SiRG

SOCIAL INSECT RESEARCH GROUP

SiRG THROUGH TIME
HOW DID THIS UNIQUE RESEARCH GROUP COME TO EXIST

URBAN ANTS
CLINT PENICK STUDIES ANTS IN NEW YORK CITY

CARPENTER BEES
BUILDERS, ARCHITECTS, AND NEIGHBORS

GLOBAL LOCUST INITIATIVE
HOW STAKEHOLDERS COLLABORATE TO HELP COMMUNITIES

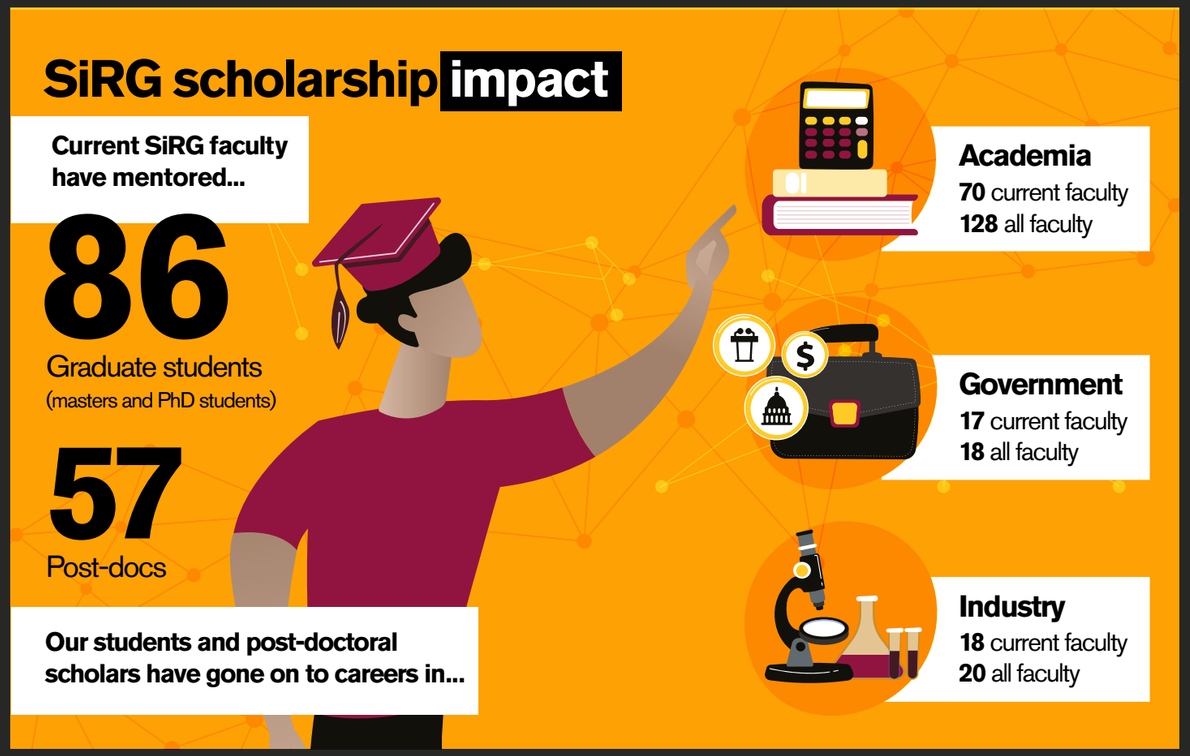
2021

A PUBLICATION OF THE SOCIAL INSECT RESEARCH GROUP AT ARIZONA STATE UNIVERSITY,
BRINGING YOU THE LATEST RESEARCH AND CUTTING-EDGE SCIENCE.

SiRG Magazine

"Our understanding of social insects is essential to our understanding of not only how the natural system on which we are dependent works, but also who we are as a social species and how our social systems are interdependent with the social systems of insects, a dominant life form on this planet. The SiRG at Arizona State is advancing and deepening our understanding of the wondrous complexity, collective intelligence and evolution insects, and all that they mean to us and our future."

- Michael Crow
President
Arizona State University



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Why Study Urban Ants?

by Clint Penick

What drives our choices in our research subjects?

Curiosity?
Most definitely.

Ease of access?
Sure that helps.

Phenomenal restaurants during your lunch breaks?
Hey not bad, you've piqued my interest.

Here are **the top ten reasons to study urban ants**, according to Clint Penick, who earned his PhD from ASU. While at SiRG, he studied queen development in *Harpegnathos saltator* ants. He also investigated how reproduction, dominance, and caste influence their endocrine profiles. After a post-doc in North Carolina, where he first explored urban ants, he is now an Assistant Professor at Kennesaw State University in Georgia, where he teaches social evolution and urban ecology.

1. City ants are diverse
We've identified over 40 ant species living in Manhattan, while the nearest "natural" area that has been sampled had only 33 species. This means that New York City has similar ant diversity–if not higher–than nearby protected areas.

2. Cities have A LOT of ants
We estimate that there are at least 16 billion ants living in NYC based on the number of ants we collect in greenspaces throughout the city. Since there are around 8 million human residents of NYC, this means that ants outnumber humans 2,000-to-one.

3. Cities are relatively unexplored
Before working in NYC, I thought every aspect of the city had already been studied, but this was far from the truth. After surveying ants in NYC for several years, we reached out to the American Museum of Natural History located in Central Park to see what previous ants they had in their collection. Despite having one of the largest and oldest ant collections in the US, they had no ants from NYC at all! (Don't worry, they now have a full drawer of NYC ants from our collections).

Sampling the City Streets
Most people visit Broadway to take in a show, but Clint Penick, pictured on the left, visits this mecca in downtown to sample for urban ants. While many city dwellers consider ants to be a pest and a nuisance, they actually perform a critical service to the countless residents and tourists thronging the streets. They are food scavengers, helping to keep city streets clean. Their voracious appetites ensure that all discarded food scraps become recycled nutrients. For example, odorous house ants–so named because they smell like coconut when crushed–form supersized colonies in cities.

URBAN ANTS

4. Cities can have really rare ants
We have found some of the rarest ant genera in NYC, including *Stigmatomma*, *Proceratium*, and several species of *Strumigenys*. Other researchers working in downtown Manaus–the most densely populated city on Earth–discovered a new species from one of the rarest ant genera of all, *Leptanilla*.

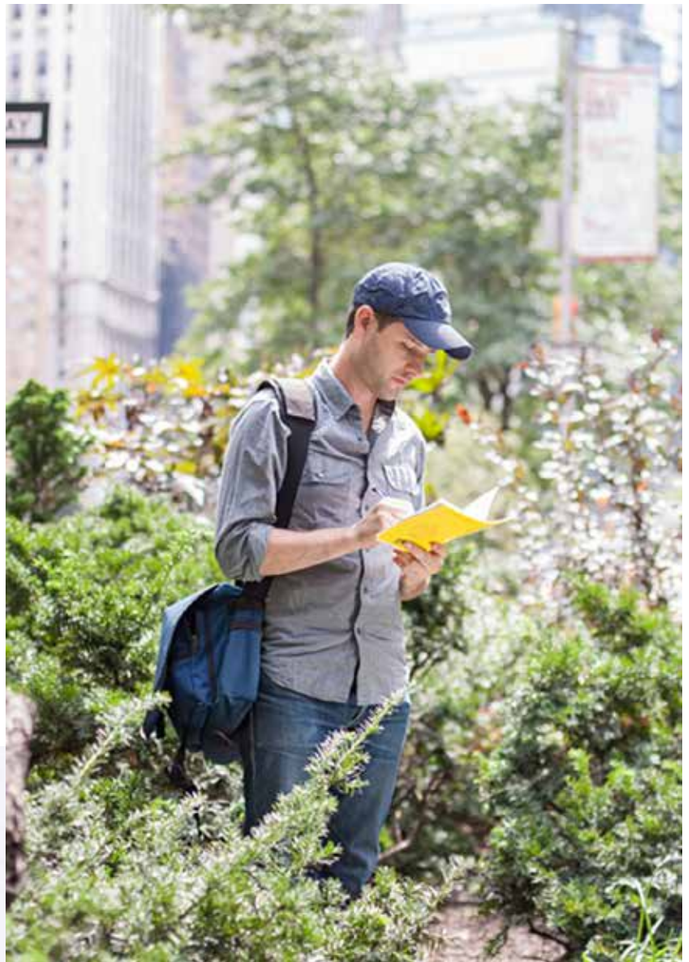
5. You never know what you're going to find
NYC is famous for being a city of immigrants, and that is also true of its ants. New species arrive regularly through the ports, and we recently discovered a new arrival that doesn't yet have an official name (it's called *Lasius cf. emarginatus* until it gets a positive ID). This species was not collected during the first survey of NYC ants, but it has since become the second-most common ant on sidewalks throughout the city.

6. Every news agency wants to talk to you
The news agencies in NYC think it's hilarious that a bunch of scientists come to their city every year just to look at their ants. We have been featured in the New Yorker, the New York Times, New York Post, and on New York's favorite news station 1010 WINS. We have also been followed by film crews from the BBC, CBC, and PBS with more on the way.

7. Literally no one else wants to talk to you
Despite all the news agencies in the city covering our work, when the typical New Yorker sees us sucking ants up off the street with our aspirators, they put their head down and mind their own business. In a city that sees everything, we're either too normal to spark their curiosity, or look too odd huffing the sidewalk that they don't want to pause. In over five years of working in NYC, I have never once been stopped by a pedestrian to ask what I'm doing.

8. Lunch breaks are amazing
Field work in remote regions of the world may be beautiful, but there's no way you'll get a lunch as good as the bagel and lox at Barney Greengrass on Manhattan's Upper West Side.

