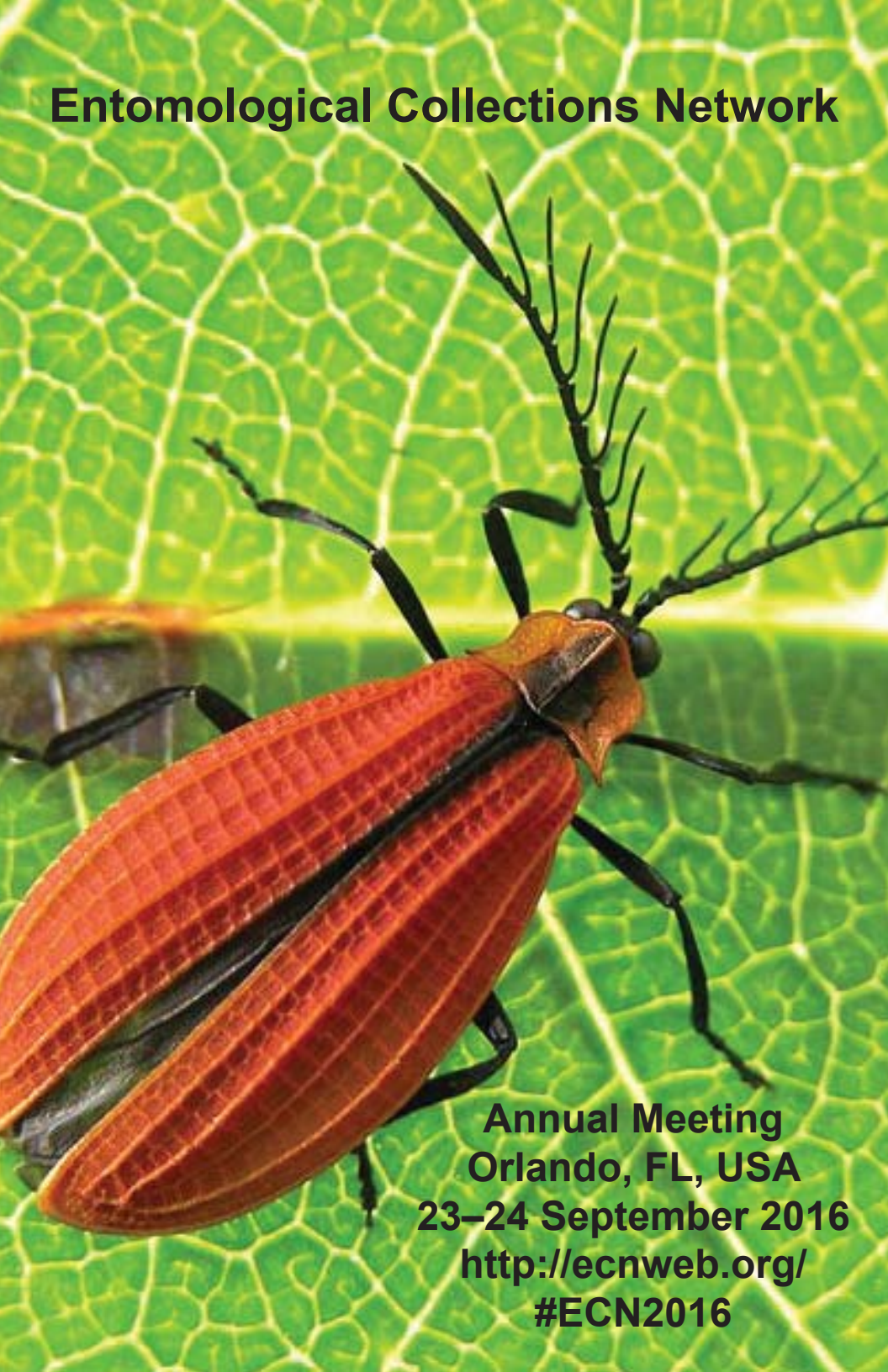
Entomological Collections Network



Annual Meeting
Orlando, FL, USA
23–24 September 2016
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Entomological Collections Network

Annual Meeting

Friday, September 23 – Saturday, September 24, 2016

Rosen Center Hotel, Orlando, FL

#ECN2016 http://ecnweb.org/

Friday, September 23, 2016

Rosen Center Hotel, Grand Ballroom A

7:00–8:15 am **Registration and coffee**

8:15–8:20 am **Welcome and announcements**

CONTRIBUTED TALKS SESSION 1

8:20–8:35 am **BoilerBug: A networked science collaboration between the Purdue Entomological Research Collection (PERC) and the Logansport Indiana Youth Correctional Facility (LIYCF).**

Jennifer M. Zaspel [(1)], Crystal Klem [(1)], Timothy A. Anderson [(1)], Eugenio H. Nearns [(1)], & Lori Harshbarger [(2)]

[(1)] Department of Entomology, Purdue University, West Lafayette, IN, USA;

[(2)] Logansport Indiana Youth Correctional Facility, Logansport, IN, USA

The Purdue Entomological Research Collection (PERC) is the largest and most important collection of insect specimens in the state of Indiana. The PERC has acquired numerous historical collections of great significance to the systematic entomology community. Despite the importance of its holdings, the PERC has remained underutilized by, and in some cases inaccessible to, scientists and other professionals from outside of Purdue. As part of recent digitization workflows and ongoing electronic expansion efforts, we developed a new project, BoilerBug, with the Logansport Indiana Youth Correctional Facility (LIYCF). This collaboration involves data transcription of digitized specimens by high-risk Indiana youth. Current workflows involve hourly student workers with dedicated desktop stations 5–6 days per week. Training workshops are held regularly and the LIYCF instructional staff and PERC curatorial assistants manage quality of data entry. Student workers will receive a certificate of participation in a biodiversity sciences project at Purdue University and electronic expansion efforts in the PERC will be accelerated, ultimately increasing its accessibility to the scientific community.

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We wish to congratulate and thank **Louise Fall** for **60** years of service to BioQuip and our entomological family.

8:35–8:50 am **The University of Arizona Insect Collection (UAIC): Renovation and revitalization**

Wendy Moore & **Gene Hall**
Department of Entomology, University of Arizona, Tucson, AZ, USA

The University of Arizona Insect Collection is a UA core facility that is the cornerstone for entomological research and insect diagnostics for the state of Arizona. The UAIC maintains 2.0+ million insect specimens and is the most comprehensive in the world for the Sonoran Desert Region. To continue its mission of documenting the insect biodiversity of the Sonoran Desert and adjacent regions, the UAIC recently underwent extensive renovations and upgrades, leading to unprecedented expansion and research activity. As part of the Symbiota Collections of Arthropods Networks, the UAIC is digitizing the collection to facilitate making specimen data available to researchers worldwide. The UAIC is involved with the Arizona Sky Island Arthropod Project (ASAP) as part of the first in-depth survey of sky island arthropods in the region. The UAIC is a repository for fossilized arthropods from packrat middens collected in the southwestern United States and northern Mexico, providing data for reconstructing past climates and arthropod communities. The collection is also involved in local outreach, including the UA's Arizona Insect Festival, which attracts thousands of attendees annually. Through the generosity of the Schlinger Foundation, each year the UAIC hosts the Visiting Systematist Program, supporting research in the UAIC and Sonoran Desert. As part of UA's Cooperative Extension Insect Diagnostics Clinic, the UAIC provides identification services to the public, agriculture, medical, veterinarian, forensic, state, and federal agencies.

8:50–9:05 am **Submitted for your consideration, three ideas from the wandering mind of a wondering curator: 1) The Art of Leaving (we all do it, one way or another); 2) Recapturing Bycatch: so we can set it free; 3) Identification—the future of placing name.**

Michael L. Ferro
Clemson University Arthropod Collection, Clemson Univ., Clemson, SC, USA

Three vignettes into the shadowy recesses of deep curation. 1) Leaving can be a very dangerous time for specimens and research but we rarely teach proper methods. Whether the destination is the white-light in a new lab or the black-light sheet in the sky, there are strategies to leave with style. 2) "The best collecting is done in someone else's museum." If we rearrange existing technology,

workflows, and resources we could easily make past and future bycatch available to researchers. 3) You're gonna hate this, but we need to rethink how we "identify" specimens. Placing a "name" is much more complicated than we like to admit and (sigh) it should be more formal (ugh) and maybe even involve standardized forms (That's a terrible idea!).

9:05–9:20 am **A digital species index of the entomology collection at the Academy of Natural Sciences of Drexel University**

Stephen C. Mason, Jr., Isabelle Betancourt, & Jon K. Gelhaus
Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA

The entomology collection at the Academy of Natural Sciences (ANSP) of Drexel University includes approximately four million insect specimens and some of the oldest specimens collected in the western hemisphere in addition to the most important Orthoptera collection worldwide. Like most large entomology collections, no inventory of the species in the collection was available and even a physical search for a species could not insure that all available specimens would be recovered for study. During 2010 – 2014, a species level inventory, funded by the Institute of Museums and Library Services (IMLS), created a master index of all species in the collection. This is now searchable online: http://symbiont.ansp.org/entomology. This species inventory took place in concert with a facility renovation that was funded by NSF. At present, the collection has representatives of 100,000+ species, approximately 10% of the described insect fauna. Additional information collected in the project included number# of specimens per species, type of specimen preservation, type status, and specimen location in the collection. The process of the IMLS project along with future goals will be presented.

9:20–9:40 am **Coffee break**

MEMBER SYMPOSIUM 1:
Collecting Methods

Organizers: Sydney Brannoch [1] & Gavin Svenson [2]
[1] Case Western University, Cleveland, OH, USA; [2] The Cleveland Museum of Natural History, Cleveland, OH, USA

This symposium seeks to highlight various collecting strategies employed by researchers working across a diversity of invertebrate taxa. This will include the unique and interesting aspects of taxon-specific field work. "Tricks of the trade," sampling equipment (both professional and makeshift), and lessons learned along the way will be discussed by our presenters.

9:40–9:55 am **Goldilocks and the scolytine collectors (Coleoptera: Curculionidae): a tale of plants, sharp objects, and timing**

Anthony I. Cognato & Sarah M. Smith
A.J. Cook Arthropod Research Collection, Dept. of Entomology, Michigan State University, East Lansing, MI, USA

Bark and ambrosia beetles occur throughout the world's forests and utilize a diversity of plants and their parts as a food source for larvae and adults. Specimens are often taken at lights and flight intercept traps however these specimens are typically the most common and widespread species. Collection directly from infested plants yields greater diversity and specimens and provides valuable insight into the biology of the species. However, their mostly subcortical lifestyle hides them from the general insect collector and collecting requires training to recognize infested plant hosts. Once found, the beetles are excised from the host with a combination of saws, chisels, pruning shears, hatchets and knives. Much practice is needed to remove the beetles without damage. Collecting bark and ambrosia beetles is at times a haphazard process greatly liable to timing. Most scolytines feed within dead or dying plants and the stage of the decay is critical for the beetles' decision to utilize a particular plant. Thus scolytine collectors often arrive too early or too late at a dead plant but sometimes the plant is just right and yields a taxonomic bounty. Increasing search effort over space and time can give a better estimate of the scolytine alpha diversity for a given area.

9:55–10:10 am **Suction traps quantitatively sample small flying insects**

Colin Favret [(1)], Étienne Normandin [(1)], Alexis Trepanier [(1)], Louisa Babchia [(1)], Laurence Lefebvre [(1)], & David Voegtlin [(2)]
[(1)] University of Montreal, Montreal, Quebec, CANADA; [(2)] Illinois Natural History Survey, Champaign, IL, USA

Suction traps traditionally are approximately 12 m tall and designed to monitor the flight activity of migrating insect pests, especially aphids. Smaller, 2 m suction traps, also originally deployed to collect aphids, are an effective means to collect many other small flying insects. In a pilot study conducted in the Laurentian forest of Quebec, Canada, suction traps collected a larger number and a greater species diversity of Hymenoptera than did adjacent Malaise traps. Because suction traps have a 360˚ sampling radius, the catch of different traps can be quantified and compared more easily than that many other flight intercept traps.

