

Colorado State University

College of Agricultural Sciences

C.P GILLETTE MUESUM OF ARTHROPOD DIVERSITY

2024 Newsletter

A Year in Review: Collaboration;
Appreciation; Innovation

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Museum in Numbers - 2024

Home to nearly 5 million individual insects and other arthropods, the collection within the C. P. Gillette Museum of Arthropod Diversity is one of the most comprehensive in Colorado and throughout the Rocky Mountain Region.

The meticulous curation of a wide breadth of specimens has facilitated collaborations with research projects beyond the state, such as the Montana Moth Project and the iDigBees Biogeography Database. The thorough process of transcribing the museum's collection into an online database has expanded the museum's outreach on arthropod research, being cited in 271 studies since 2020.



Digitized Over 27,000 Specimens

Including 23,000 digitized bee records and 4,000 moth entries. Data of arthropods from the museum are uploaded to Ecdysis and the Global Biodiversity Information Facility.



Visited by 736 Guests

Including students (undergraduate and beyond), scientists, professors and other CSU faculty, community members, and more who sought out the museum for research, formal tours, or to further their knowledge on a topic of interest.



Added Over 18,000 New Specimens

With around 12,000 moths from the Montana Moth Project and around 6,000 other insects- a majority being beetles -from Oklahoma State University. The museum also added 800 new books to its Bruner Library.



Developed a Team of 93 Individuals

With the help of generous donors, CSU's Department of Agricultural Biology, and an NFS grant for iDigBees, 12 student interns, two graduate students, and one post-doc received funding. The remaining individuals define the museum's dedicated volunteer force.



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Our Mission

Since its founding in the late 1800's, the museum has remained committed to its mission of discovery, preservation, and promotion of the Rocky Mountain Region's diverse arthropods. Members of the public, the scientific community, and Colorado State University can engage with the museum through tours, internships/volunteer programs, and research collaboration to further acknowledgement of



arthropods as critical species across the globe. The C. P. Gillette Museum of Arthropod Diversity acknowledges its presence as an institution which serves to uphold CSU's land-grant mission of inclusive

learning, collaborative engagement, and intentional discovery. These values manifest in the museum's four pillars of value- curiosity, excellence, inclusion, and community. This newsletter serves to highlight the accomplishments of the museum's team throughout 2024. The establishment of new collaborations emphasizes the museum's current and potential contributions to the CSU community and beyond.

Celebrating Paul Opler (1938 - 2023) “My legacy is my family, my students, and my published works.” - Paul Opler, 2017

The C. P. Gillette Museum of Arthropod Diversity is forever indebted to the dedicated effort of Dr. Paul Opler, a passionate entomologist who strived to further the museum's capacity to make arthropod education accessible through collection expansion and specialized publications. Opler joined CSU as both a special appointment professor and an Assistant Director of the museum. His dedication to both positions had

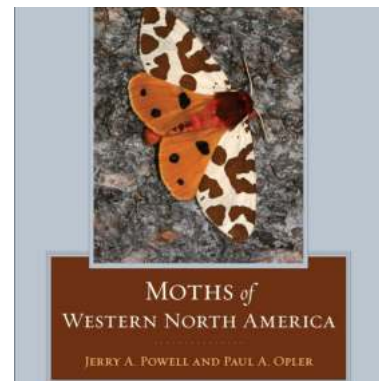
profound impacts on both student research and the museum's expansion. These achievements followed Opler's retirement from a phenomenal career in entomology with over 150 publications in the form of books, coauthored chapters, and peer reviewed journal articles. Many of these publications are prominent works in the field of Lepidoptera and field ecology research, garnering hundreds of citations. Opler



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was also an active member of the Entomological Society of America. One of his notable contributions in this community being his role as the first editor of *American Entomologist*. A celebration of Opler's career hangs on a wall near the entrance to the museum's annex. It highlights the influential books he's written and the many pamphlets and articles he's developed. His participation as an active and passionate member of the entomological community leaves behind a legacy that will inspire current and future members of the field for years to come.



Paul Opler and a lepidopteran spreading board. Opler's novel with Jerry Powell, *Moths of Western North America*. Paul Opler and Evi Buckner-Opler in front of his career celebration wall at the museum's annex.