9. Urban ants do a lot of good
Ants are considered pests by most urbanites, but New Yorkers dubbed the ants of Broadway their "unofficial sanitation department" after we found that ants were eating the equivalent in garbage of 10,000 hotdogs each year.



10. We live in an urbanizing world
Now that over half the human population lives in cities, we ourselves have officially become an "urban species." As cities continue to expand, it is essential to understand how they affect ants and other urban wildlife. Cities can also help us predict the effects of climate change outside of cities, as urban species are already exposed to similarly elevated temperatures associated with the urban heat island effect. Research on cities today can therefore offer a window into our future and hopefully provide answers for how humans and wildlife can coexist.

You Never Know What You'll Find
One thing Clint Penick enjoys about urban research is that you never know what you'll find. After one busy day of sampling, he and his team decided to visit a local comedy club. To their surprise, Dave Chappelle took over the stage for an impromptu performance.

A Prestigious Honor
The Robert A. Johnson Chair in Social Insect Research

SiRG is proud to announce its new endowed chair, which brings recognition to the important ant research conducted here and helps cement our current and future role on the world stage

An endowed chair is the gold standard of recognition in academia. Establishing such a chair position requires a substantial gift to the university and the endowment lasts forever. An appointment as an endowed chair is the highest level of recognition that a university can bestow on one of its faculty. Such an appointment signifies that the recipient has achieved the very top level in his or her field. It is used to reward and recognize extant faculty, or as a powerful tool to recruit talent.

Endowed chairs are rare at ASU. Among our current 3,785 full time faculty, of which 2,002 are tenure track, there are only 56 endowed chairs (1.5 and 2.8% respectively). Nearly half fall within the business school, as successful entrepreneurs seek to give back to the next generation of business school students. The College of Liberal Arts and Sciences (CLAS) currently has 13 occupied chairs, three of which fall within the Natural Sciences. Our new Robert A. Johnson Chair in Social Insect Research is a very special gift for the Social Insect Research Group (SIRG).

Bob Johnson in the Andes of Argentina
Here you see Bob Johnson at an elevation of approximately 15,000', where he and his research team found one species of *Pogonomyrmex*, the highest elevation ever recorded for this genus. The collecting trip was sponsored by E.O. Wilson with the goal of collecting *Pogonomyrmex* ants for a revision of the genus in South America.

© Rick Overson

I remember as a grad student that Bert was **'The Ant God'**

- Bob Johnson

An Enduring Relationship with ASU

Dr. Robert Johnson, known to all of us as Bob, gifted an endowed chair to ASU to directly support SIRG. His desire is that it will be used to reward and attract the best social insect researchers in the world, especially those working on the evolutionary ecology of ants. Bob's exposure to ants began as a child watching ants in his backyard at the urging his mother, who sought something to keep him busy. But Bob's passion for evolutionary ecology and ants developed while he earned his Ph.D. at ASU.

One of the founding members of SiRG, Bob takes personal pride in its growth and development. He was especially pleased with successful recruitment of Professor Bert Hölldobler, who he considers a "good friend, colleague, collaborator and supporter." Their paths first crossed in the early 1990's at the American Museum of Natural History's Southwestern Research Station. Bob needed Bert's permission to access his study site.

"I remember as a grad student that Bert was 'the ant god' for students and faculty that studied social insects," Bob recalled. "I believe that he still holds that honor."

Bert also recalls the time they first met. "Bob was a graduate student at ASU at that time and he was about to start a research program on *Pogonomyrmex rugosus*, which was quite common in my study area," Bert said. "He asked me whether I mind that he works in my field site. He was a tall, slim, polite young man, with long hair. I told him that I do not mind... ."

It is only fitting that our inaugural holder of the chair is Professor Bert Hölldobler, a world-renowned ant biologist and sociobiologist. The two have deep mutual respect. "Bob is a gifted ant taxonomist and superb naturalist and collector," said Bert. The admiration Bob has for his friend Bert was officialized when he named one of his beloved ant discoveries "*Pogonomyrmex hoelldobleri*."

Bert Hölldobler is best known for his award-winning books including "The Ants" and "The Superorganism", both coauthored with Professor Edward O. Wilson. "The Ants" earned them a 1991 Pulitzer Prize. Professor Hölldobler was a full professor at Harvard University for 18 years before returning to his native Germany in 1989 and accepting the post of Ordinarius and Chair for Behavioral Physiology and Sociobiology at the University of Würzburg. Upon his retirement from Würzburg, Bert joined the faculty at ASU in 2004, his office right next to Bob Johnson's. Together the two helped build SIRG by attracting the world's brightest young faculty working with social insects.

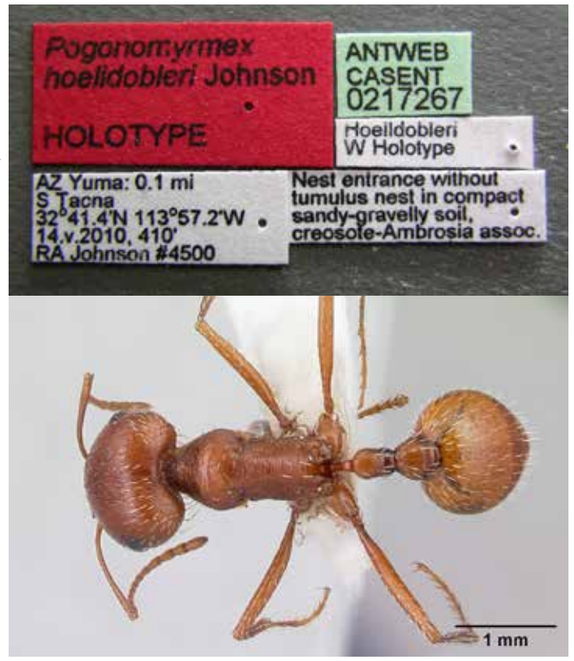
> ***"Bob is a gifted ant taxonomist and superb naturalist and collector."***

Inaugural Johnson Chair - Bert Hölldobler

Bert Hölldobler is a behavioral biologist who investigates the self-organization of insect societies. He and his research team explore the behavioral mechanisms that underlie communication and division of labor systems in ant societies. He is fascinated by the territorial interactions of ant colonies and how ants will posture fiercely without actually enganging in aggression. He also investigates how the complex multimodal communication codes in ant societies have been broken by a variety of solitary insects, which live as parasites inside ant colonies.

A Lasting Gift

The endowment gift from Robert Johnson will support social insect research at ASU for years to come. Such a chair validates the importance of SIRG to the campus and international communities. "Social insect research has become 'mainstream science'," remarked Bert Hölldobler. "An endowed chair in this field signifies that ASU will be committed to remain a major player in the field, and I consider it a very special honor to be the inaugural chair of this prestigious professorship." The appointment of Bert Hölldobler as the inaugural Robert A. Johnson Chair in Social Insect Research brings increased international recognition to this vibrant group of social insect scientists with its outstanding faculty and will help keep SIRG strong for years to come.



© Michele Esposito

© Erin Prado

Bert Hölldobler is advancing Darwin's essential theory of life, that it is always on the move, always evolving in fantastic ways and much richer and more complex than humans have really understood. Hölldobler has focused on the fantastically rich complexity and evolutionarily depth of social insects in ways that help to understand not only who they are and how they live and evolve in their social networks, but also, who we are and how our social networks evolve. A modern Darwin, Hölldobler is allowing advancing our species and our collective future with his understanding of social insects.

- Michael Crow
about the
Robert Johnson
award recipient

Southwestern Research Station
Bert was never afraid to get down in the dirt for his beloved ants. Here he is filming the territorial tournament of the Honey Ants (*Myrmecocystus mimicus*).

GRADUATE RESEARCH

Carpenter Bees

Builders, architects, and neighbors

by Madeleine Ostwald

True to their name, carpenter bees are among nature's most accomplished builders. Using only their mandibles, they painstakingly excavate spaces as large as 100x their body size, by tiny increments of sawdust.

A Lasting Structure

The product of these labors is a lasting, protective structure that will be inherited, contested, and modified for generations. So coveted are these structures that competition over nests is a fundamental driver of their social behavior. My dissertation research explores how the environment drives social evolution: for carpenter bees, as for humans, the built environment shapes family life, relationships, and communities.

Nesting within their own tunnel mazes, carpenter bees are uniquely at home within the human built environment. So comfortable are they cohabiting in our porches, eaves, and fences that they have earned a uniquely villainous reputation among bees, known more as pests than pollinators. Their compatibility with human structures places them among the minority of animals expected to thrive in an increasingly human-disturbed future.

I work with *Xylocopa sonorina*, a carpenter bee native to western North America that is a fixture of the neighborhoods surrounding the ASU campuses. Despite their destructive tendencies, these are the charismatic mega-fauna of the bee world, especially the charming, green-eyed yellow males that emit plumes of rose-scented sex pheromone on spring afternoons. Familiar as these bees are, their nesting biology has remained mysterious due to the challenges of observing life inside their wooden fortresses.

Tough Neighbors

Carpenter bees can be difficult neighbors, not only for humans, but for one another. Like the human-built areas they inhabit, carpenter bees tend to live in aggregations, or neighborhoods of adjacent nests, each of which might house a single bee or small group. While bees may spend the winter with close family, the social boundaries between nests blur in the spring as females disperse to build a new nest, or, more commonly, to join or usurp an existing one.

These property battles can be fierce, with victors evicting and sometimes even killing previous tenants and their brood. Our metabolic rate measurements shed some light on this surprising carnage: we found evidence for high energy costs of nest excavation, suggesting important benefits for bees that manage to avoid–through whatever means–building their own nest.