10:10–10:25 am **Carrion baited trapping for nicrophorine silphids: Lessons learned the hard way**

Derek S. Sikes
University of Alaska Museum, Fairbanks, AK, USA

This talk will cover all the key lessons the author has learned (many the 'hard way') about how best to capture nicrophorine silphids using carrion-baited traps. Issues covered will include: avoiding scavenging vertebrates, economics, timing, and how to prepare and transport putrifying flesh safely. Some attention will be given to published solutions the author has never personally tested. Emphasis will be given to what one should not do when attempting to run carrion-baited traps.

10:25–10:40 am **Let us become zorapterists: field surveys in different continents**

Yoko Matsumura [1,2], José A. Rafael [3], Josenir T. Câmara [3], Rolf G. Beutel [4], & Yuta Mashimo [5]
[1] Keio University, Tokyo, JAPAN; [2] University of Kiel, Kiel, GERMANY; [3] National Institute of Amazonian Research (Instituto Nacional de Pesquisas da Amazônia or INPA), Manaus, BRAZIL; [4] Friedrich-Schiller-Universität Jena, Jena, GERMANY; [5] Fukushima University, Fukushima City, JAPAN
An international collaboration between researchers from Brazil, Germany, Italy, and Japan is focused on the biology and evolution of a cryptic and enigmatic insect group, the Zoraptera. This inconspicuous taxon, characterized by two adult morphs (winged and eyed against wingless and eyeless), are presently one of the smallest insect orders, with 40 described species. We reported new distributional records and new species from different parts of the world. We also investigated the mating behavior and anatomy in detail, using innovative morphological techniques. Currently, we focus on the species level phylogeny, mainly using molecular data. For this project we carried out field work in different regions of South America, Asia, and Africa. Our research demonstrates that ground lice can be easily collected and easily reared under laboratory condition. Despite of the great uniformity of the general body morphology, the genitalia and also the mating behavior differ conspicuously among species. These characters provide an exciting opportunity to investigate zorapterans as organisms model in evolutionary biology, with different modes of selection shaping somatic and genital body parts. As obtaining specimens of the small and cryptic insects has repeatedly turned out as difficult and often unsuccessful, we will introduce here how to collect and how to rear zorapterans efficiently based on our experience on different continents. We hope that this will inspire research on this small but exciting group and will encourage you to join the brotherhood of zorapterists!

10:40–10:55 am **Snowfield insects: Collecting omaliine staphylinids at the top of the world**

Logan Mullen & Derek Sikes
University of Alaska Museum, Fairbanks, AK, USA

Alpine snowfields support unique insect communities that often rely on arthropod fallout, windblown insects and spiders from lower altitudes, as their primary food source. Climate change-induced warming is exceptionally severe at northern latitudes and in the alpine, lending urgency to the documentation of insects associated with shrinking snowfield habitats. Here, I review snowfield insect methods and share anecdotes from my experiences collecting snowfield-associ-

ated omaliine rove beetles in Alaska. Although snowfield insect collection often requires relatively simple methods (i.e. forceps, aspirator, or pitfall traps), reaching remote alpine collection sites and identifying microhabitats of target taxa can prove challenging, particularly so when grizzly bears or rock slides are involved.

10:55–11:10 am **Collecting Strepsiptera**

Jeyaraney Kathirithamby
Department of Zoology, Oxford University, Oxford, England, UK

Strepsiptera, an order of entomophagous parasitoids, are one of the most difficult insects to collect, and this has deterred people from studying this fascinating group of insects. There are only two free-living stages in Strepsiptera: the 1st instar planidium larva and the adult male, except in the basal family Mengenillidae, where both males and females emerge to pupate externally from the host. For this reason, collecting Strepsiptera is difficult at the best of times. The free-living males live for only about 6 hours, and females of the suborder Stylopidia are obligate endoparasitoids. Even in the family Mengenillidae where the males and females are free-living, one has to devote several hours to days collecting in order to find even a small number of specimens. There are only a few records of Strepsiptera being caught in sweep nets, thought occasionally free-living males come into traps. It is the latter that have been described, usually as a monotypic species. To obtain the obligate endoparasitic females one has to find the host in order to collect the female, and collection of stylopized hosts has to be timed to the precise day when the female extrudes through the host cuticle. I shall outline the mechanisms of collecting a range of Strepsiptera, including those parasitic in planthoppers, wasps, grasshoppers, crickets, ants and silverfish. Since cryptic species are common in Strepsiptera, it is advisable to collect the host as well. Stylopisation changes the behaviour of hosts, which makes stylopized hosts with endoparasitic female strepsipterans difficult to collect. The most successful way of obtaining material for physiological and molecular studies is by rearing the hosts and infecting them to get the various life history stages. I shall outline mechanisms of rearing Strepsiptera in wasps, leafhoppers and orthopterans.

11:10–11:25 am **Moth vs myth: Multifarious collecting of Lepidoptera**

Paul Z. Goldstein
Systematic Entomology Laboratory, USDA, National Museum of Natural History, Washington, DC, USA

Diversity in size and habits of Lepidoptera, the variety of purposes for which they are collected or "sampled", and their extreme fragility demand a concurrently diverse array of collecting techniques, many of them taxon- or season-specific, and the minutiae of which too voluminous to review here. Instead, I summarize some proven-effective modifications of existing methods and identify straightforward best practices for streamlining and strategizing field work against a backdrop of traditional collecting lore. These range from trivial, Lepidoptera-specific protocols for baiting and sugar-roping, to the more deceptively trivial tools of potentially broader entomological interest. Chief examples surround the pros and cons of killing agents and aspects of multi-purpose light-trapping geared towards targeted systematic and life history studies, generalized survey work, and generating frozen collections of genome-grade tissues.

11:25-11:40 am **Collection techniques and biogeography of grylloblattids and other alpine insects**

Sean D. Schoville
Dept. of Entomology, University of Wisconsin-Madison, Madison, WI, USA

Alpine insects are frequently microhabitat specialists with patchy distributions and narrow seasonal activity patterns. Collecting these insects requires active searching and knowledge of habitat preferences and behavior, although some passive pitfall strategies can be employed. I discuss the range of techniques used to collect snowfield insects (especially grylloblattids) and discuss some unique features of their distribution. Notably, unique trapping techniques for snowfield environments are useful in characterizing occurrence patterns in these species. Based on extensive sampling and genetic data, I discuss biogeographic models that explain the current distribution and pattern of endemism in alpine insects, using grylloblattids as an example. Finally, I discuss how limited museum collections of these species stand in contrast to their importance in understanding global change processes.

11:40–11:55 am **How do malaise trapping, pan trapping, and sweep netting compare for sampling braconid wasps (Hymenoptera: Ichneumonoidea) in grasslands?**

Robert R. Kula [(1)], Marion A. Leménager [(2)], Morgan Rondinelli [(2,3)], Noah P. Winters [(2)], & Abigail A. R. Kula [(4)]
[(1)] Systematic Entomology Laboratory, USDA, National Museum of Natural History, Washington, DC, USA; [(2)] Dept. of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; [(3)] Dept. of Ecology & Evolutionary Biology, University of Michigan, Ann Arbor, MI, USA; [(4)] Dept. of Science, Mount Saint Mary's University, Emmitsburg, MD, USA

Braconid wasps are critical for regulating insect populations in natural and agricultural ecosystems. They are also sensitive to environmental perturbation and thus are indicators of ecosystem quality. Reliable estimates of braconid diversity are critical for understanding how ecosystem management affects braconid populations. Townes-style Malaise traps are commonly used to sample braconids. Other methods for sampling braconids are available, but the current understanding of how effective those methods are relative to Townes-style Malaise trapping is based on anecdotal observation. We sampled grasslands in northern Virginia using Townes-style Malaise traps, SLAM-style Malaise traps, yellow pan traps placed on the ground, as well as elevated 1.22 meters from the ground, and a sweep net to compare braconid diversity sampled using those methods. Collectively, tens of thousands of braconid specimens representing >300 morphospecies were acquired from hundreds of samples. Differences in species richness, abundance, and composition will be presented, and the value of those methods for sampling braconids in grasslands will be discussed.

11:55–12:00 pm **Concluding remarks**
12:00–1:30 pm **Lunch**

CONTRIBUTED TALKS SESSION 2

1:30–1:45 pm **Collections digitization and correctional facilities: an unlikely partnership**

Nicole Gunter & Gavin Svenson
The Cleveland Museum of Natural History, Cleveland, OH, USA

The digitization of museum collections is time consuming and costly, often with limited budgets available to digitize large numbers of specimens. To increase the productivity and reduce costs, efforts are generally focused on recruitment of students, volunteers or through citizen science projects. These participants involved in digitization projects gain a broad set of skills that are highly valued in entry-level positions while the agencies that fund digitization grants value such educational outreach. Here we discuss a novel outreach opportunity between a museum and a local correctional facility aimed to provide a highly desired skill set to pre-release inmates that will ideally improve employment prospects upon release. Historically, the Cleveland Museum of Natural History (CMNH) had partnered with a local correctional facility on an outreach program raising local threatened butterflies. This preexisting relationship prompted discussions between the Invertebrate Zoology Collection at CMNH and wardens at the pre-release correctional facility to establish a new collaboration. The procedures and hurdles of establishing a new project, our digitization workflow, and the benefits of the project for both partners are discussed.

1:45–2:00 pm **Diversity of living arthropods in North American insectariums**

Steven G. Nichols & **Anthony I. Cognato**
Dept. of Entomology, Michigan State University, East Lansing, MI, USA

We surveyed the arthropod diversity in North American insectariums and the factors that potentially associate with the diversity. An electronic questionnaire consisting of 27 questions was sent to members of ECN and zoological groups. As of July 2016, we received 29 responses from a potential pool of at least 150 institutes. 177 species were listed as part of insectarium collections. The most common species across the participating institutions included (in order): 1. *Gromphadorhina portentosa* (common hissing cockroach), 2. *Archispirostreptus gigas* (giant African millipede), 3a. *Grammostola rosea* (Chilean rose-hair tarantula) 3b. *Exatosoma tiaratum* (Australian walking stick). No one factor largely associated with diversity in our preliminary data. Overall, "ease of rearing" and "food availability" tied as the most influential factors when considering the spe-

cies best suited for display followed closely by "time associated with care". The "ability to collect locally" received the lowest consideration when deciding the composition of live collections. There was an association between attendance and advertising. Insectariums with larger attendance averaged 6 advertising venues, whereas insectariums with smaller attendance averaged of 3.7. The most common advertising venues were social media and institution websites. Potentially, increased advertising may improve the attendance in insectariums. However, these observations and conclusions await further analyses upon the completion of data acquisition.

2:00–2:15 pm **The arthropod collection at the Universidad del Valle de Guatemala - 2016**

Jack C. Schuster & Enio B. Cano
Universidad del Valle de Guatemala, Guatemala City, GUATEMALA

The collection was begun in 1975 by Jack Schuster. It now has 45.5 large Cornell and Cal Academy insect cabinets with over 200,000 specimens, including at least 52 primary types, mostly from Guatemala, Central America and Mexico. The collection includes approximately 169,000 pinned specimens, 20,000 in alcohol and 13,730 on slides. About half of the collection is Coleoptera, about half of which is Scarabaeoidea. This includes over 8000 Passalidae, one of the largest and most diverse collections in the world. Lepidoptera is represented by almost 13,700 pinned specimens. Hemiptera (including Homoptera) includes almost 17,400 specimens, Hymenoptera almost 14,200 and Diptera almost 8500, with emphasis on forensic flies (including larvas and pupas, Culicidae and Simuliidae. Schuster has a separate collection (not included in the previous totals) of more than 1200 Guatemalan species of Ichneumonidae, including 690 from his property.