Presidential Visit

The Arthropod Museum was delighted to provide a tour in October for CSU President Amy Parsons, Dean of Agricultural Sciences Carolyn Lawrence-Dill, and Interim CEO Nathalie Brochu of Butterfly Pavillion. Staff and volunteers shared insight into the museum's vast collection and current research collaborations. The visit followed the significant, newly-founded CSU-Butterfly Pavillion partnership. This aims to uplift invertebrate research and education opportunities.



[From Left to Right in Above Image]: Carolyn Lawrence-Dill, Chuck Harp, Marek Borowiec, Amy Parsons, Nathalie Brochu.



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Hot off the Microscope: Montana Moths

Silence drapes the Montana plains as night falls. The serenity is accompanied in tune by the crunching of footfall as a group of individuals march towards their final destination. The growing symphony is complete once a moth-catching system is set up, and the admired soloist—a joined underwing moth—bellows a tune from its flapping wings before falling into the collection bucket. The evening described is one of many routinely experienced by volunteers of the Montana Moth Project, a moth collection effort founded by the Northern Rockies Research & Educational Services, Inc. The research project was established to document the distribution and diversity

“You don’t know what you lose if you don’t know what was there in the first place.”

of moths across Montana’s 56 counties. As the fourth largest state in the nation, the apparent lack of moth population and distribution records demanded an opportunity to further understand Rocky Mountain West moths before more species are lost. “You don’t know what you lose if you don’t know what was there in the first place,” a sentiment expressed by Chuck Harp, the collections manager of Colorado State University’s C. P. Gillette Museum of Arthropod Diversity in a 2024 NPR ‘Short Wave’ segment. This driving force behind the research project facilitated the early collaboration between the Arthropod Museum and Northern Rockies Research & Educational Services, Inc. With the help of on-site volunteers, Montana moths are collected at



Undergraduate Olivia Lucas organizing a box of Montana Moth specimens.



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night, frozen, packaged, and shipped to Fort Collins, Colorado for further processing. Museum volunteers then identify, pin, and curate organized boxes of moths to establish a permanent record. The museum provides organized data that's then utilized for analysis of current moth ecology in counties throughout Montana and their potential shifts over time. In the past 5 moth-gathering seasons, the museum spread, labeled, databased, and imaged around 39,000 moths for this project. Within this wide breadth of individual specimens,

1,400 species have been identified. Two previously unidentified moth species were also discovered this past year in the collections sent to the museum, and at least 4 sites in all 56 Montana counties have been processed through the museum. The established relationship between the Arthropod Museum and the Montana Moth Project will continue to yield exciting breakthroughs for Montana's moth ecology while providing volunteers unique opportunities to acquire curation skills.





Hot off the Microscope: Ant Phylogeny

It may sound challenging at first to find the connection between a miniscule insect, like the ant, and an ever-growing tree. To aid in this puzzle, imagine the roots of the tree as the ancestral foundation supporting all currently extant ant lineages. They eventually converge into the trunk and bark of the tree, traveling upwards and expanding out into numerous branches. Some branches remain fully independent in their growth, while two or more share an origin node. And at the very tip of each branch is the indication of a unique, individual ant species.

In 2019, C.P Gillette Museum's current director, Dr. Marek Borowiec, began collaborating on an international effort to create the most comprehensive ant phylogenetic tree to date. Utilizing genomic data, Dr. Borowiec and 6 other researchers described the evolutionary relationship between 277 ant genera across the 16 currently extant subfamilies. The 5-year research project, as described by Borowiec, was two-fold in its purpose. It firstly served to provide other ant researchers the "latest, greatest, and most comprehensive" phylogenetic tree to date. "any question of ecology or evolution of ants requires some knowledge of their evolution, so this provides a backbone or framework for that kind of work," Borowiec described in a brief interview. Borowiec and colleagues expect their phylogenetic tree