Rooming Together

In other cases, nest disputes are resolved more peacefully. For bees, as for grad students, living with roommates is one solution to high costs of living. Our data suggests that *X. sonorina* often nest with non-relatives; due to their tendency to shop around for housing opportunities, bees are no more related to their nestmates than to the bees in neighboring nests. From this data has emerged the picture of a heterogeneous, fluid, and highly interactive neighborhood of distant relatives.

The vast majority of bee species build their nests in soft, impermanent substrates like soil or stems, which serve only long enough for their offspring to emerge and start over the following spring. By drilling into dense wood, carpenter bees lay the groundwork for a durable network of nests that will support their successors for a dozen years or more.

A Deeper Look

To view these long-term changes to the built environment in real time, we conducted a year-long series of bimonthly CT scans of an occupied nesting log. These scans revealed a dynamic labyrinth of nests that grew and

> ***"The vast majority of bees build their nests in soft, impermanent substrates."***

© Brooke Lyman

A female carpenter bee excavating her nest.

A male carpenter bee resting after being tagged.

A male carpenter bee peeking out before leaving the nest on a mating trip.

An occupied log being scanned by the CT machine.

expanded as they were variously colonized, inherited, or usurped. We found that tunnels widened with overuse and were eventually abandoned, likely as their width made them indefensible to the constant threat of eviction. In these ways, the social histories of these bees are stamped on their multi-generational building project, as much as the structures themselves come to define the fates of the bees that inhabit them.

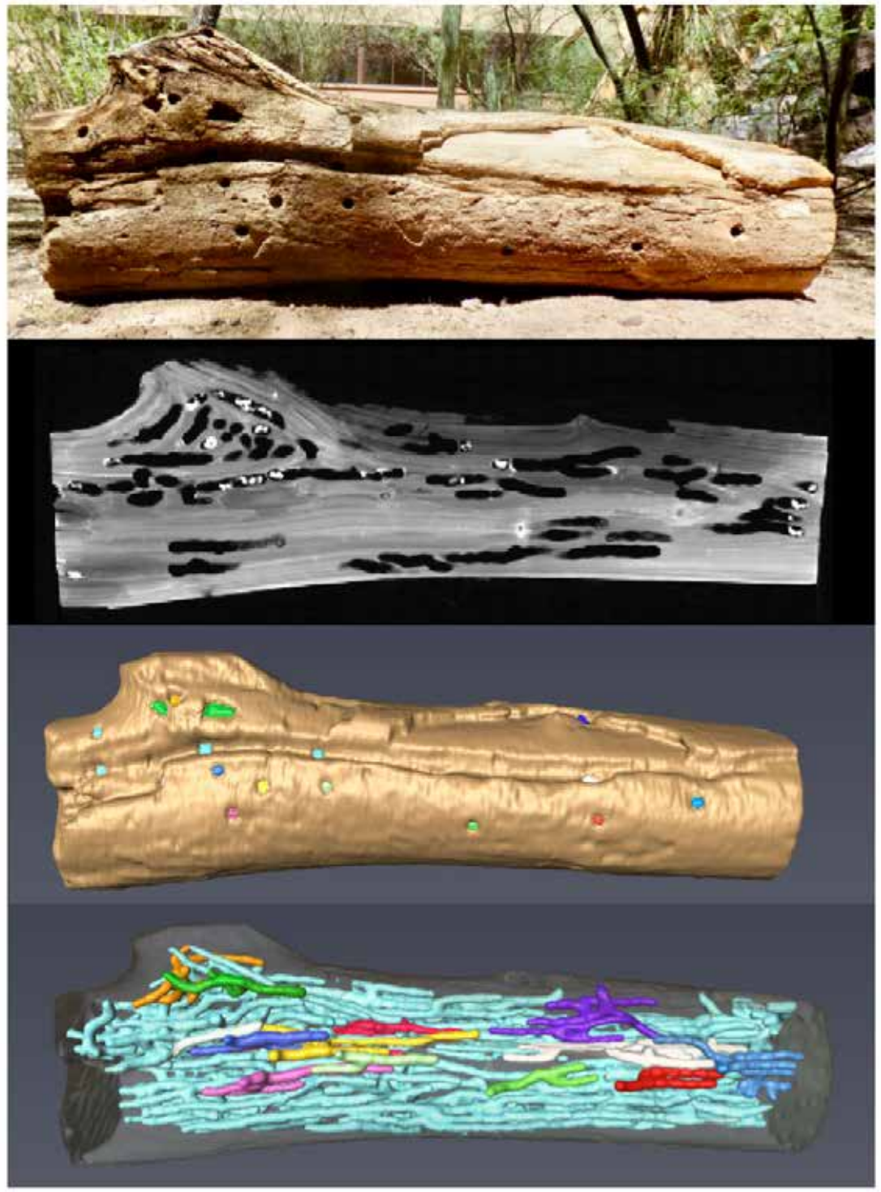
Social Animals

Carpenter bees can be finicky research subjects. When I started my dissertation research, I spent many fruitless hours searching riparian habitats for nests, finding little success with the traditional methods of the field biologist. Instead, the surest and quickest methods of carpenter bee nest tracking are social: through word of mouth, posts in the neighborhood Facebook group, and even Craigslist ads.

Around my neighborhood, I have studied carpenter bees nesting in eaves (upper right), wood piles (above), fence posts, and even giant tiki head statues (right).

My research has depended on support from my local community, from the many neighbors that have provided me access to their bee tenants, to the hospital technicians who supported my use of their CT machine, to my generous roommates, who did not object to the temporary placement of an 8-foot log full of bees in our yard during the spring 2020 stay-at-home order.

Like us, carpenter bees live dynamic social lives that extend beyond their individual homes; especially in challenging times of social distance, there is comfort in a community of neighbors.



CT scans and 3D reconstructions showing a labyrinth of neighboring nests made by my study species in a single large log. We scanned this log twice a month at the Phoenix hospital, arriving late in the night when the bees were quiet and the CT scanner was not being used for human patients. One reason these carpenter bees may be so social in Arizona is that large wood structures are rare in desert landscapes, making sharing a nest a necessity.

STAFF PROFILE

Keeper of the Ants — a USDA containment facility is part of SiRG

Lab technician Kevin Haight is responsible for maintaining the secure ant containment facility for SiRG faculty at Arizona State University. Without Kevin, a great deal of the research we conduct on ants would not be possible, or would be very difficult to accomplish.

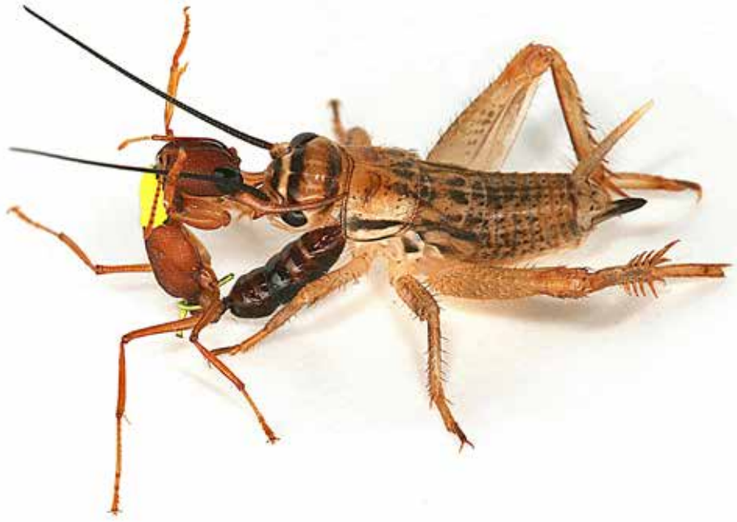
Hidden Behind Closed Doors

Right across from the ASU bookstore, on the third floor of the Interdisciplinary Science and Technology Building 1, lies a secure lab with no windows hidden behind two locked doors. Every morning Kevin Haight locks up his bike and then bounces up the three long flights of steps–a habit he picked up from his microbiologist father, whose office was on the 6th floor of San Jose State University's Duncan Hall. He strides down the corridor, greeting anyone in his path with a smile and jovial nod. A quick swipe of his key card on the outer door, a couple of steps, and then he unlocks the second door to the inner sanctum.

Routine takes over, as his eyes carefully roam around the already lit room filled with hundreds of clear plastic boxes. Each one is home to an ant colony not native to Arizona. Row upon row of Indian Jumping Ants, *Harpegnathos saltator*, a russet ant with a dark brown abdomen, ferocious looking mandibles, and alert black eyes. This primitively social ant has extremely keen eyesight that lets them accurately track moving prey. Synchronized bending of the middle and hind legs gives them the power to launch themselves at their prey, their long, finely serrated jaws firmly grabbing hold. They curl their abdomen inward, stinging the soft-bodied insect or arachnid with paralyzing venom, then carry the catch back to the nest.

The lab also houses colonies of *Camponotus floridanus*, commonly called the Florida Carpenter Ant, a large bicolored ant native to Florida. They can be recognized by the erect hairs on their antennae. Despite the common name, these ants don't damage the wood structure of homes, seeking out already rotted or pithy wood for their nests.

"Containment is a pretty big deal," Kevin said. He meanders through the room, his eyes scanning the rows of identical boxes. It is his



A *Harpegnathos saltator* ant paralyzing a live cricket
To identify each individual in the colony, Kevin Haight developed a method to tie colored wire around the waist of each ant, designing a specialized tool to tighten the tiny knot.

responsibility to make sure these tiny visitors don't escape. "First, I check the room, make sure nothing is on fire, no lids are off. I need to know there aren't any ants ruling the roost." Only once he has checked the perimeter and confirmed there are no wayward ants, can he allow the students into the USDA containment facility. They are eager to get back to their experiments.