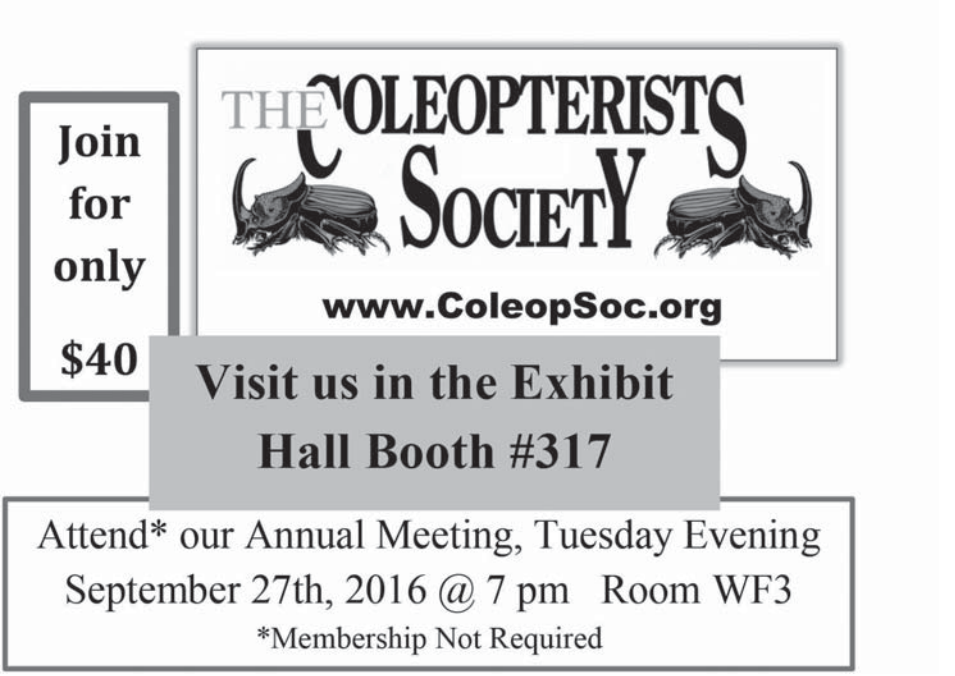
2:15–2:30 pm **The "SWAT Team" approach to collections management at the Field Museum: the process, the pitfalls, and the results**

Crystal Maier
Field Museum of Natural History, Chicago, IL, USA

The Field Museum has recently piloted a project which aims to advance re-curation and digitization which targets key taxa and places nearly all collections management efforts for a limited period of time into targeted collections that have historical, taxonomic significance and are particularly data-rich. The Harry Nelson riffle beetle collection, a collection of

nearly 600,000 specimens with detailed biological and distributional data, was selected as one of the first taxa to be recurated in this manner. Three months in, interns, volunteers, and two collections digitization specialists are well on their way to the completion of recuration, digitization, and photography of types, with over 300,000 specimens databased in 3 months.

2:30–2:50 pm **Coffee break**



MEMBER SYMPOSIUM 2:
Tales from the Field

Organizers: Derek A. Woller [1] & Michael L. Ferro [2]
[1] *Dept. of Entomology, Texas A&M University, College Station, TX, USA;*
[2] *Clemson University Arthropod Collection, Clemson Univ., Clemson, SC, USA*

During the 2015 Entomological Collections Network (ECN) meeting, Max Barclay's talk contained many interesting ideas, one of which was particularly captivating: he mentioned that scientists tend to be reserved when talking about the fun and enjoyment they have at work because how dare they enjoy their job! On the other hand, depending on one's perspective, it might be said that mounting 10,000 specimens isn't all that fun. And, for that matter, neither is reviewing papers, databasing, cracking the whip on student workers, etc. BUT, if you're like us, spending some time out in the field makes it all worthwhile! Who hasn't had that moment out in nature where they found an incredible insect, had a near-death experience, encountered memorable locals, or even just brought back leaf litter that contained amazing things never-before-seen? We bet EVERY one of you has at least one of these tales and we're hoping you can share it with us eventually. For now, though, sit back, listen, and enjoy the entertaining tales from the field told by those who have dared to enjoy their jobs (maybe a little too much in some cases). In case you're curious, presentation abstracts have been withheld to enhance your listening experience because spoilers are no fun. NOTE: Talk times vary in duration and on purpose.

2:50–3:05 pm **Gecko coitus, penetrating Canada and other sordid tales: my love affair with field entomology**

Zachary H. Falin
Biodiversity Institute & Natural History Museum, University of Kansas, Lawrence, KS, USA

3:05–3:10 pm **The unexpected cost of cheap luggage**

Victoria M. Bayless
Louisiana State Arthropod Museum, Louisiana State University, Baton Rouge, LA, USA

3:10–3:25 pm **Expedition to the Cerro de la Neblina tepuis, Venezuela, 1984**

Richard L. Brown
Mississippi Entomological Museum, Mississippi State University, Mississippi State, MS, USA

3:25–3:30 pm ***Pseudactium ursum***

Christopher E. Carlton
Louisiana State Arthropod Museum, Louisiana State University, Baton Rouge, LA, USA

3:30–3:45 pm **Ups and downs of insect collecting in southern Mexico**

Jim Woolley
Texas A&M University, College Station, TX, USA

3:45–3:50 pm **Stuck On a Mountain with No One to Hug**

Richard A.B. Leschen
New Zealand Arthropod Collection, Landcare Research, Auckland, NEW ZEALAND

3:50–4:05 pm **Lucy Evelyn Cheesman (1881-1969) collecting maverick of the South Pacific**

Beulah Garner
Natural History Museum, London, England, UK

4:05–4:10 pm **"Serendipity": a soil washing adventure**

Brittany Owens
Louisiana State Arthropod Museum, Louisiana State University, Baton Rouge, LA, USA

4:10–4:25 pm **Longboats, laksa, moonrats, and pitcher plants: collecting in Gunung Mulu National Park**

Norman Johnson
C.A. Triplehorn Insect Collection, Ohio State University, Columbus, OH, USA

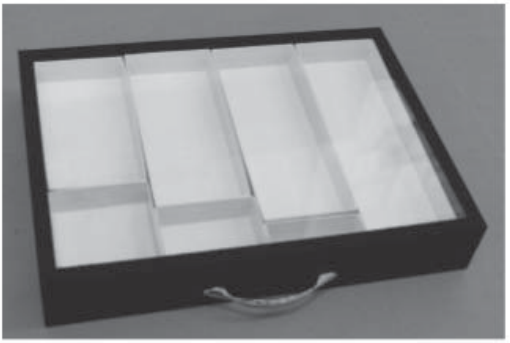
4:25–4:35 pm **Mad dogs and Englishmen...**

Maxwell V.L. Barclay
Natural History Museum, London, England, UK

4:35–4:50 pm **I want the word 'intrepid' in my obituary**

Michael A. Ivie
Montana Entomology Collection, Montana State University, Bozeman, MT, USA

4:50–5:00 pm **Concluding remarks**
5:00–6:00 pm **ECN business meeting**
6:00–7:00 pm **ECN mixer and poster session - poster presenters should plan to be near posters for questions.**
7:00–9:00 pm **ECN annual banquet (Rosen Center, Grand Ballroom C)**



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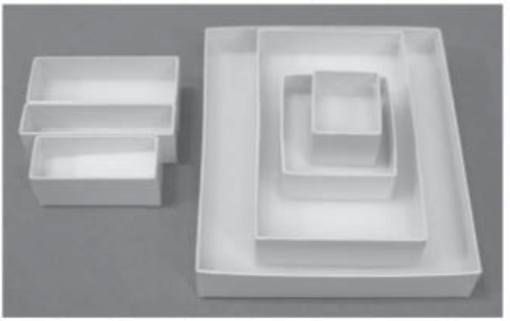

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Saturday, September 24, 2016
Rosen Center Hotel, Grand Ballroom A

7:00–8:15 am **Registration and Coffee**

CONTRIBUTED TALKS SESSION 3

8:15–8:30 am **The Collection Formerly Known as INBio: Current Status, Access and Future Plans**

Michael A. Ivie
Montana Entomology Collection, Montana State University, Bozeman, MT, USA

After a visit to the former INBio collections, I interviewed Directora Rocio Fernandez Salazar, head of the Museo Nacional de Costa Rica. Based on that meeting, as well as with several others involved, I will report on the recent history of the collection, the current status, and plans for the near future, as well as procedure for obtaining and returning loans.

8:30–8:45 am **The new collections facility of the Denver Museum of Nature & Science**

Frank-Thorsten Krell, Jeff Stephenson & David Bettman
Department of Zoology, Denver Museum of Nature & Science, Denver, CO, USA

During most of its history, the Denver Museum of Nature & Science has stored its collections where there happened to be space, with at least 52 spaces and crevices occupied throughout the growing building. None of these spaces were climate-controlled, dust and clutter were common, and pest management was difficult. Since the 1980s, the entomology collection had been housed in a space under the current IMAX Theater. Crowded conditions in the old collections area affected access to specimens and led to an inefficient workspace. The specimens themselves were crowded into drawers, often overlapped or "shingled," causing difficulty of access and potential damage. In 2014, the Denver Museum completed its largest building project in its 116 year history, adding a dedicated single space for all collections. A two story underground facility, the Avenir Collections Center, was built between fall 2011 and early 2014. It comprises 63,000 sq ft of collection and work spaces and mechanical rooms, securing an energy-efficient,

climate-controlled environment. The storage space for entomology grew from 37 Lane cabinets holding 1,069 Cornell drawers to 138 custom-built Delta Design steel cabinets with a capacity of 4,792 drawers. In September 2014 the entomology collection moved into its new home and has been reorganized since, with this work in the Coleoptera part still ongoing. We have now sufficient space to recurate the collection with growth space for many years to come. The entomology part of the project was supported by a collections improvement grant from NSF (DBI-1203367).

8:45–9:00 am **Overview of the inaugural ECN/SysEB co-sponsored collections management workshop: Lessons learned and future directions**

Floyd W. Shockley
Dept. of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, DC

Insect collections are organized and maintained only through specialized knowledge and experience of curators and collections managers which has historically passed directly from one curator or collections manager to the next since no formal program existed to do this in a broader, more comprehensive fashion. In July 2016, the Smithsonian Institution hosted the first in a series of entomological collections management workshops, co-sponsored by the Entomological Collections Network (ECN) and the Systematics, Evolution, and Biodiversity (SysEB) section of the Entomological Society of America (ESA). During the three-day workshop, participants received training in entomological collections management topics including collections management policies, specimen preservation, curation, storage, conservation and outreach. In addition, it provided an important networking opportunity for participants to share their own experiences and perspectives with one another. During this talk, I will provide an overview of the course content and topics, show images from the workshop, and discuss the future of the program, particularly with respect to improvements for next year when the workshop will be taught at Purdue University.