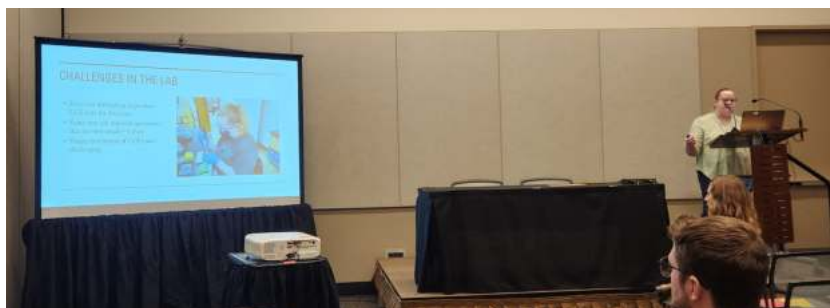
"This is the kind of research that museums are really invaluable to because some of our specimens... were only available as a single museum specimen...they are just so rare."



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to be the primary source for ant research for the immediate future. He explained the second objective of this research as “-making people who build phylogenies or use evolutionary trees a little bit more aware of the fact that it can be really hard to do that. Even with huge amounts of data that comes from genomic data, there still might be issues and difficulties in building trees.” When describing the process of gathering genomic data, Borowiec highlighted the intricate role museums play within such studies. “This is the kind of research that museums are really invaluable to because some of our specimens that are included in the evolutionary tree, they were only available as a single museum specimen somewhere out there because they are just so rare.” The final publication, ‘Evaluating UCE data adequacy and integrating uncertainty in a comprehensive phylogeny of ants’, is currently approaching its publish date in the journal of Systematic Biology at the time of this writing.



PhD candidate Stephanie Eskew’s Rose Gall Wasp, *Diplolepis*, Specimen Collection, and her presentation at the 2024 ESA’s Entomology Meeting.



Graduate Student Vilas Brown and Dr. Lauren Esposito (above) hosting a symposium at the 2024 ESA’s Entomology Meeting, and with Dr. Zach Grienbenow (below) at an outreach event at the Gregory Allicar Museum of Art.



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CSU Student Opportunities: Celebrating Success

For many years, the C. P. Gillette Museum of Arthropod Diversity has fostered skill development in curation, research, and communication for students through volunteer, internship, and independent research opportunities. The museum's student integration effort is unique in that students at every chapter of their academic journey (undergraduate, graduate, post-graduate, and PhD) can become involved in the museum's many projects or utilize the vast collection to investigate their own research question.

“There’s a lot of opportunities to learn different parts of entomology that I’ve never thought about before.” - said undergraduate Olivia Lucas. Olivia first began volunteering with the museum the Summer before transferring to CSU. Her responsibilities began with consolidating and organizing the museum's current collection. Soon after, Olivia was brought onto the Montana Moth Project, and has since played an active role in identifying, labeling, and grouping the vast collection of specimens. She has also had the opportunity to support other research underway by different faculty members at the museum, providing her lots of exposure to the different questions pursued in the field of entomology. “A lot of people, they’re there [at the museum]

because they’re getting an experience that they wouldn’t get anywhere else on campus.” Olivia plans to continue working with the museum until her graduation and has found her passion for insects and curation.

Recent CSU graduate Mickey Paletta spoke highly of his time at the museum, detailing his involvement in Montana Moths, iDigBees, and an independent study. “The museum helped me gain experience, and also plenty of knowledge, and that led into me being able to apply for jobs and also get those jobs,” Mickey expressed in an interview. Becoming well-versed in identification, georeferencing, and communication, Mickey’s appreciation of the museum resonated throughout the interview. His sentiments highlight the museum’s character whilst supporting student's breakthrough into job fields of their interest.

Career opportunities becoming accessible, following working in the museum, was a sentiment also expressed by CSU Master’s graduate, Ben Rossen. After meeting Chuck Harp while working at the Westminster Butterfly Pavillion, Ben spent 6 months curating the museum’s velvet ant collection. This effort involved organizing displays of velvet ants, point mounting, reattaching limbs,



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and researching updates to the phylogenetic organization. Ben spoke of the importance of curation and making biological information accessible to individuals who have no background in the subject. Ben is now an intern at the USDA Systematic Entomology Laboratory in Washington, DC, and credits the skills he developed at the museum for acquiring this position.