Falling into Fire Ants

Growing up in California, the only ants Kevin encountered were the Argentine ants. "As a kid, looking at them on the sidewalk, they're not all that spectacular." He was lucky enough to attend a tropical biology course in Costa Rica as an undergraduate, where he first encountered the lengthy marching lines of leafcutter ants, each transporting a bright green leaf up to 50 times its own bodyweight. "Oh wow," Kevin said, recalling his time abroad as a college undergrad, "ants are actually way more diverse than I thought they were. They do all kinds of really cool things."

And so when he returned to the University of California San Diego, he dipped his toe into ant research with Andrew Suarez, conducting aggression assays between introduced populations of Argentine ants in California. Not quite sure what to do next, Kevin decided to try out graduate school. If it didn't work out, he figured he could always head to the family farm. "I wanted to study something relevant to the general public," he explained. "I wanted to investigate economically important ants."

That list for him boiled down to three: leafcutter ants, Argentine ants, or fire ants. He had already worked with Argentine ants and knew them from growing up. They just didn't pull at his imagination. He loved the leafcutter ants, but that would mean juggling research abroad, which would be logistically difficult. The process of elimination left him with fire ants. "It checked all the right boxes. It was economically important. It was sexy. And it was in the United States."

Luckily for Kevin, the world leader in fire ants was Walter Tschinkel at Florida State University. "If it had been Walter Tschinkel at Harvard, I never would have been able to study fire ants. I didn't have the grades." Tschinkel had already been at Florida State for more than 25 years studying the ecology, natural history, nest architecture, and organization of fire ants. His book *The Fire Ants*, which he wrote while Kevin was in his lab, was nominated for a Pulitzer Prize.

"I was able to find the perfect guru in a place that was accessible to me. And so I spent eight years at Florida State, four years doing my masters and then four years working for Walter as a technician and studying fire ants."

Hot Days, Long Nights

"We were so lucky to be able to recruit him," Bert Hölldobler said, reflecting back on the hire. "He got his myrmecological training in the lab of Walter Tschinkel. (I can't) think about a better place to be trained as an experimental myrmecologist. His Master thesis is excellent, and he could go on for a Ph.D. However, he decided not to, because he always felt he wants to become a research specialist responsible for running myrmecological laboratories, and I have to say, he is probably the best among his peers."

A few months after starting at ASU in the Fall of 2006, a special shipment of *Harpegnathos saltator* ants arrived. Ant and termite scientist Jürgen Liebig had had his colonies shipped from Germany and they happened to arrive on Kevin's very first Christmas Eve in Arizona. "We can't wait for days to unpack these things. They need to come out now," Kevin recalled. Everyone in the lab chipped in. "We ended up transferring ants until 3am or longer," Jürgen said. "Kevin helped without any complaints. In fact, it was rather fun doing this tour-de-force ant transfer." Several graduate students helped get the colonies settled into their new space.

> ***"We can't wait for days to unpack these things. They need to come out now."***

While they're working, they're joking around with each other. "We didn't really know each other that well, so it was an interesting, fun bonding experience. Bonding through work."

Kevin makes it sound like running a containment facility is easy, but it's not. He maintains the very delicate cultures of the ponerine

Kevin Haight pours plaster nest molds
Dental plaster is used to make nests to house the various ant species kept in the lab. It is used to form floors and chambers inside plastic containers, and its porousness helps maintain nest humidity. In many cases we use foam forms to preform nest cavities when we pour the plaster. These are then removed after the plaster sets. For other nests the plaster is poured to form a floor with no cavity. We use a glass plate for a nest ceiling, so we can observe the ants inside.

STAFF PROFILE

genus *Harpegnathos*, which have now been bred in the laboratory for more than 18 years. "It is, to my knowledge, the first non-parthogenetic ant species that was successfully bred over many generations in artificial nests," Bert Hölldobler explained. "The flourishing of these ant cultures is entirely due to the skills and dedication of Kevin Haight."

It's a routine he enjoys. "I did a lot of fieldwork in Florida, and that was hot and sweaty and definitely work for a young man," Kevin said. "I'm happy now that I'm old and gray to be, you know, in the office. They still send me out every once in a while, into the field."

On the Hunt in Borneo

One field trip with Jürgen Liebig included 18-days of trudging through the mud and dark forests of Borneo in search of another *Harpegnathos* species near a remote field station only accessible by boat. They knew the ants were there because they had previously been caught in pitfall traps.

"We didn't see a single one," Kevin said. "Not even an entrance." These ants don't recruit. They hunt individually, so there are no long foraging trunk columns. The two scientists spent long days searching for a dark ant in a dark forest.

"The only way to find them is to be so freaking lucky that you spot one before it spots you and scuttles away." But unless it happens to be traveling with recently caught prey, you would have a hard time following it in the leaflitter. These ants are incredibly cryptic and have exceptional vision. They're going to see you and feel your vibrations in the ground long before you spot them. "We could have been so completely surrounded by them and we just never knew," Kevin added. They knew going in their chances were slim. "Well, we gotta try, you know. The only way to get them, is to go look for them."

In the end, they may have been lucky not to find them. While they had all the collecting permits to import these ants into the United States and export them from Brunei on the island of Borneo, they traveled via Hong Kong. As they are changing planes in Hong Kong, the authorities stopped and searched everyone's hand luggage looking for contraband. "We had no idea that they would be searching people's bags as they were getting on the plane. What would have happened? Would an overzealous official have decided, oh no, this is not happening on my shift. We might have ended up with a long layover in Hong Kong," Kevin said, laughter in his eyes.

A Mentor in his own Right

Kevin, you quickly realize, enjoys his job and loves working with students. He was recognized in 2018 with the Annette Jecker Outstanding Staff Award. "I definitely enjoy teaching the undergrads and guiding the grad students and postdocs. Imparting that knowledge on to them, so they can benefit from it in their research."

© Jürgen Liebig

Harpegnathos saltator
Here we see a *Harpegnathos saltator* tending a larva in one of the colonies maintained at SiRG.
© Jürgen Liebig

A LOOK BACK

Origin & Evolution

How SiRG came into existance

by Robert E. Page

To many of you familiar with ASU, the Social Insect Research Group (SiRG) may seem to have always been here, spawned from the big bang 13.8 billion years ago. But, in fact, it has a much more recent history.

As an organizational entity, there is nothing institutional or official about it. Groups don't really exist at ASU. ASU's official titles for research groups include Center, Institute, Initiative, and Program, but not Group.

The name, and the entity SIRG, evolved from the self-organized nature of the group. According to Jennifer Fewell, it may have been proposed as early as 1995 by Steve Rissing, a social insect researcher at ASU at the time, to identify the kernel of ASU faculty involved with social insects: him, Jennifer Fewell, Jon Harrison, and Bob Johnson.

SIRG, in its current manifestation dates to 2002, when Jennifer and Jon were on sabbatical leave in Germany. Jennifer was in Würzburg working with Jürgen Gadau. She was encouraging Bert Hölldobler who was then Ordinarius and Chair for Behavioral Physiology and Sociobiology, and soon to retire, to come to ASU and start a center for social complexity, a dream that she and some faculty in social and neuro sciences had been entertaining. Bert already had an affinity for Arizona through his long-time research program with his beloved ants in Portal, where he owns land. He was also close friends with Bob Johnson, a superb ant taxonomist, ecologist, and naturalist. At the time Bert was also entertaining offers to join Cornell or a possibility at Harvard.

I was introduced to the idea of joining the social insect group at ASU during a Gordon Conference on Genes and Behavior held in Ventura, CA in February 2004. Jennifer brought it up during a break. "Why would I want to go to ASU?" was my immediate response. At that time, I was a full professor and department chair at UC Davis. But when she mentioned that Bert was seriously considering joining ASU, I paid attention. Bert had been a good friend for many years and I had trained several of his students as postdoctoral researchers in my lab. Subsequently Jon Harrison joined in the "full court press" and urged me to apply for an open position as the Founding Director of the brand-new School of Life Sciences. His argument was that as director, working with Bert, we could build a world class group in social insects. Although I could see the sense of it, I still wasn't convinced.

Persistance Pays Off

But Jon is a persistent negotiator. He convinced me to send my CV as a way of introduction, then informed me the dean wanted me to visit. I didn't want any of my colleagues at UC Davis to know I might be looking at an opportunity that would take me away, so I agreed I wouldn't go to campus, but would meet off campus near the airport. I booked a round trip flight with a short layover at Sky Harbor airport. When I got off the plane I expected to be greeted by the dean of the College of Liberal Arts and Science, David Young, instead I was met by Jon - I was suspicious. We went off campus to the Buttes Resort and I was escorted to a meeting room in the basement where I encountered a search committee. I had been ambushed! There I was in my blue jeans and athletic shoes, backpack slung over one shoulder, being interviewed for a faculty/administrative position.

Apparently, the interview went well enough and I was invited to return to campus just to look around. They booked me into the Mission

Palms hotel. Bert and his wife Friederike were already there, though Bert was still indecisive about joining ASU. We had breakfast together and Bert detailed what we could accomplish if I joined as the Director of School of Life Sciences. The great program we could build.

"Why the hell would I want to leave UC Davis and join ASU?" I asked. "Why not?" Friederike replied. She had me. I didn't have a good answer and it forced me to think seriously about it.

Hesitation Unjustified

When I got my Ph.D. in 1980 from UC Davis, Michele, my wife, told me that Davis was her dream place to live and raise our family. The chance that I would ever be able to go back and join the faculty were slim, so she agreed to go anywhere we needed to further my career, except Florida or Arizona! We were fortunate to be able to return to Davis and have a career, so when I told her that I was kind of interested in leaving for ASU and the challenge of founding a new school, I expected the worst. "Why the hell not," she asked and I was hooked.

Stronger Together

I finished the process of applying and competing for the position, retired from UC Davis, and began as Founding Director in May 2004. Bert also accepted the position and we made two joint decisions:

1. We would use the faculty hiring commitments made to use during recruitment to build a social insect group that was oriented vertically with respect to biological processes: genes, anatomy and physiology, behavior, and social interactions, rather than taxonomy.