9:00–9:15 am **Worldwide Collections Survey Results – Focus on Entomology: Update from GBIF Task Force on Accelerating the Discovery of Biocollections Data**

Deborah Paul [1], Shari Ellis [2], Siro Masinde [3], Leonard Krishtalka [4], Barbara Thiers [5], Jean Ganglo [6], Eduardo Dalcin [7], & Masanori Nakae [8]
[1] Institute for Digital Information, Florida State University, Tallahassee, FL, USA; [2] Florida Museum of Natural History, University of Florida, Gainesville, FL, USA; [3] GBIF Secretariat, Copenhagen, DENMARK; [4] Biodiversity Institute, University of Kansas, Lawrence, KS, USA; [5] New York Botanical Garden, Bronx, NY, USA; [6] University of Abomey-Calavi, BENIN; [7] Inst. Pesq. Jardim Botânico do Rio de Janeiro, Rio de Janeiro, BRAZIL; [8] National Museum of Nature and Science, Tsukuba City, JAPAN

Perhaps there are some 600,000,000 entomological specimens worldwide, with about 8% of these digitized (Cobb et al 2014). If so, it seems that entomological collections must make up roughly a minimum of 15% to an estimated upper maximum of 60% of the world's total museum specimens (using Ariño 2010 and related estimates). A global collections survey initiated in 2016 resulted in over 600 responses from over 2000 collections. The Global Biodiversity Information Facility (GBIF) Task Force (TF) on Accelerating Discovery of Biocollections Data launched this survey as part of an initiative to make recommendations for future worldwide data mobilization. For respondents by collection type, 3.6% (n=71) selected terrestrial invertebrate collections, 8% (n=161) chose arthropod collections. What percentage of these collection types are databased? Averaging the responses for all arthropod respondents indicates they are 38% databased, and terrestrial invertebrates, 55%. While 14% of all respondents lack a digitized database, only 1% (of n=513) report no plans to digitize. Arthropod respondents report 55% of their databased collections data are published. Across all respondents, the most frequently cited benefits of digitization are increased use of the collections and data, increased exposure, and better knowledge of holdings. Primary impediments to digitization included funding, time, and being overwhelmed by size of the task. We need to prioritize collections digitization strategically to effectively address worldwide, national, and regional needs to support research, education, policy and decision-making. The GBIF TF plans to release a final findings and recommendations report at the end of 2016.

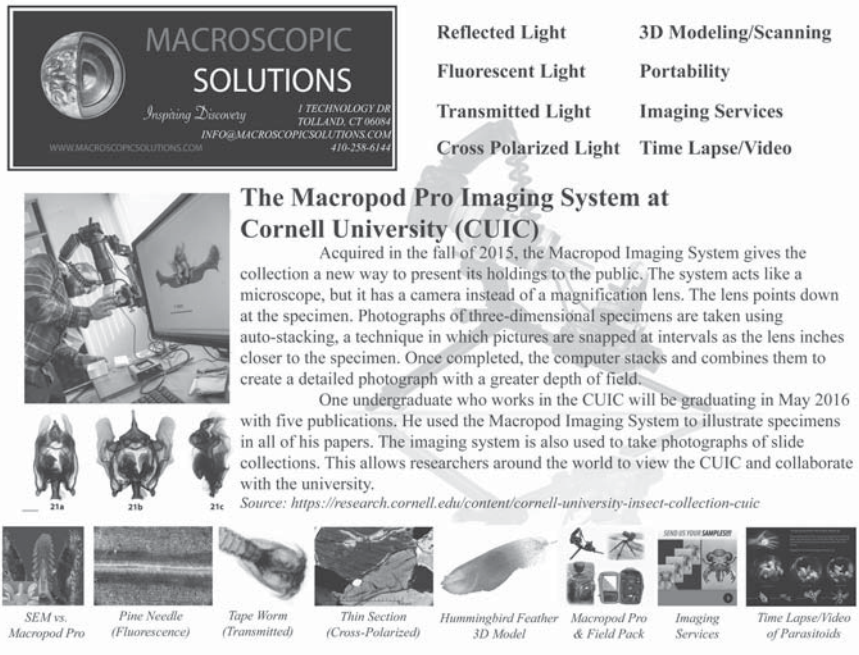
ECN Entomological Collections Network

9:15–9:30 am **Digitization of Platygastroidea in the NationalMuseum of Natural History: Harnessing the intern apocalypse**

Elijah Talamas & Matthew L. Buffington
Systematic Entomology Laboratory, USDA, National Museum of Natural History, Washington, DC, USA

An effort to digitize Platygastroidea in the National Museum of Natural History has thrived for the past three years. Results includes a photographic catalogue of platygastroid fossils housed in the Paleontology department, completion of a photographic catalogue for all determined species of Platygastroidea housed in the National Insect Collection, and the ongoing construction of a SEM library for genera of Platygastroidea. Most of this work was performed by participants in the Smithsonian Internship Program, highlighting the synergy and incredible productivity that can arise when energetic young minds are combined with experienced taskmasters.

9:30–9:50 am **Coffee break**



MEMBER SYMPOSIUM 3:
Collecting & Collections in Megadiverse Countries

Organizer: Guanyang Zhang
Frank F. Hasbrouck Insect Collection, Arizona State University, Tempe, AZ, USA

How to collect insects in Brazil? What is the state of entomological collections and collecting in India? Would you like to learn about Chinese Mesozoic fossil insects and collection-based entomological education and research in China? And are you interested in connecting with entomologists working in Ecuador and Singapore? The "Collections and Collecting in Megadiverse Countries" symposium will address precisely these questions. This symposium will feature 7 talks by 8 speakers based in five countries, representing three biogeographic or four politico-cultural regions: Brazil, Ecuador (Neotropics/South America), China (Palearctic/East Asia), India (Oriental/South Asia) and Singapore (Oriental/Southeast Asia). Speakers will share their unique experiences working in these countries/regions and address critical questions about entomological collections and insect diversity research. This symposium will facilitate communications among scientists from different regions, catalyze new collaboration, and stimulate discussions about the state of entomological collection and collection-based research in some of the most entomologically diverse countries/regions in the world.

9:50–10:10 am **Singapore's new Lee Kong Chian Natural History Museum: Complementing old treasures from the Raffles Museum with thousands of newly discovered species**

Rudolf Meier & Wei Song Hwang
Lee Kong Chian Natural History Museum, National University of Singapore, SINGAPORE

Singapore's old Natural History Museum (RMBR: Raffles Museum of Biodiversity Research) recently moved into a new building and has been renamed the Lee Kong Chian Natural History Museum. It contains a moderately-sized traditional insect collection (ca. 200,000 specimens) with strengths in aquatic insects and butterflies (e.g., 2000 specimens in the recently acquired Fleming collection). It is expected to grow very fast due to an ongoing species discovery project that utilizes the ca. 2 million specimens collected from Singapore's mangrove fragments and freshwater swamps. Approximately 50,000 specimens have been barcoded using a cost-effective NGS sequencing approach. We estimate that these 50,000

specimens represent ca. 2,000 species. We discuss a newly developed specimen sorting pipeline that is cost-effective and yields specimens that are pre-sorted to species-level before being moved to the collection. All specimens come with genetic information and one specimen for each putative species is imaged and made available online (see http://nathist.science.nus.edu.sg/). The ambitious goal is an inventory of Singapore's insect fauna which is likely to contain 50,000-100,000 species.

10:10–10:30 am **Scarabaeid collections in India**

Kolla Sreedevi
Division of Entomology, ICAR-Indian Agricultural Research Institute, New Delhi, INDIA

Scarabaeidae under order Coleoptera comprises of May or June beetles that are diverse and cosmopolitan in distribution. It includes the dung rollers as well phytophagous insects and estimated nearly 30,000 species to occur in World and 2000 in India. Species diversity yields valuable information of the species richness, evenness and abundance of the respective groups, which can throw light on ecology, evolution and phylogenetics. Surveys were made during last four years (2012-15) in different states of India, mainly from Himachal Pradesh, Uttarakhand, Uttar Pradesh, Assam, Meghalaya, Rajasthan, Maharastra, Andhra Pradesh, Karnataka and Tamil Nadu. The scarab collections were made from plains, mid altitude and high altitude through manual scouting and light traps with mercury bulb and black light as light sources. The species diversity across the latitude and altitude were documented and interesting groups that are restricted to certain altitude and latitudes are recorded. Nearly 150 species were collected that belong to Melolonthinae, Rutelinae and Dynastinae subfamilies of Scarabaeidae. The emergence, orientation and navigation patterns for major and abundant species were studied, which differed from species to species. Melolonthines are the dominant ones followed by rutelines. Regular collections were also made at fortnightly intervals in fixed location from May to July for three years (2013-2015) and documented clear species shift in their emergence resulting in temporal distribution of the species thereby avoiding competition and aiding in co-existence of species. The spatial and temporal distributions were worked out across species and regions. The diversity indices, Whittaker's rank abundance and Preston's log plot are worked out for the species composition and abundance across locations. The collections and documentation will strengthen the database, preparation of checklists and catalogues along with new records of Melolonthinae, Rutelinae and certain Dynastinae of Scarabaeidae in India.

10:30–10:50 am **State of Entomological Research and Collections in Megadiverse India**

Krushnamegh Kunte
National Centre for Biological Sciences, Tata Institute of Fundamental Research, GKVK Campus, Bengaluru, INDIA

India faces a major taxonomic impediment due to many decades of neglecting modern systematic research, the inaccessibility of reference materials of taxonomic importance, a culture of academic isolation and fiefdom coupled with a lack of in-house taxonomic expertise. This is compounded by a lack of vision that taxonomic advancement is central to understanding basic evolutionary and ecological processes. In this talk I will describe a roadmap to modernize taxonomy and species discovery that some entomologists and entomological collections are following in India. Specifically, I will show how new collections and citizen science projects are generating geo-referenced data especially around critical climatic transitions, biogeographic barriers and biodiversity hotspots that have influenced diversification and endemism in the Indian Region. Modern morphometric, molecular and phylogenetic studies are being undertaken, which require considerable new work in the field and also substantial collaborations across museums, universities and governments. This should lead to a truly international scientific enterprise.

10:50–11:05 am **Entomological collection, research and education at the Museum of Biology, Sun Yat-sen University**

Hong Pang
Museum of Biology, Sun Yat-sen University, Guangzhou, CHINA

The Museum of Biology at the Sun Yat-sen University (SYSBM) houses over 960,000 specimens in the herbarium and the collections of vertebrates, insects and fossils with a special focus on the flora and fauna of Southern China. The collections are the largest among universities in China. The museum is designated by the Chinese government as a National Second-grade Museum and a National Science Education Base. The SYSBM has 10 full-time researchers and more than 50 graduate students. The insect collection at SYSBM was established during the 1930s by W.E. Hoffmann and J.L. Gressitt. Subsequent workers including Prof. Zhelong Pu have greatly expanded the collection. Currently, the insect collection contains more than 700,000 specimens, making it one of the largest in China. We continue to add specimens to the insect collection through trips in southern and southwestern China, in provinces such as Yunnan, Jiangxi, and Guangdong. The SYSBM is also a center for research and education. Our research

in the Beetle EcoEvol Lab (http://beetlelab.wix.com/ecoevol), led by Professor Pang, focuses on the systematics and evolution of beetles. Active projects include digitization of fossil dragonflies, systematics of Lycidae, comparative morphology of Rutelinae (Scarabaeidae), and reproductive behaviors of coccinellids. We collaborate with international researchers from Australia, Sweden, UK and Russia. Students of insect systematics are part of the doctoral program of zoology and graduates frequently gain employment in government, academia and industry.

11:05–11:25 am **Disparity in biodiversity and taxonomic expertise: Tales from the Museum of Invertebrates, Pontifical Catholic University of Ecuador**

Clifford Keil
Museum of Invertebrates, School of Biological Sciences, Pontifical Catholic University of Ecuador, Quito, ECUADOR

The entomological collection of the Museum of Invertebrates was begun in 1982 by Professor Giovanni Onore. The collection has grown constantly with the addition of student collections, collections related to research projects and targeted collections by foreign collaborators and thesis students. We have nearly 2 million specimens, the majority are pinned specimens stored in drawers in metal cabinets. Additionally, we have a large and growing collection of spiders and aquatic insects in alcohol. The collection is strong in the Coleoptera, Lepidoptera and Hymenoptera. Recent activity has strengthened the collection in the Membracidae, Tabanidae, Formicidae, and termites. We have a collection of about 2000 types. Geographically, the collection is strong the provinces of Pichincha (Quito), Cotopaxi, Pastaza and Orellana where PUCE has a research station. One of our major efforts is to complete an electronic, geo-referenced database. This has been underway for 8 years and is less than half completed. We are currently expanding the collection into the areas of agricultural pests, canopy insects, and under collected regions. Because Ecuador is a megabiodiverse country, foreign collaborators have made important contributions to the development of the collection through determination of specimens and collections in particular regions or taxonomic groups. In most groups, more than 50% of the specimens are undetermined and the collaboration of experts is necessary to obtain reliable identifications. Obtaining research permits has been difficult. Recently we have been successful in streamlining this process and have received approval to export specimens for molecular characterization.

