mae in November.

Murphy Stokes