2. We would encourage the new faculty to use their startup investments to build common lab resources shared among the group.

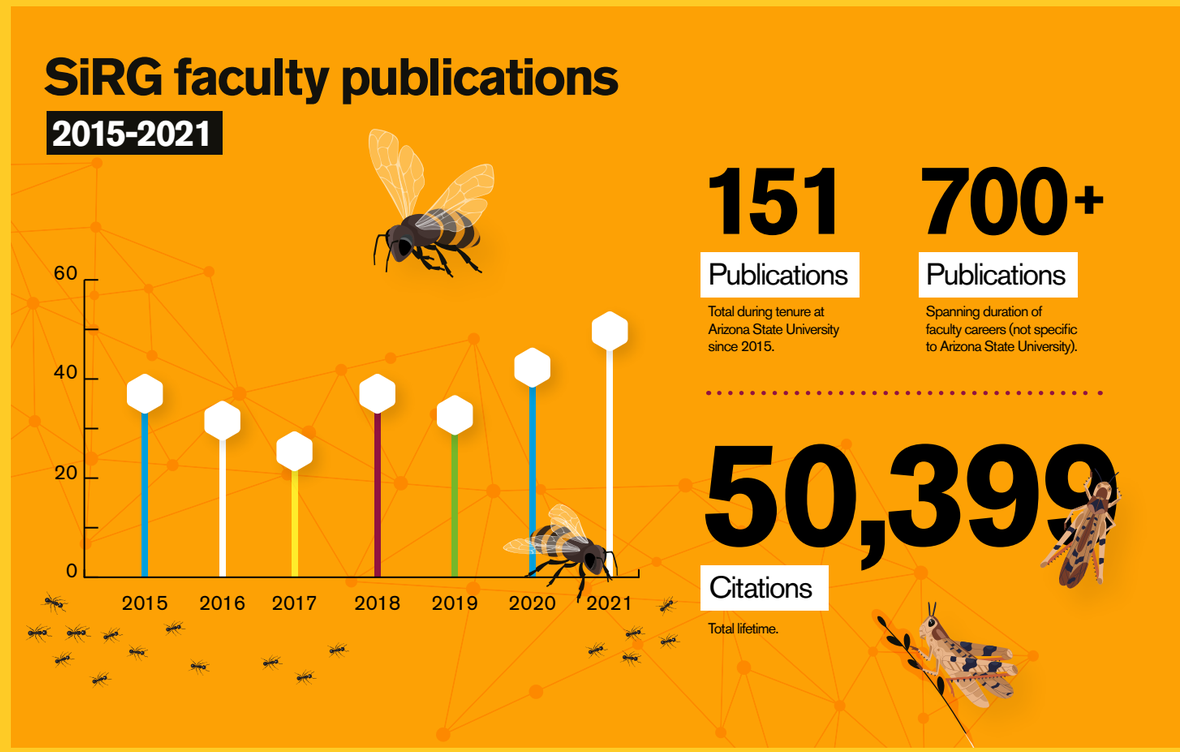
Finicky Floorplan Financials

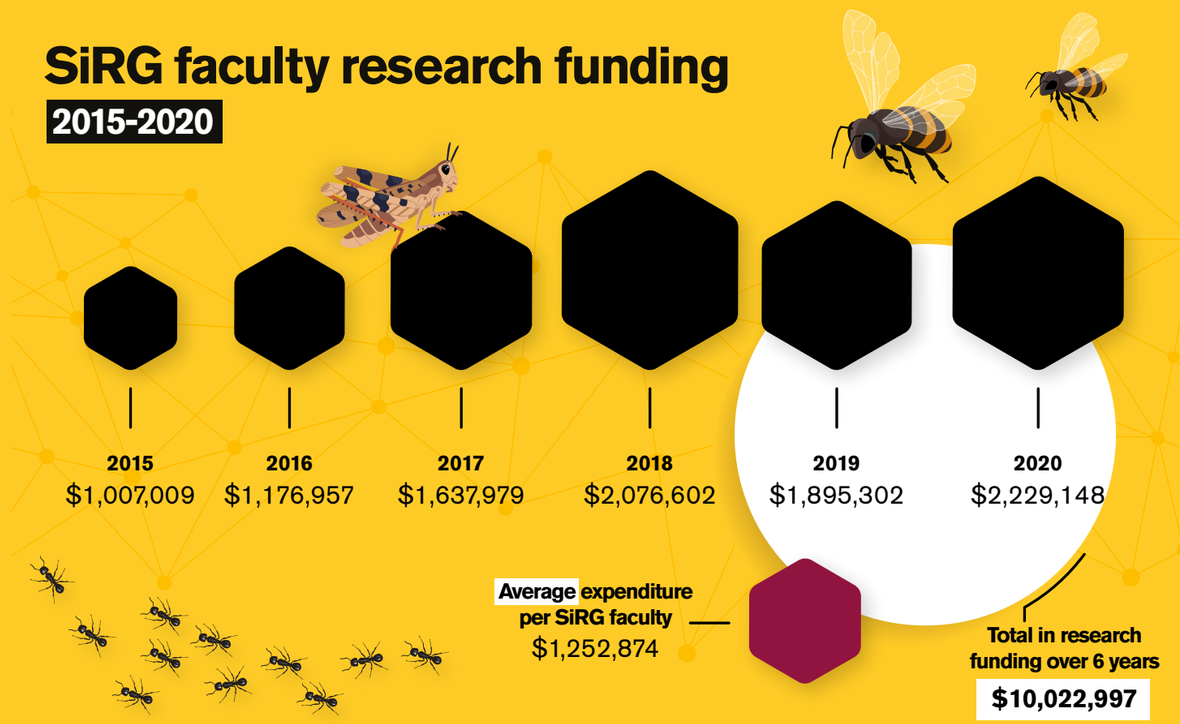
Shortly after I joined ASU there were discussions about a new interdisciplinary research building, ISTB-1. The Dean asked if I thought it would be a good place to house our new social insect group. He told me the expectation for this new building would be that faculty would annually expend $200 from their grants per square foot of lab space occupied. That is an amount I thought impossible, and there are few labs at ASU even today that regularly meet that level of funding. But I said "sure". The existing SoLS buildings were over-crowded and there was no way to build the new SIRG group in contiguous space outside of ISTB-1.

I bet that the floor space funding model would be abandoned before we were held responsible. The building was built with the help of Jon Harrison acting as SoLS planner and liaison. It was a huge task at which he excelled. Jon assumed the role of SoLS Associate Director for Facilities in 2005. In 2006, we started moving in. As SoLS director, I made arguments to the dean about how we needed to divide the total area of the labs by the total expenditures of all the faculty to justify our use of the space. He agreed, but direct accountability was never implemented.

New faculty were hired to fulfill the commitments made to Bert and me, but we also hired faculty that aligned with the major initiatives of ASU, set by President Crow. We hired two faculty as part of the Neuroscience initiative, and two aligned with Sustainability. Some of our hires were successful targets of opportunity to recruit outstanding faculty, early to mid-career, and some were recruited from international open searches. Our success rate was 100%.

The next issue was filling the space. This was my biggest concern. I walked the halls and there was so much empty space, but as we recruited more exceptional faculty it gradual-





ly filled with graduate students and postdocs. The walls filled with posters from research meetings where our students won prizes for their outstanding work. Bert and I kept promoting the value of the group in terms of the science and highlighted that we had become the best social insect group in the world, something publicly proclaimed by E.O. Wilson on one of his visits. The dean of CLAS and the President of ASU both valued SIRG as a unique entity and the best in its class. No one ever again discussed the floorspace funding model.

Footprints in the Sand

We, the SIRG faculty, were all proud of what we had built and wanted to share it with the rest of the social insect world. We invited the top international social insect researchers to come, interact with our students, and present SIRG lectures. Guests came and our international reputation grew. This effort continues to this day and has been very successful in promoting our group, especially our students and postdocs. Our invited speakers often become network nodes for our students, hiring them directly post-graduation or connecting them with others investigating similar questions.

Just like the social insects we study, SIRG organized itself. There are no task masters – though Bert is constantly overseeing and encouraging participation in SIRG activities, and avidly attends student presentations – no blue print, and no external plan. SIRG has never taken any institutional resources to support or maintain it, instead It is organized by the passion and energy of its members. The xxx graduate students, xxx postdocs, and xxx faculty feel an identity of belonging to SIRG and organize workshops and seminars, invite guest speakers, have happy hours together, and plan and map future directions.

Over time, I moved from being the SoLS director to the dean of CLAS, and eventually University Provost. All the while, Bert and I kept an eye on SIRG to "protect" it from "institutional entropy". Institutional entropy is when the energy that keeps collaborative research going within a group (center, institute, etc.) declines and the group returns to the lowest energy state where each member becomes an independent research enterprise contained within a lab and no one interacts. It also occurs when the institution, such as the university, no longer takes an interest and fails to support it. Bert and I both worked to promote the excellence in SIRG to the higher administration to keep them aware of how special it is. Today, SIRG is an independent, integrated entity and still enjoys the support of the upper administration. As a consequence, SIRG continues to evolve and be infused with new energy by hiring outstanding new faculty, attracting the brightest and best graduate students and postdocs, and now, has an endowed chair for social insect research, a truly special and enduring source of energy.

National Science Foundation CAREER awards in SiRG

National Science Foundation CAREER awards are presented in support of junior faculty who exemplify the role of teacher-scholars through research and education that advances the mission of their organization. Awards are presented once a year, and funds distributed over a five-year period.