As a recent graduate, it can feel daunting to adopt the well-earned title of a 'scientist.' CSU graduate Riley Hoffman described the confidence she gained in her research abilities when entering the forensic science graduate program at UC Davis, following an involved senior year with the museum. "I think that my ability to do the independent research at the museum was a big reason as to why I got into grad school," Riley explained. She also shared the support the museum staff expressed when finalizing her choice of a master's program. Now in her final year of the program and finishing research for her thesis, Riley spoke fondly of her time at the museum and expressed gratitude for the continued support she feels, even hundreds of miles away. "Dr. Cooke showing me that I'm able to key things out and I'm able to teach myself how to key things out by myself was incredibly important" - Riley Hoffman.

Traveling alongside Dr. Marek Borowiec to

the museum, Stephanie Eskew is a fourth year PhD candidate revising the genus of Rose Gall Wasps, *Diplolepis*. Following her transition to CSU from the University of Idaho, Stephanie's made groundbreaking changes through both her research and involvement in the museum. Herself and other faculty created a wet lab for the museum, allowing researchers to extract DNA segments for further sequencing. Feeling especially lucky to work alongside gall wasp specialist and thesis committee member, Dr. Crystal Cooke, Stephanie highlighted the outreach skills she's developed through her time at the museum. "Being able to explain to someone just coming in and knowing nothing about galls. Being able to give them a little slice of the knowledge, and explain it well, is great!" Stephanie is on track to complete her PhD thesis in the next year-and-a-half.

Students or members of the community interested in becoming involved with the museum are encouraged to check out its website through the CSU Department of Agricultural Sciences or reach out to any current staff members.



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The Art of Curation: Bruner Library

Curation at the C. P. Gillette Museum of Arthropod Diversity involves organizing more than just specimens. The Bruner Library houses a vast array of books, articles/journals, field notes and anecdotes arranged by the arthropod taxonomy they represent. Once used in Hartshorn as a medical record room, the still-standing compactors were the key to Dr. Boyce Drummond's plan to display the physical records and make them more accessible. Heading the library for over 5 years, Dr. Drummond's tenacity for organization and passion for books has transformed the library from a haphazard pile of publications to a systematic display of the evolution of entomology. "That's part of the joy for me, is to see how books developed and how they've changed over time in terms of editions," expressed Drummond in an interview. Supported by a team of committed volunteers, the Bruner Library is currently uploading its collection to a digital database with hopes to increase accessibility and interest in the museum's literary volume. Some editions in the collection date back over 150 years, with books from the museum founder Clarence P. Gillette and professor/researcher Miriam Palmer. The library also receives donated collections from entomologists of today; housing the libraries, publications, and field notes of the recently passed Paul Opler and James Scott. Drummond and the team of volunteers hope that the finishing organization of the physical collection, along with the sharing of a digital bibliography and literature census, allow the museum to support students and researchers in different departments across CSU and the realm of academics. The museum is incredibly grateful to Drummond and the many volunteers who have developed the Bruner Library into the outstanding display of entomological knowledge it currently is today. The library is open to the public and welcomes any and all interested in entomology.





Giving Thanks!

The C. P. Gillette Museum of Arthropod Diversity strives to be an institution to foster stewardship of invertebrates through conservation, research, and education. The accomplishments and breakthroughs done by the museum could not have occurred without the support of dedicated staff, associates, donors, and volunteers. This newsletter served to highlight such accomplishments, and looks forward to another flourishing, collaborative year!

Staff

Dr. Marek Borowiec | Chuck Harp | Dr. Crystal Cooke | Stephanie Eskew | Dr. Todd Gilligan | Tim McNary, M.S. | Dr. Boyce Drummond

Associates

Dr. Deane M. Bowers | Dr. John W. Brown | Dr. Paula E. Cushing | Dr. Frank T. Krell | David Leatherman | Dr. Will K. Reeves | Dr. Andrew D. Warren

Donors

Mat Seidensticker and Northern Rockies Research & Education Services | Frances & Greg Penkowsky | Pam Piombino | Kelly Richers

And a Special Thanks to the Incredibly Dedicated, Growing Team of Volunteers!

Jan Kilgore | Tim McNary | Christina Douglas | Donna Johnson | Scott Ellis | Thomas Schultz | And Many More



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