11:25–11:40 am **Collecting insects in Brazil: past, present and challenges for the future**

Cristiano Feldens Schwertner
Universidade Federal de São Paulo, Diadema, SP, BRAZIL

Collecting insects in Brazil can be quite challenging, for both the huge biodiversity of habitats and species, and for legal reasons. I will give an overview of the state of the art of the knowledge on True Bugs (Heteropetera) collections in Brazil, showing results of recent field trips in different biomass/ecosystems in the country, focusing on the Pentatomoidea. Also, I will address legal issues in collecting and challenges for research the True Bug diversity in the country.

11:40–12:00 pm **Silent stories – Mesozoic insect fossil treasures in the Capital Normal University, Beijing**

Chung Kun Shih [1,2] & Dong Ren [1]
[1] *College of Life Sciences, Capital Normal University, Beijing, CHINA;* [2] *Department of Paleobiology, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA*

The insect fossil collections in the Capital Normal University (CNUB, Curator Dong Ren) comprise more than 250 thousands of fossil insects and plants, mainly from the Lower Cretaceous (124 Mya) Yixian and the Middle Jurassic (165 Mya) Jiulongshan Formations of Northeastern China. In addition, CNU Team conducted field work and collected fossils from the Pennsylvanian, Carboniferous Tupo Formation (313 to 318 Mya) of Ningxia, China. Recently, CNU started to collect amber specimens from the Late Cretaceous (99 Mya) of Myanmar. The CNU Team, 3 Professors, 2 Associate Professors, 5 Visiting Professors, 8 PhD students and about 30 Master students, have worked with many corroborators in China and in foreign countries on various joint research projects. In Oct. 2015, the Team moved to a new building with state-of-the-art laboratory, office and fossil storage facilities and advanced instrumentation. We are actively working on sorting, curation and management of fossil specimens. Over the past 15 years, we have documented morphology and taxonomy of more than 17 new families, 325 new genera, and 476 new species in 19 orders of insects, as well as phylogeny and their interactions of insects with coexisting plants, vertebrates and other insects. Three cases of associations with plants: (1). Three families of Mecoptera and one family of Neuroptera, having long-proboscid siphonate mouthparts for consumption of pollination drops from gymnosperm reproductive organs, demonstrated pollination mutualism; (2). Mimesis or camouflage was present in two lacewing taxa (Neuroptera) that imitated co-occurring pinnate gymnosperm

pinnules; (3). A scorpionfly (Mecoptera) involved mimicry of a ginkgo leaf, providing mutual protection to both plants and insects. An example of association with vertebrates: Integumental blood feeding was established by ectoparasites such as early and transitional fleas (Siphonaptera) that possessed long beaks consisting of robust, serrated stylets involved in piercing thick vertebrate integument and imbibing host blood and possibly lymph. Two instances of associations with other insects: (1). Male–male competition and extreme sexual display were represented by two genera of Mecoptera with exaggerated male organs; (2). Reproduction was highlighted by a pair of copulating froghoppers (Hemiptera), hitherto the earliest record of copulating insects. These intricate associations provide an expanded understanding of the ecologic role and evolutionary developments that insects had with other organisms in mid-Mesozoic ecosystems.

12:00–1:30 pm **Lunch**

CONTRIBUTED TALKS SESSION 4

1:30–1:45 pm **Introduction to the Lepidoptera collections at the McGuire Center for Lepidoptera and Biodiversity at the Florida Museum of Natural History**

Andrew D. Warren
McGuire Center for Lepidoptera and Biodiversity, Florida Museum of Natural History, University of Florida, Gainesville, FL, USA

The McGuire Center for Lepidoptera and Biodiversity was established in 2004, when the Lepidoptera collections from the Allyn Museum of Entomology (in Sarasota, FL) and the Florida State Collection of Arthropods (in Gainesville, FL), were combined and moved into a new facility on the University of Florida campus in Gainesville. In the past 12 years, many additional Lepidoptera collections have been acquired, to form what is now one of the world's largest and most comprehensive collections of butterflies and moths. Being a new and rapidly growing institution, several Lepidoptera families remain incompletely curated, and only a small percentage of the specimens have been databased. Despite these challenges, the collection serves as an extremely valuable resource for anyone conducting research on Lepidoptera, and many exciting discoveries have been made among specimens housed in the McGuire Center collections; some of these discoveries will be discussed.

1:45–2:00 pm **Understanding phenology through big data: Case studies in native bees**

Michael C. Orr [(1)], Joan M. Meiners [(2)], Olivia Messinger Carril [(3)], James P. Pitts [(1)], & Terry Griswold [(4)]
[(1)] Utah State University, Logan, UT, USA; [(2)] University of Florida, Gainesville, FL, USA; [(3)] Southern Illinois University, Carbondale, IL, USA; [(4)] USDA-ARS Pollinating Insects Research Unit, Logan, UT, USA

Phenology is integral to the study of bee life history and ecology. When bees emerge from their overwintering nests determines what floral communities they encounter, which, in turn, determines their fecundity. Within bee communities, phenology can influence interspecific interactions, resource partitioning, and even pollination network stability. We investigated phenological trends using elevation, geography, and phylogenetic relationships through heavily-sampled inventory projects and total data, with special attention paid to a subset of better known species. Although general trends were apparent, significant exceptions existed. Unfortunately, our understanding of phenology is confounded by under-

studied factors such as voltinism; extended diapause; opportunistic emergence; and the covariance of abiotic factors like geography, elevation, temperature, and precipitation. Much work remains to truly understand bee phenology. In light of issues such as climate change, which can cause phenological mismatches among bees and flowers, the study of phenology will only become more important with time.

2:00–2:15 pm **TransANIC: Building a dataset of 600 Australian insect transcriptomes**

David K. Yeates, David J. Ferguson, Bryan D. Lessard & Andreas Zwick
CSIRO Australian National Insect Collection, Canberra, ACT, AUSTRALIA

During mid 2015 resources were made available for ANIC to build a dataset of 600 Australian insect transcriptomes within 18 months. Building on protocols established during the 1KITE project (http://1kite.zfmk.de), as well as established collector networks, and developing new techniques and processes, all samples were delivered to BGI Tech Solutions Hong Kong within 12 months. Identified specimens were collected during a series of field surveys beginning in northern Australia in the southern winter of 2015. We developed a modified malaise trap head that allowed us to obtain live specimens for identification and further processing. Almost all samples were endemic Australian Lepidoptera, Coleoptera and Diptera. COI and 28S (D2/D3 region) DNA barcodes were sequenced in ANIC, permitting molecular identification (COI) and tracking (28S) of samples from RNA extraction to assembled transcriptome. Both snap-frozen and RNAlater-preserved specimens were shipped to BGI on dry ice (World Courier) to ensure RNA of highest integrity, which is crucial for the building of high quality RNA-seq libraries. BGI extracted the RNA and provided quality control data for each sample, indicating that 90% of the extracts were of good quality sufficient for library building, irrespective of preservation method or size of the samples (ranging from 1mm to 7cm). Sequencing was carried out by BGI on a HiSeq 4000 system, and sequence data produced for an initial 20 samples are of outstanding quantity and quality. On average, data for each species comprised 71M reads of 100bp length, which equates to 7.1Gbp for each sample. Per base quality values average around 40 (99.99% accuracy) and remain at this level for the entire 100bp. Assembly of reads with IDBA-tran and search for 1886 orthologous genes resulted in the typical number of genes found (~1700), but twice the typical amount of data for each gene, giving evidence to the high quality of the RNA sequences.

2:15–2:30 pm **Preserving and vouchering butterflies and moths for large-scale museum-based molecular research**

Soowon Cho [1,2], **Samantha W. Epstein** [3], Kim Mitter [2], Chris A. Hamilton [3], David Plotkin [3], Charles Mitter [2], & Akito Y. Kawahara [3]
[1] Department of Plant Medicine, Chungbuk National University, Cheongju, SOUTH KOREA; [2] Department of Entomology, University of Maryland, College Park, MD, USA; [3] Florida Museum of Natural History, University of Florida, Gainesville, FL, USA

Butterflies and moths (Lepidoptera) comprise significant portions of the world's natural history collections, but a standardized tissue preservation protocol for molecular research is largely lacking. Lepidoptera have traditionally been spread on mounting boards to display wing patterns and colors, which are often important for species identification. Many molecular phylogenetic studies have used legs from pinned specimens as the primary source for DNA in order to preserve a morphological voucher, but the amount of available tissue is often limited. Preserving an entire specimen in a cryogenic freezer is ideal for DNA preservation, but without an easily accessible voucher it can make specimen identification, verification, and morphological work difficult. Here we present a procedure that creates accessible and easily visualized "wing vouchers" of individual Lepidoptera specimens, and preserves the remainder of the insect in a cryogenic freezer for molecular research. Wings are preserved in protective holders so that both dorsal and ventral patterns and colors can be easily viewed without further damage. Our wing vouchering system has been implemented at the University of Maryland (AToL Lep Collection) and the University of Florida (Florida Museum of Natural History, McGuire Center of Lepidoptera and Biodiversity), which are among two of the largest Lepidoptera molecular collections in the world. And the link to the article: https://peerj.com/articles/2160/.

2:30–2:45 pm **Cataloging 100 Years of Food Protection – The FDA and You**

Peter Gothro [(1)], George Ziobro [(2)], & Jeffrey DeGrasse [(3)]
[(1)] *Food and Drug Administration (FDA), Office of Regulatory Affairs, Pacific Regional Laboratory Northwest, Bothell, WA, USA;* [(2)] *FDA, Center for Food Safety and Applied Nutrition, Office of Food Safety, College Park, MD, USA;* [(3)] *FDA, Office of the Commissioner, Office of the Chief Scientist, Office of Scientific Integrity, Silver Spring, MD, USA*

In 2014, the White House issued a memorandum that, among other things, instructed federal agencies with permanent collections to better support, manage, and increase accessibility of them. In 2015, the FDA issued the Scientific Collections Management and Access Policy (FDA Staff Manual Guide 9005.1), which directs the Agency to implement the White House memorandum. This talk will outline the process of developing a coherent strategy to implement the policy across several large groups that is able to capture relevant regulatory data, catalog it, and where applicable, make available externally. The data may consist of product labeling, specimens (plant material, microbial cultures, recovered insects, filth elements), images (glass plates, slides, photographs, alternate light source images), chemical spectra, and more recently, genetic sequencing information. In addition to developing a strategy to manage this information, the Institutional Scientific Collections Working Group (ISCWG) will find and implement a Collections Management System to manage and utilize these scientific collections.

2:45–3:00 pm **Inselect - applying computer vision to facilitate rapid record creation and metadata capture**

Lawrence N. Hudson [(1)], Elizabeth Louise Allan [(1)], Vladimir Blagoderov [(1)], Natalie Dale-Skey [(1)], Alice Heaton [(1)], Pieter Holtzhausen [(2)], Laurence Livermore [(1)], Benjamin W. Price [(1)], Emma Sherlock [(1)], Stéfan van der Walt [(2,3)], & Vincent S. Smith [(1)]
[(1)] *Natural History Museum, London, England, UK;* [(2)] *Stellenbosch University, Stellenbosch, SOUTH AFRICA;* [(3)] *Berkeley Institute for Data Science, University of California, Berkeley, CA, USA*

Inselect is an open-source desktop application that assists with many of the challenges of dealing with the whole-drawer scans and similar images that are generated by digitization of entomological collections. Available for both Mac and Windows, the software offers a high level of automation by combining image processing, barcode reading, validation of user-defined metadata and batch processing. Originally conceived to work with pinned insect collections, Inselect

has since been applied to several other object types. Within the Natural History Museum, London, for example, the software has been used to process in excess of 100,000 microscope slide images. We will give an overview of Inselect and how it can be integrated into existing workflows. Inselect is under active development - we are very excited to engage with the wider museum community in order to increase the software's capabilities and to make it as broadly applicable as possible.