Arianne Cease, PhD

CAREER: Deciphering how dynamic environments and nutrition affect life history tradeoffs in a highly migratory insect pest

Award period: 2020-2025

This CAREER project will combine local and international educational opportunities, as well as lab and field research to test how nutrition, population density, and historical habitat variability interact to affect migration, immune function, and reproduction of locusts. The results will be used to develop sustainable management and policy recommendations and will be provided to global partners to improve livelihoods, and human and environmental health.

Christian Rabeling, PhD

CAREER: Exploring the patterns and mechanisms of ant social parasite speciation and evolution: Integrating teaching and research to foster biodiversity discovery in organismal evolutionary biology

Award period: 2020 – 2024

My research program aims at unraveling the complex evolutionary history of ant social parasites and their hosts, and seeks to understand the influence that convergently evolved behavioral changes have on the speciation patterns and mechanisms generating social parasite diversity. The project utilizes an integrative approach, that includes (i) reconstructing the speciation patterns and the evolutionary history of ant social parasites based on phylogenomic data; (ii) unearthing the global biodiversity of ant social parasites by using an integrative approach to biodiversity discovery and social parasite taxonomy, effectively delimiting species and revising ant social parasites across the ant tree of life; (iii) deciphering the genetic mechanisms underlying social parasite speciation and evolution. In summary, this project uses an integrative approach to organismal evolutionary biology, exploring how socially parasitic lineages originate repeatedly and convergently from their eusocial ancestors in direct sympatry.

Global Locust Initiative Laboratory

There are thousands of species of grasshoppers around the world, but only a small handful are considered locusts. These 19 or so species, which are scattered throughout the family *Acrididae,* look and act like regular grasshoppers during recessions between outbreaks.

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Locust Transformation

The calm, plant-munching lifestyle of this normal period belies a dramatic transformation that occurs rapidly under the right conditions. Locusts tend to live in arid climates with unpredictable sources of water and food. They are well adapted to survive in these nutrient poor conditions.

But conditions change. The rains come and their environment suddenly turns into a buffet of green plants. The insects profit off the abundance. Their numbers increase dramatically.

An individual that hatches during these times of plenty senses the increased density of fellow locusts. At a certain threshold, it switches developmental pathways to a gregarious phase where, depending on the species, they may change color, morphology, and physiology. All locust species undergo a dramatic change in behavior; instead of actively avoiding one another, they congregate and begin marching in coordinated bands that ripple across the landscape.

If these ecological conditions persist and juveniles reach their final developmental stage with newly functional wings, these coordinated formations take to the skies. The ensuing swarms of voracious herbivores, in the case of the desert locust *Schistocerca gregaria* for instance, can contain tens of billions of individuals ranging over many square miles with the capacity to consume the food of tens of thousands of humans. Voracious and copious, they can clear cut all vegetation, leaving crops demolished and people starving.

Our Genesis

The Global Locust Initiative (GLI) aims to develop sustainable pathways to address devastating locust outbreaks involving all relevant stakeholders. We grew out of many conversations among researchers, government and non-government agencies, and farmers' groups around the world. The ASU team officially launched GLI at the first international GLI conference in April 2018, an event that included 27 institutions and 14 countries.

This groundbreaking event underscored the breadth and importance of addressing locusts and their impacts on food security. The FAO UN estimated the last major desert locust plague (2003-2005) alone cost about $450 million to control and caused about $2.5 billion in crop damage.

The more profound impact of locust plagues is long-term effects on livelihoods. A study in Mali, West Africa found that children born during plague years in villages affected by locusts are much less likely to ever start school. The effect is greatest for young women.

Connected Through Adversity

Due to their impressive migratory capacity, locusts are a continental and global challenge. Locust plagues link distant communities, as do policies and markets. These factors all influence human behavior, which feeds back into the system. Locusts are part of a complex social-ecological-technological

system. Understanding how these components are connected and working together across boundaries and sectors is essential to build sustainable global futures.

Thousands of conversations with partners around the world over the past 15 years highlight how essential it is to link disparate communities. There is a need for a global organization to link partners, share knowledge, understand locust neurobiology, communicate ways to work with international governance, and push new frontiers in locust research, response, and management.

Dual Approach

The GLI realizes that collaboration and science are both required to make strides in locust plague mitigation. Thus GLI has both a GLI Network, which is the public service arm that serves as an information resource and fosters collaboration among stakeholders, and the GLI Lab, which conducts fundamental and applied lab and international field research, and partners with stakeholders to implement solutions. As of last year, the Network has more than 400 members dispersed over 55 countries.

Tales from the Field

Five members of GLI share stories of their research and time in the field, working with communities directly impacted by locusts, conducting basic and applied research, and enjoying the camaraderie of working together globally to find sustainable solutions.

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Alana Burnham
Senegal Community Outreach Specialist

Favorite grasshopper:
Oedaleus senegalensis,
known as *soccet dugub* in Wolof

In March, I traveled to Senegal to distribute the finished booklets to participants. These materials were created with the help of Senegal's Plant Protection Directorate, French and Senegalese locust experts, and community members in rural Senegal.

In this photo, you can see me and participating women in Gniby, Senegal, celebrating the conclusion of the project's first phase in a sabar or drum circle in Wolof. During a sabar, you first hear the rhythmic drumming performed by a griot or gewel, a traditional oral historian or bard. Individual women or groups of friends then leap into the middle of the circle, expressing themselves in a fast-paced dance that can incorporate cadenced jumps and kicks.

As a guest, you will be pulled into the fray regardless of your dancing ability. Here you can see how I was loaned a skirt (a necessary dancing accessory) and drawn into the circle with the women participants. The women are waving their booklets and certificates in the air, repeatedly calling, "Waa soccet, yaangi ni!"–"People of the grasshopper, represent!"

TALES FROM THE FIELD

Jenni Learned
Research Specialist &
Former Cease Lab Manager

Outbreak response to
Scistocerca cancellata in Argentina

Favorite grasshopper:
Schistocerca cancellata
I provided support during the setup of the analytical lab and the locust rearing facility, and I served as a member of the field team on research trips to China, Senegal,
Australia, and Argentina.

I left the Cease lab to become the
Operations/GIS specialist for the Maui Nui Seabird Recovery Project in Hawaii.

Locust Outbreak Response in Andalaga, Catamarca, Argentina

The objectives of this trip were to experimentally assess *S. cancellata* in the field, to form collaborative relationships with local researchers, and to collect specimens for the ASU locust rearing facility. Overall, Dr. Cease and the Living with Locusts team were able to demonstrate that a rapid response to an ongoing locust outbreak is possible and can lead to successful outcomes.

This photo exemplifies why *S. cancellata* impressed me the most. I remember hunting them in the field, and throughout the semi-arid habitat (similar to the Sonoran Desert) individuals would gather and even feed on the seemingly unpalatable desert vegetation. The resilient critters went on to survive an adventure filled journey back to ASU where they became the pioneers of research colony.

Balanding Manneh
PhD Student, University of Cambridge

Favorite grasshopper:
Oedaleus senegalensis

Project title: The effect of Nitrogen fertilization on the growth and reproduction of the South American locust (*S. Cancellata*).

We grew a lot of wheatgrass to feed the locusts. Pictured is me grinding the grass to measure protein and carbohydrate contents. For my project, I had three treatments of wheatgrass that were fertilized with different concentration of nitrogen fertilizer.

Control = 0g of urea/m2
Medium = 0.15g of urea/m2
High = 0.30g of urea/m2

Our goal was to study the impact of nitrogen fertilization on the reproduction, survival, and growth of the locust. As an undergrad, it was a great learning experience that helped me better understand the scientific method. I learned how to propose a hypothesis, then test whether or not the hypothesis is supported by the findings. It was a great introduction to research in science.

A Humble Hero
If you were to describe Balanding Manneh, the phrase that often springs to mind is humble. In 2016 he won the President William Jefferson Clinton Global Hunger Leadership Award from the NGO Stop Hunger Now. In addition to his lab research, Balanding was fundamental to setting up the team's field research in Senegal, West Africa, joining the 2015 and 2016 field teams.

Hunger is something he understands intimately. He grew up in Gambia, Africa, where several of his childhood friends perished from starvation or malnutrition related illnesses. He has made it his life's work to help alleviate hunger worldwide, focusing his research on understanding how locust plagues can be curbed.

Desert Locusts
Rains allow locusts to increase exponentially. They travel downwind and can fly up to 150 km in a single day.

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TALES FROM THE FIELD

Deanna Zembrzuski
PhD Student, Arizona State University

Favorite grasshopper:
Melanoplus sanguinipes

Project title: Establishing the nutritional landscape and macronutrient preferences of a major U.S. rangeland pest, *Melanoplus sanguinipes*, in field and lab populations.

My projects aims to study the interactions between grasshopper diet and immune challenges on grasshopper survival and performance. We specifically look at how Melanoplus *M. sanguinipes*' nutritional intake changes under Metarhizum infections, and how this grasshopper survives and performs when given restricted diets of specific ratios of carbohydrates to protein. Through this research, we hope to find ways to use nutrition and bio pesticides together as more efficient management strategies.

M. sanguinipes
A female migratory grasshopper
© Peterwchen, Wikimedia Commons

Locust Outbreak in Ethiopia
Hopper bands of desert locusts feeding on pasture and vegetation.

©FAO/Michael Tewelde

Marion Le Gall
Assistant Research Professor, ASU

Project title: USAID project Bay Sa Waar, which means "Farm your part" in Wolof, part of their program Communities for Sustainable Agriculture

We worked with women in five communities to develop a system for monitoring Senegalese grasshoppers with light traps.

We were setting up and developing an early warning system to monitor the Senegalese grasshopper. We were thus delivering locust light traps to women's groups in Senegal. Finding transportation in rural Senegal is not always easy, but we had a truck.

One morning we were driving and it broke down. A common occurrence while traveling. In the six trips I made to Senegal, I have not once been spared mechanical issues with cars. I remember particularly fondly my 2018 trip where the only way to start the vehicle was to push it. Every. Single. Time.

Our rescue vehicle, our knight in shining armor, appeared covered in bullet holes... The ideal vehicle for a USAID-sponsored mission.

The point of this photo is not the car troubles, or what on earth happened to this car before it became our unexpected transport.

The point is that in Senegal you ALWAYS get help and more often than not, a good laugh. Senegal is known as the country of "teranga", meaning hospitality in Wolof, which can easily be expanded to a strong sense of community, solidarity and sharing.

SiRG faculty

Gro Amdam, PhD

Gro Amdam studies how individual honey bee behavior is affected by physiology and genetics. Her labs have established a new paradigm for how reproductive genes can influence behavior. Central to this work are the structural and functional properties of Vitellogenin proteins, which are encoded by homologous genes in almost all egg-laying animals, including insects, crustaceans, fish, reptiles, amphibians, and birds. Their current work include pioneering gene knockdown methodology, protein structure-function assays, in vitro cell and animal technologies, as well as a battery of physiological tests and stress-assays.

Arianne Cease, PhD

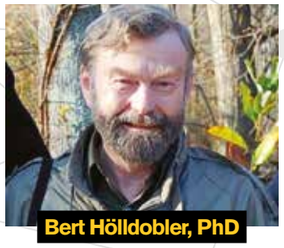
Arianne Cease is a sustainability scientist with a focus on the behavior and ecophysiology of organisms in social-ecological-technological systems. Her research involves interdisciplinary approaches to understanding how human-plant-insect interactions affect the sustainability of agricultural systems. She is the director of the Global Locust Initiative (GLI) whose mission is to promote interdisciplinary locust research and management to improve farmer well-being and global food system sustainability.

Jennifer Fewell, PhD

Jennifer Fewell is a President's Professor, faculty leader for the Organismal, Integrative and Systems Biology Group and interim director of the School of Life Sciences. Her research centers around the organization and evolution of insect societies. She is particularly interested in the topics of work organization and the emergence of the division of labor in social groups. Fewell also studies the roles of self-organization and selection in shaping social cooperation. In current work, she examines the role that self-organization plays in the transition from solitary to group living.

Jon Harrison, PhD

Jon Harrison's lab studies the ecology and evolution of insect metabolism, focusing on mechanistic studies of oxygen delivery, cardiovascular function, regulation of body size, effects of body size on physiological function, thermoregulation, thermal effects on physiological function and metabolic control. Applied questions addressed include understanding climate change effects on mosquitos and pollinators, examining the role of mito-toxic fungicides in pollinator decline, and exploration of the roles of land management on locust outbreaks.



Bert Hölldobler, PhD

Bert Hölldobler investigates how insect societies are organized. His research team explores the behavioral mechanisms that underlie communication and division of labor systems in ant societies. They research how separate ant colonies communicate during territorial interactions and how the complex multimodal communication codes in ant societies have been broken by a variety of solitary insects, which live as parasites inside ant colonies. He has published eight books in sociobiology and behavioral ecology on the herbivory of leafcutter ants, organization of ant societies, social insect colonies as superorganisms and parasitism within superorganisms.

Robert Johnson, PhD

Robert Johnson has broad research interests in the evolutionary ecology of North American seed-harvester ants. Professor Johnson's research focuses on life history, nest founding strategies, biogeography, community structure, and hybridization and caste determination, primarily using the seed-harvester ant genus Pogonomyrmex. His interests also include the ant fauna of Baja California, Mexico, and adjacent areas of mainland Mexico.

Juergen Liebig, PhD

Juergen Liebig studies central features of insect societies such as reproductive division of labor, hierarchy formation, chemical communication, individual plasticity, and odor discrimination at the level of the individual and the olfactory receptor. He and his group members use behavioral experiments, molecular and neurophysiological approaches, and chemical analyses to reveal mechanisms and evolutionary patterns that shape the organization of ant and termite colonies. Professor Liebig collaborates globally with teams in chemistry, genomics, neurophysiology, and computational and developmental biology.

Robert Page, PhD

Robert Page, professor emeritus, joined Arizona State University in 2004, after retiring as regents professor emeritus and chair emeritus at the University of California Davis, as the founding director of the School of Life Sciences. He served as provost at ASU (2013-2015) and dean of the College of Liberal Arts and Sciences (2011-2013). He has published several books on honey bee behavior and genetics including "The Art of the Bee," (2020). Professor page holds many honors including election as a member of the American Academy of Arts and Sciences, and was awarded the Alexander von Humboldt Research Prize.

Theodore P. Pavlic, PhD

Theodore P. Pavlic has an interdisciplinary background including a doctorate in electrical and computer engineering. His research focuses on understanding adaptive decision-making strategies in autonomous systems. To this end, his laboratory does empirical work with natural systems, such as social-insect colonies, and does engineering work building decision-making algorithms for artificial systems, such as decentralized energy management systems for the built environment.

Stephen Pratt, PhD

Stephen Pratt studies the emergence of complex social behavior in leaderless, decentralized groups, particularly social insect colonies. His lab uses experiments, mathematical models, and computer simulations to understand the behavioral rules and communication networks that allow colonies of ants, bees, or termites to act as a collective intelligence. Inspired by the analogy between individual organisms and colonial "superorganisms," they apply ideas from psychology and economics to understand group cognition.

Christian Rabeling, PhD

Christian Rabeling studies the evolutionary biology, biodiversity, and biogeography of ants. His lab explores the speciation mechanisms governing the parallel evolution of ant social parasites across the ant tree of life; the symbioses of ants with other organisms, ranging from the mutualistic interactions of fungus-growing ants and their symbionts to the antagonistic interactions between social parasites and their hosts; and the island biogeography of ants in the South Pacific region.

Brian H Smith, PhD

Brian H Smith has maintained a long-standing research program into how associative and nonassociative plasticity modify odor guided behavior and early olfactory processing in the brains of honey bees and bumble bees. His lab investigates how these learning capabilities work together in different contexts to regulate decision making about statistical properties of odor environments. He developed a program for training PhD students and postdoctoral researchers to understand how to work in large and small teams of in order to investigate complex problems requiring a multidisciplinary approach.

EQUAL OPPORTUNITY

SIRG: A Center for Social Transformation

How can we promote Diversity, Equity, and Inclusion

by Daniela Mera-Rodriguez

Not unlike social insects, humans can do little as isolated individuals. However, as a community, members of the Social Insects Research Group have the potential to help tackle societal issues.

The novel Coronavirus pandemic (COVID-19) has highlighted the health disparity and socioeconomic isolation that some groups and communities face (Walmsley et al., 2020). For instance, essential front-line workers, who are required to continue working throughout the crisis, are disproportionately people of minority groups in low-wage jobs, who are also less likely to get paid sick time. They have had to face the terrible choice of contagion risk or starvation, making them more vulnerable to unemployment. People in minority groups are also less likely to enjoy access to good coverage and quality of health services, as well as to childcare. Data from the CDC shows that non-White people are almost three times more likely to die from COVID-19 compared to White people (CDC 2020). In addition, only a privileged portion of the population can work from home and the possibility to work from home also varies depending on income, race and ethnicity (Mehta & Zessoules, 2020).

Map: Nationality of SIRG members over the last fifteen years. Figure based on lab rosters provided by some of the PIs and HIVED members. Information might be incomplete since not all of the lab rosters were received.

This, along with multiple events of racial violence, discrimination and disinformation over this last year, has put an emphasis on the need for Diversity, Equity, and Inclusivity in our communities (Brechenmacher et al., 2020; Caldera-Villalobos et al., 2020). Many of us have questioned our role in contemporary society, our involvement in our community wellbeing, and how our own existence is articulated within the functioning of global human systems. In an individualistic society, collective questions reflect our thoughts. “What are our responsibilities, challenges, and opportunities? How can we embody change in a positive and achievable way?”

These questions have reinforced the idea that we are significantly more powerful when we work collectively rather than as isolated units. In social insect societies, each individual insect has a specific role and the combination of their modest actions has a large impact on the functioning of their social systems (Wilson, 1971; Hölldobler & Wilson, 1990; 2009). Similarly, the synergy of human actions, within the confine of limiting conditions, is crucial to achieve transformation in our current society. A long path lies ahead to achieve positive change. We should ask ourselves “How can we, as social insect researchers, contribute to this change?” Making our society truly diverse, equal and inclusive is an ambitious goal, and we need to address many challenges before meaningful progress can be seen.

SIRG Diversity Today

For the last 15 years, SIRG has been center of scientific discoveries and development of philosophical thinking. SIRG has been home to astonishing researchers, who have enhanced our understanding of social insect systems and nurtured the curiosity of future generations of scientists. Ideally, SIRG would serve as a hub between its members as well as a community where the potential that each individual has to transform society through

academia and education is highlighted. SIRG should contribute to building a better society and help to tackle inequalities, both through direct action and through transformation of inner ideas to raise awareness on issues that preclude diversity, equity, and inclusivity.

So far, SIRG has been home to researchers from more than 19 countries spanning the continents of America, Asia, Europe, and Africa (Map on prior page). People from varied scientific backgrounds have joined SIRG looking to advance our scientific understanding of social insects. Yet, similarly to other scientific communities (Botella et al., 2019), SIRG still suffers underrepresentation of several minority groups among its members. Unfortunately, many groups of people have been historically underrepresented in scientific research including women, racial and ethnic minorities, people with disabilities, people in the LGBTIQ+ community, indigenous groups, and other socially disadvantaged groups (Syed et al., 2011).