3:00–3:20 pm **Coffee break**

MEMBER SYMPOSIUM 4:
Bridging the Gap between Literature and Specimens

Organizers: Donat Agosti [1,2], & Lyubomir Penev [3]
[1] American Museum of Natural History, New York, NY, USA; (2) Plazi, Bern, SWITZERLAND; [3] Pensoft Publishers, Sofai, BULGARIA

Two major digitization initiatives concerning entomological collections seem not to meet and are instead developing independently. On the one hand, millions of specimens are digitized, labels converted, and identifiers issued. On the other hand, most of the scientific literature derived from specimen observations as well as the main effort to digitize the entomological (biodiversity) libraries end up stored as semantically unstructured PDFs or as entire journal runs, respectively. Most publishers are maintaining this deep, increasingly obvious rift between collections and literature, not least of which is because specimen identifiers are not included, and the subsections dealing with taxa and taxonomic treatments cannot be easily linked. Building requisite biodiversity knowledge graphs or metrics on the use of entomological collections is consequently severely impeded. In this seminar, based on ongoing efforts to create an Open Biodiversity Knowledge Management System or biodiversity knowledge graph, a plea is made to actively create a bridge between digital specimens and taxonomic literature. The key elements necessary to overcome the previously mentioned limitations remain the taxonomic publications and specimens, but the importance of properly handling subarticle elements like taxonomic treatments and scientific names and their citation will be introduced. The legal aspects of providing open data are outlined. Technical aspects to converting legacy literature and link literature and specimens, both in legacy literature as well as in prospective publishing is demonstrated using TreatmentBank and the suite of Pensoft publications (e.g. Biodiversity Data Journal).

3:20–3:35 pm **Introduction, treatment, TreatmentBank: bridging the gap between literature and specimens**

Donat Agosti
Plazi, Bern, SWITZERLAND

3:35–3:50 pm **Modeling taxonomic literature**

Terry Catapano
Plazi, New York, NY, USA

3:50–4:05 pm **The legal sides of taxonomic publishing**

Will Egloff
Plazi, Bern, SWITZERLAND

4:05–4:20 pm **The future of scientific taxonomic publishing**

Lyubomir Penev
Pensoft Publishers, Sofai, BULGARIA

4:20–4:35 pm **Cybertaxonomy in use**

Torsten Dikow
Dept. of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA

4:35–5:00 pm **Demo: ARPA writing tool**

Lyubomir Penev
Pensoft Publishers, Sofai, BULGARIA

5:00–5:25 pm **Demo: TreatmentBank and GoldenGate: (Online) editing of legacy taxonomic literature and creating links to digital specimens**

Terry Catapano
Plazi, New York, NY, USA

5:25–5:30 pm **Concluding remarks**
5:30–6:30 pm **Inselect demo & workshop**

CONTRIBUTED POSTERS

Poster sessions run throughout the meeting from 7:30 a.m. on Friday, September 23 through 5:30 p.m. on Saturday, September 24. Poster presenters should stand with their posters as often as possible, and must be with their posters during the mixer on Friday evening to answer questions. Posters must be removed no later than 6:30 p.m. on Saturday evening.

Poster 1 **Panning for gold: Hymenopteran trap color preference in a forest clearing**

Ryan M. Carpenter [(1)], Matthew L. Buffington [(2)], Sam Droege [(3)], Michael W. Gates [(2)], Abigail A.R. Kula [(4)], David R. Smith [(2)], & Robert R. Kula [(2)]
[(1)] State University of New York at Geneseo, Geneseo, NY, USA; [(2)] Systematic Entomology Laboratory, USDA, National Museum of Natural History, Washington, DC, USA; [(3)] USGS Patuxent Wildlife Research Center, Laurel, MD, USA; [(4)] Department of Science, Mount Saint Mary's University, Emmitsburg, MD, USA

Water-filled pan traps are commonly used to sample insects, and yellow is considered the best color for collecting a maximum number of species. However, preference has been assessed for relatively few taxa, mostly insects in agroecosystems, using a small number of colors. The objective of this research is to determine if species richness, composition, and abundance differ with pan trap color for select groups of Hymenoptera. Bees, Proctotrupomorpha, Cynipoidea, Ichneumonoidea, and several feeding guilds were analyzed in this study. To address the research objective, insects were sampled using colored and clear water-filled Solo™ bowls placed in a power line easement forest clearing. Bowls were arranged in circular plots, and each plot contained seven different colored bowls. The collection resulted in 25,004 specimens, that have been sorted into 402 morphospecies. Species richness was analyzed for five groups, and abundance was analyzed to reveal that bee abundance was significantly higher in all colors compared with clear and red, but otherwise, significant differences were not observed between any of the other colors. Proctotupomorpha was significantly higher in yellow then compared with all other colors. Evaluating quantified color preferences from a large sampling effort, will allow researchers to make scientifically sound decisions about what colors to select when sampling particular Hymenopteran taxa and feeding guilds.

ECN Entomological Collections Network

Poster 2 **Catching them all: A case study in sampling arthropod diversity**

Michael J. Skvarla [(1)] & Ashley P.G. Dowling [(2)]
[(1)] University of Maryland, College Park, MD, USA; [(2)] University of Arkansas, Fayetteville, AR, USA

As natural environments continue to be altered due to climate change, the introduction of invasive species, and habitat fragmentation, there is an increasing need to survey and document terrestrial arthropod assemblages. While the most effective survey methods have been established for a few specific taxa, such as ants, few studies have attempted to determine the most effective survey methods for the entire terrestrial arthropod assemblage at a site. In order to begin to answer this question, we surveyed a plot in the Boston Mountains of Arkansas using 70 traps of 12 trap types and Berlese-Tullgren extraction of leaf litter and identified 46,146 specimens representing 533 species from an array of higher taxa. We determined that Malaise and pitfall traps collected the most species and specimens and had the lowest similarity of the collection methods tested. We also estimated that 600 and 1000 samples were needed before the species accumulation curves for Malaise and pitfall traps, respectively, become asymptotic.

Poster 3 **Insight into historical drivers of collection diversity: Digital evidence from the entomology type collection at the Academy of Natural Sciences**

Vaughn M. Shirey
Academy of Natural Sciences of Drexel University, Philadelphia, PA, USA; Drexel University Department of Biodiversity, Earth, and Environmental Science, Philadelphia, PA, USA

Specimen metadata has many practical uses for biodiversity scientists and ecologists across the globe; however, viewing the same metadata through a humanities perspective can reveal and confirm interesting insights into historical drivers of collection diversity, both in taxonomic and geographic domains. The relatively unexplored human aspect of natural history collections can prove to be both interesting and informative for quality control. Using data associated with entomology type specimens from the Academy of Natural Sciences, the oldest natural history museum in the New World, we employed various network analysis and Sankey flow visualization approaches to portray the development of the type collection from inception to today and reveal the correlation between history and collection composition. As a result of this analysis, we can hope to characterize our collection and assess collecting biases through time and space – allowing for us to assess the fitness of a dataset to a particular problem among other utilities.

Poster 4 **From field to genome, and beyond**

Chia-Hua Lue [(1)], Matthew L. Buffington [(2)], & Michael Gates [(2)]
[(1)] Dept. of Entomology, National Museum of Natural History, Smithsonian Institution, Washington, DC, USA; [(2)] Systematic Entomology Laboratory, USDA, National Museum of Natural History, Washington, DC, USA

Building specimen databases for field biologists is extremely time and energy consuming. However, these databases are important for organizing information on biodiversity that can be used by the primary researcher, or shared with other scientists and the public. Two specimen capture digital workflows will be reviewed: 1) a project to identify and describe the spatial and temporal variation of local biodiversity of Drosophila (pomace flies; Insecta: Diptera: Drosophilidae) and their Eucoilinae parasitoid wasps (Hymenoptera: Figitidae) along the east coast of North America. Samples were taken from seven locations spanning their geographic range from New Hampshire to South Florida between 2012-2014. More than 3000 individuals were collected and 1500 of these databased following Darwin core standards. Each of these individuals is identified in the laboratory and assigned a unique National Museum of Natural History (NMNH) barcode, which links each specimen to the collection event, taxonomic information, museum information and molecular database; 2): new advances in the collection, preservation, and databasing of specimens for genome-grade tissue have been developed. Specimens are collected, identified, databased, and preserved in liquid nitrogen in the field; the occurrence and observational data is recorded in the NMNH Field Information Management System (FIMS), and the data subsequently parsed into FreezerPro (for tissue management) and K-Emu (for specimen management). Both methods generate digital field notebooks.

Poster 5 **Using TaxonWorks and macrophotography to digitize donated wet insect collections**

R. Edward DeWalt, Dmitry Dmitriev & Matt Yoder
Illinois Natural History Survey, University of Illinois, Champaign, IL, USA

NSF CSBR 14-58285: Natural History: Securing Alcohol Types and Donated Alcohol Specimens at the INHS Insect Collection is underway. The Illinois Natural History Survey received many donations, large and small, from regional institutions and individuals. Two donations of Plecoptera (K. W. Stewart, University of North Texas; S. W Szczytko, University of Wisconsin-Stevens Point) will serve to highlight the usual difficulties for wet material: storage and preservatives of all kinds, deteriorating and oversized labels, unidentified material…..etc. How do we process this material efficiently, e.g. touch it as few times as possible, and

accomplish movement to new storage, capture the label data, and incorporate it into the collection? Anticipating efficiencies of scale we developed a protocol that will allow for the segregation of myriad tasks into relatively rapid subsets. Macrophotography of labels and specimens precedes batch loading of images into our TaxonWorks program. Automated processing of images transfers text to editable windows, dropdown lists normalize label data, onboard georeferencing assigns coordinates and estimates error, and additional passes assign taxonomy. Our work will help to inform others' efforts on how to process donations of wet specimens efficiently and gather large amounts of usable data at the same time.

Poster 6 **Building an accessible weevil tissue collection for genomic research at ASUHIC**

Guanyang Zhang, Sangmi Lee, Bukola Obayomi, Joseph Hunter, Salvatore Anzaldo, & Nico Franz
Frank F. Hasbrouck Insect Collection, Arizona State University, Tempe, AZ, USA

Fresh specimens are essential for genomic research, but are seldom curated by public entomological collections. On the other hand, genomics research laboratories often maintain own collections of molecular quality specimens. Lab-curated tissue collections may not be accessible to the scientific community, even if projects are funded by public sources. To tackle the challenge of making genomic material accessible, we at the Arizona State University Hasbrouck Insect Collection are building a weevil tissue collection using specimens recently collected from more than 10 countries. Long-term accessibility to the broader entomological genomics research community is our goal of the project. We have thus far curated more than 700 species, with a taxonomic emphasis on the Entiminae and a geographic emphasis on Central American and the West Indies. Specimens are collected and preserved in 95% ethanol in -20 or -80 degrees Celsius freezers. A species number beginning with the prefix "WTC" (weevil tissue collection) is given to each species curated. And another catalogue number unique to each specimen is also assigned. We provide images for all species. Duplicate specimens are mounted. There is a large proportion of singletons, i.e., species represented by a single specimen in a collecting event. To make the tissue collection accessible, we use Google Fusion Table and the Symbiota Collections of Arthropod Network (SCAN) database to store and publicize specimen data. Remote identification and loan request is achieved by looking up the fusion table or the SCAN database.