Lack of representation of minority groups is a critical issue in education and academia because it generates a chain reaction (Ertl et al., 2017; Herrmann et al., 2016). Since there are few people from minority groups as leaders or principal investigators in research teams, students from marginalized groups do not have role models with whom they can identify. Therefore, having nobody like them to admire, students from underrepresented groups do not feel allowed to be ambitious or skilled enough to pursue a successful scientific career (Syed et al., 201; Ertl et al., 2017). In addition to the lack of representation, students from underrepresented groups are faced with additional hurdles such as unequal access to resources, funding, and education opportunities (Wallace & York, 2020). All of which contributes to perpetuating the general lack of diversity in Science, Technology, Engineering, and Mathematics (STEM) (Botella et al., 2019; Ramalho et al., 2020). Scientific communities around the world have begun to address this important issue and SIRG also needs to start taking action.

In some ways, SIRG is already paving the way for new scientific endeavors. I would like to highlight Professors Jennifer Fewell, Arianne Cease, Gro Amdam, and Yun Kang. Their leadership and research on evolution, physiology, ecology, neurobiology and behavior of social insects are inspiring. Their presence in SIRG as female faculty has empowered and motivated new generations of women, who find themselves represented in a historically male-dominated field. Yet, and despite this remarkable achievement, out of the 13 current faculty positions in SIRG, only four are occupied by women and only two are occupied by people in the Black Indigenous and People of Color community (BIPOC). None of the faculty members in the history of SIRG is Black, Latinx, or Indigenous. Thus, SIRG should keep fighting for the inclusion of people coming from other socially marginalized groups, as well ensuring they are welcomed and provided with a safe space and enough resources to help them succeed in leadership positions. This will trigger an important incentive for future diverse groups of students to make a career doing social insect research.

In general, SIRG has already started to form a scientific group with people coming from different scientific backgrounds including principal investigators, post-doctoral researchers, lab managers, graduate and undergraduate students. Yet, the milestones achieved to date are just the beginning and there are a lot of efforts we still need to put into building a more diverse, equal and inclusive research community. This is evidenced in the lack of diversity in the group, 81% of the SIRG members listed come from developed countries in North America or Europe. Only 15% of the current SIRG members identify themselves with

racial groups different to White (HIVED 2020 survey results). The lack of Diversity, Equity and Inclusivity in SIRG might be representative of the current general lack of diversity in STEM research academic groups (Botella et al., 2019) and therefore, as the largest center for social insect research in the United States, SIRG has embraced a full commitment to remedy this by promoting future diversity not only in terms of nationality and gender expression, but also ethnicity, gender identity, race, disability, age, religion, sexual orientation, and economic background.

Taking Action

There are many actionable steps each of us can take to contribute building the diverse, equal and inclusive academic community we seek. The first and one of the most impactful actions should be to reflect upon our roles as part of a society in which not everyone is equally privileged and/or oppressed. We are privileged people when we are part of certain social groups that have benefited and prospered because of advantages conferred upon them by society (Black & Stone, 2005). These privileges are granted just as a birthright, and not because of skills or merit. In contrast, we are oppressed people when we belong to a social group that has historically suffered from pervasive and intergenerational experiences of social injustice, which overtime can be imposed and internalized into the daily lives of the oppressed people (Burnette & Figley, 2017).

Both, the privileged and the oppressed must be willing to identify their roles in the transformation process as well as to change behaviors that contribute to inequities. We also need to be aware that people can experience a mixture of oppressed and privileged status. For example, a person can be White (a historically privileged social group) and part of the LBGTIQ+ community (a historically marginalized social group) at the same time, meaning this person lives a unique mixture of privileged and oppressed experiences that determines their actions, commitments and responsibilities towards DEI issues. This unique intersection of social contexts is what defines our own realities, responsibilities and necessities. It also directly impacts our desires, behavior, decisions, and mistakes. Being aware of our privileges does not minimize our oppressions, in contrary, it opens the path to building social justice. It is also very important to note that being a socially privileged person does not mean being exempt of life difficulties and struggles. It just means that this person has a social advantage that was conferred just by the nature of their identity. We will not be truly equitable as long as we are not equitable for everyone and rights are not taken away from anyone. Recognizing our position in the unequal society makes us aware of our challenges and commitments, and it also guides our future actions.

Therefore, we should all reflect on how privileged we are as current scientists. We are privileged in many different senses. For instance, during the current pandemic times, researchers in certain positions (e.g. tenured positions, grad-students) get the opportunity to be paid for doing what we love most: we kept our jobs and practiced social distancing in contrast to a lot of people, who are either risking themselves to contagion or losing their income.

However, we should also recognize that not all the people in the scientific community are equally privileged. Some of us are at the intersection of multiple marginalized communities which frames our reality differently as well as determines our social commitments and responsibilities. We should all strive to make SIRG a safe space for people of any age, ethnicity, gender expression, gender identity, disability, color, national origin, intellectual perspective, race, religion, sexual orientation, veteran status, or socioeconomic background.

Building on this need for societal change, in June 2020, grad-students in SIRG created a DEI committee called HIVED, which stands for Honoring Inclusive Voices for Equity and Diversity. HIVED aims to facilitate representation and success of marginalized groups in SIRG and to create opportunities to promote a safe, inclusive, and respectful academic culture. HIVED is an important step towards the establishment of institutional structures for the advancement of Diversity, Equity, and Inclusion in SIRG.

HIVED at Home

The committee already started acting. Shortly after forming, HIVED conducted a survey to gather demographic information about SIRG members, feedback on Diversity, Equity, and Inclusion topics to determine what specific issues SIRG may be facing. HIVED also hosted workshops on DEI topics such as sexual violence, racism, and how to be inclusive to the LGBTIQ+ community.

The goal of these workshops was, and will continue to be, an opportunity to advocate for a safe, educational space where conversations can occur. While invaluable, these initial efforts are preliminary. We need to keep working together. Some of the future HIVED actions include the analyses of the demographic information gathered, the continuous creation of spaces for open discussion and learning on DEI issues, as well as the establishment of a SIRG funding source to financially support undergraduate students in minority communities. All SIRG members can also join HIVED actions by supporting HIVED initiatives, attending the DEI workshops, volunteering for organization activities, as well as donating funds.

In addition, it is crucial to recognize that mental associations triggered automatically on thinking about social groups - implicit bias- is present in almost all of us. These are the hardest behaviors to identify and change, because they originate unconsciously (although there are tools available to help identify them: https://implicit.harvard.edu/implicit/user/agg/blindspot/indexrk.htm) (Payne et al., 2019). Therefore, we need to put ourselves in a position to learn, identify, and commit to overcome these dangerous stereotypes. Other actions include supporting institutional changes that promote DEI strategies, encouraging and advocating for underrepresented groups in biological sciences, nominating them for awards, ensuring their participation in admissions, hiring and promotion committees, supporting scientists of minority groups in their path to obtain the job they want, volunteering to work on DEI initiatives, participating in the trainings to educate ourselves on DEI issues, as well as investing time in our own learning process (suggested reading list here: www.shutdownstem.com/dig-deeper) (Ramalho et al., 2020; Wallace & York, 2020).

The fight for Diversity, Equity, and Inclusion can start in our small controlled environments like our research teams or group of collaborators. Life scientists in SIRG are familiar with the idea that diversity enhances

productivity and stability of natural systems (Tiemann et al., 2015; Hector, 2011; Ptacnik et al., 2008). This principle can also be applied to academic teams, where collaborative work and diversity have demonstrated benefits for team productivity and performance (Denson & Chang, 2009; Stvilia et al., 2011; Nielsen et al., 2017).

Equal Access to Knowledge

In this era of disinformation, one of our important missions should also be to disseminate knowledge beyond the scientific sphere and reach out to non-scientific communities, especially minority groups. We can do this by participating in outreach events, using social media to promote science, applying our artistic stills to share the results of our research in non-academic environments. Last but not least, SIRG members must keep working together on the education of future generations of students, researchers, and academic advisors, who are both passionate about social insect research, but also informed and mindful of the necessity to foster a healthier and more inclusive society.

Many discoveries remain to be made in social insect biology. Scientific research and multidisciplinary collaborations need to continue advancing our knowledge. Correspondingly, our work to build up Diversity, Equity and Inclusion needs to keep growing, as such characteristics will keep SIRG a vibrant center of transformation as it has been over the last fifteen years.

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SiRG profiles

Kim Fondrk

Kim Fondrk, retired, moved to Arizona with Rob Page and helped bring the bee lab at ASU into existence. The two collaborated for many years, breeding a selected line of high and low pollen-hoarding bees. Kim brought the first colonies to ASU and was instrumental in getting the SiRG bee lab up and running. He then returned to Davis, CA where he continued to select for the pollen-hoarding trait for several additional generations.

Cahit Ozturk, PhD

Cahit Ozturk is a research technologist managing the Bee Lab and approximately 100 colonies at the bee facility at the ASU Polytechnic campus in Mesa, AZ. He has over 30 years of experience with honeybees and has been working at the ASU bee lab since 2014. His areas of expertise are: honey bee breeding and management, including royal jelly production, queen bee rearing, in vitro bee rearing, hygienic behavior selection, bee genetics, and instrumental insemination of queen bees. He provides essential support for funded research of the SiRG faculty. He maintains contacts with the local apiculture industry and private beekeepers. And he offers basic through advanced beekeeping courses to ASU students.

Osman Kaftangoglu, PhD

Osman Kaftanoglu, retired, ran the SiRG bee lab for many years, using his expertise in honey bee behavior, reproductive biology, genetics, and queen insemination to help many SiRG research projects succeed. From assisting with ovary transplantations to figure out innovative ways to rear queens in vitro, his relentless drive to find a solution proved extremely helpful in countless research projects.

Social Insects help shape the world.

We at SiRG are proud to study these fascinating organisms to learn how they contribute to our planet's biodiversity, inform our lives, and keep us curious.

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