Poster 7 **Updating the British and Irish Hymenoptera Chalcidoidea checklist: mining of the BMNH collection for data**

Natalie Dale-Skey
Natural History Museum, London, England, UK

The British and Hymenoptera checklist was updated in 2016 in a series of publications published in the Biodiversity Data Journal (starting with Broad & Livermore 2016). The last checklist was published in 1978, and the number of recorded Chalcidoidea species was then 1394. The updated checklist has 1754 species recorded, and increase of 22%. For the 2016 checklist, data from reliably identified specimens in the BMNH collections, even if unpublished, was included, and contributed a total of 42 new records (i.e. almost 12% of the new records), to which must be added many additional country-level records.

Poster 8 **The Wisconsin Insect Research Collection – Update on a dynamic and growing research collection**

Craig M. Brabant & Daniel K. Young
Wisconsin Insect Research Collection (WIRC), Department of Entomology, University of Wisconsin-Madison, Madison, WI, USA

The Wisconsin Insect Research Collection (WIRC) is a dynamic and growing resource housing 3,000,000+ curated specimens and more than 5,000,000+ specimens in bulk with material added regularly from donations as well as ongoing taxonomic and regional survey field work. The WIRC is part of the Department of Entomology, University of Wisconsin-Madison, and plays a fundamental role in fulfilling the University's Land Grant Mission of scientific research, education, and outreach. Recent and ongoing digitization initiatives are being embraced to increase awareness and engagement of the collection, both within and outside of the University community. These include the creation of a server-based, specimen-level database in Specify. The WIRC is a primary member of the InvertNet Thematic Collections Network (TCN). One of the InvertNet goals is to provide high resolution, whole drawer images; the WIRC has completed re-curation of the Coleoptera, Hymenoptera, and Diptera as well as scanning of the Coleoptera and part of the Hymenoptera. Diptera and Hemiptera will follow by the end of the summer, to be followed by re-curation and scanning of the Lepidoptera. A new focus-stacking imaging system, built around a Canon EOS 5D Mark III camera, was added this year to augment an outdated AutoMontage-based setup. The WIRC joins other natural history collections at the University of Wisconsin by participating in a very popular Museum Studies class. Student interns from

this course, along with direct-study students and volunteers, join a growing team of enthusiastic and talented people that are helping us solidify the WIRC's primary role as a vital, dynamic, and growing entomological resource for the global research community.

Poster 9 **Collecting versus scientific outreach - a fine balance; The Natural History Museum and Operation Wallacea in Dominica**

Beulah Garner & Erica McAlister
Natural History Museum, London, England, UK

The Natural History Museum holds a world class collection of insect fauna with considerable geographic representation as well as spanning over 250 years of collecting. Our active collecting policy means we continue to collect to build and indeed expand upon our scientific and historical legacy. However, in ever more restrictive financial times, the costs of expeditions to remote localities can be prohibitive. Also, with the UK obligations to the Nagoya protocol, the obtaining of permits can also dictate our success at access to biodiverse areas around the planet. Coupled with this the Museum has a societal obligation to educate future generations on natural history and its importance to society, and our place in the natural world. For two years the Museum has partnered with a conservation organisation which has helped us to achieve all of the above goals. We have successfully participated in expeditions to Honduras, British Guiana, and Dominica. Here we report on the successes of this partnership in Dominica. Coupling scientific outreach with collecting expeditions can benefit collections enhancement, though it is not without its pitfalls (pun intended). Operation Wallacea is a network of academics from European and North American universities, who design and implement biodiversity and conservation management research expeditions.

Poster 10 **Crowdsourcing carabid collections**

Bryan M.T. Brunet [(1)], Danny Shpeley [(2)], & **Felix A.H. Sperling [(2)]**
[(1)] Museums and Collections Services, University of Alberta Museums, University of Alberta, Edmonton, Alberta, CANADA; [(2)] E.H. Strickland Entomological Museum, University of Alberta, Edmonton, Alberta, CANADA

The University of Alberta's E.H. Strickland Entomological Museum contains over 200,000 carabid beetle specimens, of which more than three quarters (173,653) have had their collection information digitized and made publicly available. Here, we describe our efforts to digitize the remainder of our ground beetle

holdings for North America as part of a continent-wide initiative with collaborators in the United States and Mexico. Our goal is to make carabid biodiversity information publicly available to researchers investigating the effects of climate change on the diversification and ecological dynamics of this widely studied insect family. Over 20,000 carabids from the University of Alberta's E.H. Strickland Entomological Museum were photographed along with their collection labels. Two part-time undergraduate students completed this work over a period of 23 weeks using standards and guidelines developed by the University of California Berkeley's Essig Museum of Entomology. Transcription of collection label data from the images is now actively being crowdsourced to an online community of volunteers using the Notes from Nature project. Upon completion of data transcription, data will be checked for quality control, re-integrated with our local database, and published to Canadensys, the Global Biodiversity Information Facility (GBIF), and iDigBio data aggregators to ensure persistent public availability for researchers.

Poster 11 **The ECOSUR Lepidoptera collection: assembling a framework for the knowledge of butterflies and moths of the Yucatan Peninsula**

Carmen Pozo, Noemí Salas & Blanca Prado
El Colegio de la Frontera Sur, Chetumal, Quintana Roo, MEXICO

The ECOSUR Lepidoptera collection is located at El Colegio de la Frontera Sur a federal research center sited in Chetumal, Quintana Roo, Mexico. This collection was established in 1990 and its main goal is the study of Lepidoptera biodiversity from the Southeast of México mainly from the Yucatan Peninsula. In the beginning, the studies were focused in butterflies, but since 2008 the collection includes moths and immature stages. Today the collection reaches 101,446 specimens of butterflies, 15,320 moths, and about 8,000 caterpillars. The taxonomical representation includes 34 families, 726 genus and 1645 species (550 Rhopalocera and 1031 Heterocera), and 64 morphospecies that need the participation of specialist for the identification. For the specimens' identification, we have collaboration with specialists for some groups; also some specimens were identified using molecular sequences through Barcoding. Since the beginning, the collection has a database but is until 2014 that we started a project of the full digitalization, that includes the photography of some specimens representing all the species in the collection. All the data is managed through BIOTICA 5.0 a software developed by CONABIO (a Mexican government agency) which has several modules like curatorial, geographic, taxonomic and ecologic, even it includes a module for specimens loans. Today we already have 96% of the collection digitalized. The information includes geographical coordinates that allow the creation of distribution maps of the species in the Yucatan Peninsula. The next step in the collection is to make more accessible the information through the internet.

Poster 12

Alaska Lepidoptera Survey: The history and future of the Kenelm W. Philip Lepidoptera Collection

Kathryn M. Daly & Derek S. Sikes
University of Alaska Museum, Fairbanks, AK, USA

Dr. Philip documented the Beringian Lepidoptera fauna from 1966-2013, with the help of over 600 volunteers. Dr. Philip developed one of the first software packages, RangeMapper, specifically designed to produce maps of species distributions, which was sold to scientists across the world. In total, Dr. Philip's efforts led to the collection of over 111,000 specimens of Beringian Lepidoptera. These specimens, currently housed at the University of Alaska Museum, with the majority of the pinned specimens destined to reside in the Smithsonian Institution (NMNH), are a priceless representation of historical Beringian Lepidoptera species composition and will be a valuable resource for future generations of Arctic researchers. An update on the current and planned future status of the collection, along with photos, is presented.

Poster 13 **A user-friendly key to North American Cenozoic fossil insects**

David M. Zelagin [(1)], Cesar Nufio [(2)], Dena Smith [(3)] & Talia S. Karim [(1)]
[(1)] University of Colorado Museum of Natural History, Boulder, CO, USA; [(2)] National Science Foundation, Ecology Division, Arlington, VA, USA; [(3)] National Science Foundation, Sedimentary Geology and Paleobiology Section, Arlington, VA, USA

Flattened, insect compression fossils preserved in shale deposits can be difficult to identify by members of the public and collections staff alike. This is because it is common for important morphologic features to be missing due to lack of preservation or due to the orientation of the specimen (e.g., dorsal view only). With these constraints in mind, we created a mobile app using the Lucid key software. A benefit of using Lucid is that the keys are interactive and adaptable, meaning that users can select from a list of available characters to use to narrow down identifications. This key focuses on the insect groups that are most commonly preserved in the Cenozoic lake deposits of North America. The key also includes the most readily identifiable and commonly preserved morphological characteristics, provides information on the fossil history and biology of the group and utilizes a growing database of images of modern and fossil specimens for reference. The fossil insect images come primarily from the Green River and Florissant Formations of Colorado and were imaged through the Fossil Insect Collaborative TCN project. Anticipated audiences for the key are amateur fossil hunters, general insect enthusiasts, and collections staff who are new to working with Fossil Insect material.

Poster 14 **Collecting methods for off-host ticks**

Brenda Leal & Donald B. Thomas
Tick and Biting Fly Research, USDA, Edinburg, TX, USA

Tick are considered important arthropods, because of their ability to vector a large range of diseases in humans, companion animals, livestock, and zoonoses. In both multiple and single host ticks, their life-cycle consist of 80-90% in the environment off-host. Traditional off-host collecting methods involve drags, flags, and CO2 traps. We experimented with mechanical devices including vacuums (Tick Vac), and remote-controlled robotic vehicles (Tick Bot). Results were comparable to traditional sampling methods. Tick abundance was episodic; this was reflected in the tick numbers recovered upon the sample collection.

Poster 15 **Digitization at the McGuire Center for Lepidoptera and Biodiversity**

Geena M. Hill, Stacey L. Huber, Andrei Sourakov, Deborah Matthews, Chris A. Hamilton, Hannah L. Owens, Jackie Miller, Andrew Warren, Jaret C. Daniels & Akito Y. Kawahara
McGuire Center for Lepidoptera & Biodiversity, Florida Museum of Natural History, Gainesville, FL, USA

The McGuire Center for Lepidoptera and Biodiversity serves as both a research facility and a center for education and outreach. Since opening in 2004, the facility has accumulated several million moth and butterfly specimens. Here we present the digitization pipeline for one of the largest collections of Lepidoptera in the world. The current digitization efforts at the Center are part of several NSF-funded projects, including LepNet (Lepidoptera of North America Network, http://lep-net.org/), ButterflyNet (http://www.flmnh.ufl.edu/mcguire/kawahara/butterflynet/), among others. We discuss mass digitization of specimens, label transcription, and data ingestion.

Poster 16 **Permanent storage of Lepidoptera in glassine envelopes: reducing resources while optimizing accessibility**

Luc Willemse & Max Caspers
Naturalis Biodiversity Center, Leiden, THE NETHERLANDS

In terms of amateurs and professionals studying and collecting insects, Lepidoptera (butterflies and moths) represent one of the most popular groups. It is their popularity, in combination with wings being routinely spread during mounting, that results in Lepidoptera often taking up the largest number of boxes and amount of space in entomological collections. As space, time and money are commodities museums want to use as efficiently as possible, any process that results in saving either one forms a welcome and timely addition to collection management. Here we propose a means to permanently store unmounted air-dried Lepidoptera in glassine envelopes. The described workflow entails registration and graphic documentation of the specimens to ensure accessibility of the data, and limits mounting to those specimens for which mounting is considered essential. The entire workflow can be carried out by non-specialist volunteers. Additionally, by disclosing data and images via internet, specialists worldwide may assist with identifications. Although only tested for Papilionidae, results suggest that the workflow and permanent storage in glassine envelopes described here can be applied to most groups of Lepidoptera.

Poster 17 **Emergency preparedness and recovery in natural history collections: What is the status?**

Amber Workman [1] & Katrina Menard [2]
[1] University of Oklahoma, Norman, OK, USA; [2] Sam Noble Oklahoma Museum of Natural History, University of Oklahoma, Norman, OK, USA

Natural History Museums are tasked with the responsibility of holding and protecting thousands if not millions of specimens and artifacts for perpetuity. Recent natural and man-made disasters have affected museums and their holdings, and have drawn attention to the lack of preparedness documentation and recovery protocols in many museums. To understand the extent of this, we surveyed as many Natural History Museums in the United States as we could for documentation and other evidence for emergency preparedness and recovery documentation and protocols. We found that the majority of museums do not have formal procedures in place. Further, we compare the documentation to the Emergency Preparedness and Recovery procedures in place for the Sam Noble Oklahoma Museum of Natural History, which has extensive documentation on both areas due to its geographic location.

Poster 18 **Oklahoma entomology revitalized: the effects of the National Science Foundation's Collection in Support of Biological Research Grant on the Sam Noble Oklahoma Museum of Natural History**

Katrina Menard [1] & Karl Roeder [2]
[1] Sam Noble Oklahoma Museum of Natural History, University of Oklahoma, Norman, OK, USA; [2] University of Oklahoma, Norman, OK, USA

The Sam Noble Oklahoma Museum of Natural History received a National Science Foundation Collections in Support of Biological Research grant in 2015 to install a compactor system in the collections space, replace all the derelict cabinetry, drawers and unit trays, and unite the collection in one organized, expandable collection. We present the biggest improvements and achievements to our collection, including the organization and unification of the largest group of insects in our collection: the Coleoptera. Further, with our near-completion of cataloging and databasing of all of our insect specimens, we highlight the fact that all of our specimens will not only be more accessible physically, but digitally.

Poster 19 **First steps of forensic entomology in Sicily: Lava fields and volcanic caves**

M. Denise Gemmellaro
Department of Entomology, Rutgers University, New Brunswick, NJ, USA

Sicily is a major Mediterranean island and one of the largest regions of Italy; it contains a variety of ecosystems, ranging from rocky and sandy coasts to volcanic formations and grassy plains and valleys. Also numerous are the volcanic and karst caves scattered throughout the island. Unfortunately Sicily is also one of the most violent Italian regions in terms of organized crime and related violent acts. These characteristics have stimulated our interest in offering a deeper knowledge of the insects of forensic importance and an additional investigative tool to Sicilian law enforcement agencies.. We also want to explore the potential insect activity on decaying matter in dark subterraneous environments. We started our study in the area surrounding Mt. Etna, the tallest volcano in Europe (over 3000 m). The first study site was set up around the town of Bronte, on the northwestern side of Mt. Etna. We placed four carcasses (2 pigs and 2 chickens) on a field of ancient lava, facing west. We visited our site twice daily and sampled at least once daily. Two of the carcasses were predated, making it impossible to collect pupae from the field; we were able to collect pupae from the remaining two. The predominant species observed was *Calliphora vicina*, which was the first to colonize the carcasses; less abundant but still present were *Lucilia* sp. We then placed two pig carcasses and one liver trap at different depths within a cave in proximity of our original site. No activity was observed for 20 days; then, *C. vicina* was observed on one of the carcasses, laying eggs in complete darkness at a temperature of 6.4° C. We monitored the development of these eggs, noting the long duration and high mortality. This preliminary trial made it possible to better understand the local requirements and permits for forensic scientific trials in Sicily. It also allowed us to improve our experimental design and helped map new sites and caves where we are expanding our research to collect new data on the distribution of forensically important insects in Sicily and to further explore their activity in caves.

Poster 20 **An integrated database for type specimens of Taiwanese insects is on the way**

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[(1)] Dept. of Biology, National Museum of Natural Science, Taichung, Taiwan; [(2)] Dept. of Operation, Visitor Service, Collection and Information Management, National Museum of Natural Science, Taichung, Taiwan; (3) Dept. of Entomology, National Taiwan University, Taipei, Taiwan; (4) Dept. of Entomology, National Chung-Hsing University, Taichung, Taiwan.

Since the 1860s, many foreign naturalists and collectors have been attracted to Taiwan because of the rich biota on this island. Tens of thousands of insects were collected and brought back to the collectors' countries or sold to famous museums. Some of the specimens, when published as a new species, became taxonomically significant type materials but were scattered around the world. A six-year project started from 2007, National Museum of Natural Science (NMNS) in Taiwan was funded by Minister of Science and Technology (formerly National Science Council) to build up a digital database for insect type specimens deposited in foreign countries. Fifteen museums & institutes from nine countries have been visited, and 3,496 type specimens of 2,250 species in 207 families and 15 orders have been imaged including the results of a five-year collaboration with Senckenberg Deutsches Entomologisches Institut (SDEI). Among them, 1,454 type materials belonging to 807 species, 109 families and 11orders have been made available for public access on the both websites of "Type Specimens of Insects from Taiwan" in NMNS and "Digitization of Historic Museum Collections of Taiwan Deposited in Foreign Countries" collaborated with National Taiwan University. Unfortunately, the project was terminated in 2012 and the funds were no longer available. For user's convenience, the type specimens databases built up independently by several academic institutions in Taiwan should be integrated including the information and images recruited from abroad, or digitalized types deposited in local institutions. NMNS takes responsibility to build up an integrated database of type specimens of species described from Taiwan, and tries to create borderless insect type material database for online services.

Poster 21 **The good, the bad and the ugly: the wild, wild west of specimen databasing**

Luciana Musetti, Sara Hemly, Matt Elder, & Norman F. Johnson
Charles Triplehorn Insect Collection, Dept. of Evolution, Ecology & Organismal Biology, 1315 Kinnear Rd., Columbus, OH 43212-1157 USA

Digital capture of data in insect collections largely lags behind comparable efforts for plants and vertebrates. This is often attributed solely to the much larger scale of entomological collections. Unfortunately, few data are available to critically assess the bottlenecks in the digitization process so as to develop new tools and procedures to address this lag. The time needed for the individual steps in digitization were recorded for two large sets of specimens: a generalist collection of Carabidae and a specialist's collection of Tenebrionidae (Coleoptera), both limited to the Americas. The time investment for the major steps – data transcription, georeferencing, nomenclatural updating – were compared. Transcription of data is a significant component of digitization, but it is not the only one. Georeferencing is particularly troublesome outside of the United States and Canada, and remains a major barrier. A taxon-based clearinghouse of collecting localities, geographic coordinates, and their sources is needed for the community to benefit from its collective efforts. Often unappreciated, though, is the difficulty in determining the current specialist opinion on taxonomic names and their status. Despite the widespread efforts of data aggregators, the low priority of taxonomic cataloging among funding agencies and even the scientific community is a major roadblock to a true catalog of life.

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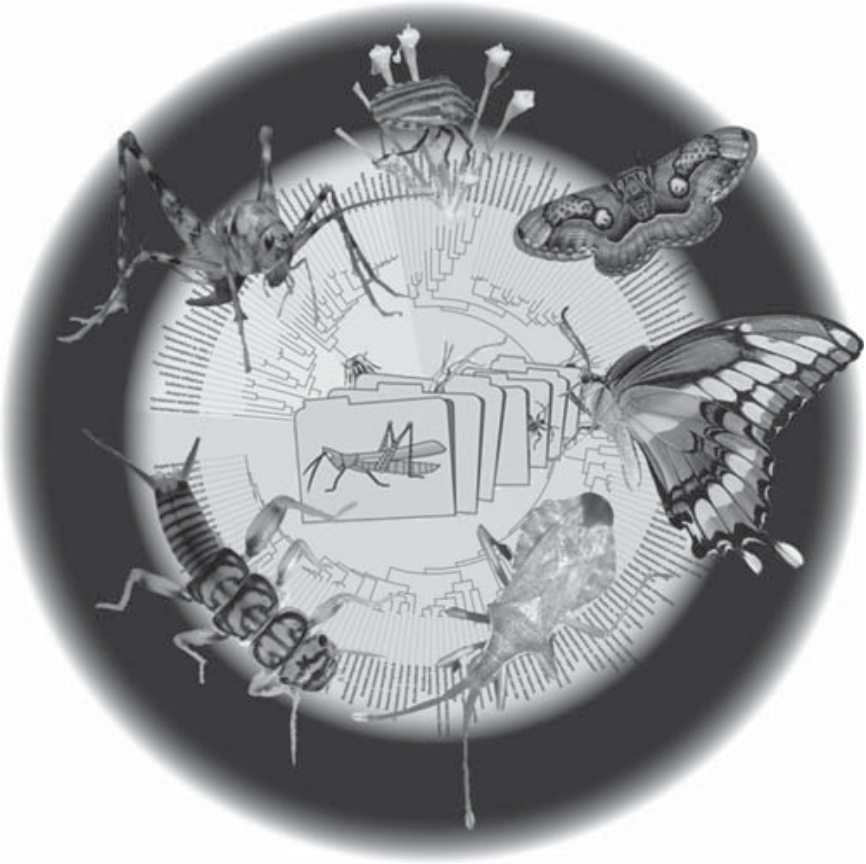
We are also very thankful for our continued partnership with iDigBio and the Entomological Society of America (ESA).



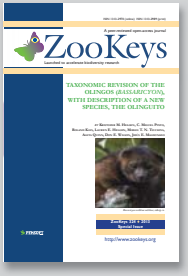
Species File Group

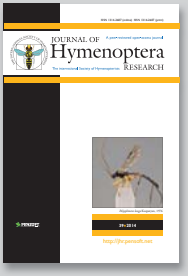
The Species File Group (SFG) is a collective of specialists whose broader goals are to advance the field of biodiversity informatics. Taxonomic databases and workbenches are the major focus of our work:

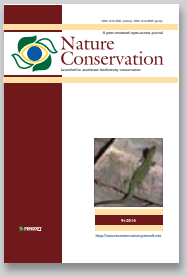
TaxonWorks http://taxonworks.org
3i http://dmitriev.speciesfile.org/
Species File Software http://help.speciesfile.org
Mx http://mx.phenomix.org

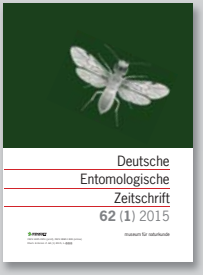
Notes

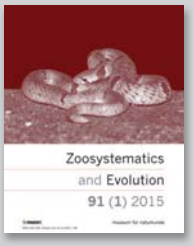
Notes











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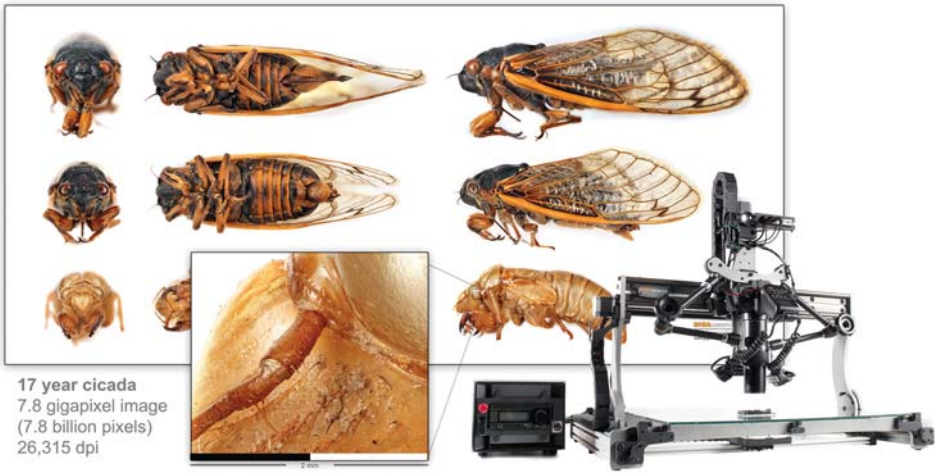

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