

NSRL NEWS

Natural Science Research Laboratory
Museum of Texas Tech University

Volume 11, Spring 2024



Antina and the NSRL: A Partnership that Began With a Mouse

by Robert D. Bradley, Director

In 2021, Joe Manthey, Caleb Phillips, and I received funding from the Texas Parks and Wildlife Department (TPWD) and US Fish and Wildlife Service for a project entitled “Morphology, landscape genomics and effective population size of the Palo Duro Mouse, *Peromyscus truei comanche*” to determine the systematics and conservation status of the Palo Duro Deermouse. The subspecies *Peromyscus truei comanche* is endemic to the Texas Panhandle, and it occurs along the edges of the Llano Estacado escarpment, primarily in the Palo Duro and Caprock canyons. Our TPWD liaison, Russell Martin, said he knew a landowner who was interested in conservation, and they might allow us to collect mice on their ranch near Palo Duro Canyon. Russell asked if I would participate in a conference call to describe our project and what we might need from the landowner. Out of respect for the landowner, Russell kept the details to a minimum, so it wasn’t until the phone rang and introductions started that I learned the owner was Ms. Ashley Watt of the Barrel Creek Ranch (BCR) near Silverton, Texas.

About 15 minutes into the talk, Ashley learned enough about crazy mammalogists and rat-trappers that she agreed to let us visit her ranch and look for *P. t. comanche* (I really think she just wanted to see if there was such a thing as a “rat-trapper”). I also learned that Ashley owned the Antina enterprise and that she had served in the military and was a Harvard graduate—pretty impressive!

We made a quick field trip to BCR in March of 2022, and we took Ashley along as we set traps. We caught a few *P. t. comanche*, and as they say, the rest is history! Since then, we have made four *P. truei* field



trips to BCR and collected valuable data. Ashley’s assistance has been integral to this project.

Further, Ashley was impressed that we took several graduate and undergraduate students (mostly female) on these trips. She appreciated the opportunities that we were offering students and approached us about helping fund future research involving BCR. Thanks to Ashley’s financial commitment to supporting additional research on her property, I am pleased to say that the NSRL now has multiple projects directly tied to Barrel Creek. We would be remiss if we did not mention and thank Jeremy Adkins, Manager of BCR, for his assistance, logistical coordination, and comradery during our escapades.

On the following pages are brief synopses of our current projects on BCR.

Conservation Status of *Peromyscus truei comanche* Based on a Landscape Genomic Assessment

Joe Manthey, Javier Colmenares-Pinzón, Caleb D. Phillips, and Robert D. Bradley

As mentioned previously, Drs. Joe Manthey, Caleb Phillips, and Robert Bradley received funding from the TPWD and USFWS to investigate the systematics and conservation status of *Peromyscus truei comanche*. Joe recruited a PhD student, Javier Colmenares-Pinzón, to conduct this research and use it as a cornerstone for his PhD dissertation. To date, Javier has generated genomic sequences for *P. truei* samples collected in the last two years from BCR, as well as those collected and archived in museums over the last 40 years. These specimens provide not only great representation of *P. t. comanche*, but also good spatial representation of *P. truei* (all subspecies) across western North America. Further, Javier is examining genomes of closely related species such as *P. nasutus* and *P. attwateri*. Javier is currently sorting through this genome sequence data, but preliminary findings indicate that *P. t. comanche* is indeed genetically divergent from the other *P. truei* subspecies.



Mammal Surveys

Robert D. Bradley

Dr. Bradley and students (graduate and undergraduate) have been conducting a mammalian survey of BCR for the last two years. The focus primarily has been on small mammal trapping, but hopes are to begin bat netting and carnivore trapping in the near future. Although the mammal community has been fairly well studied from this region, the goal of this exercise is to provide the landowner with a detailed list of species occurring at BCR.



Camera Trapping

Caleb D. Phillips

To supplement the small mammal trapping surveys at Barrel Creek, the team also has deployed camera traps across the property. Cameras were located in different habitat types to try to obtain evidence of mammal species that would not be trapped and may be rare to observe (carnivores, ungulates, etc.) To date, in addition to numerous

photos of cattle, feral pigs, and deer, the camera traps have documented coyotes, bats, and a possible mountain lion on the BCR property.

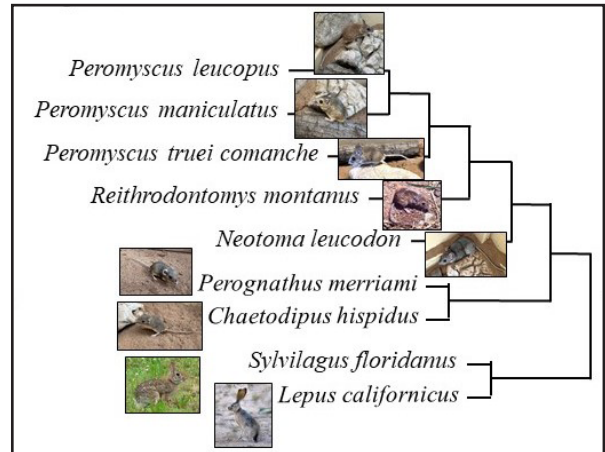


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Small Mammal Identification via DNA Sequences

Julia Carmona Cabral, Katelyn Albrecht, and Robert D. Bradley

Julia, an undergraduate in Dr. Bradley’s lab, is obtaining DNA sequences from the mitochondrial cytochrome b gene in at least one individual of every mammal species encountered at BCR. Her goals will be: 1) to determine if the mammalian fauna at BCR is divergent from other places; and 2) to construct a Tree-of-Life (phylogeny) perspective of all mammals at BCR for the owner. This tree can be updated and expanded as new mammalian species are encountered on BCR.



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Scats Galore: Dietary Analysis of Mammals of the Barrel Creek Ranch

Sufia Akter Neha, Chris Prew, Caleb D. Phillips, and Robert D. Bradley

Sufia, a PhD student of Dr. Phillips and Dr. Bradley, is building a dissertation around microbiome and dietary profiles of mammals. The primary source of her data has been stomach and colon samples, fecal pellets, and scats. Sufia has two goals. First, she will look at the microbiomes in four species of *Peromyscus* (*attwateri*, *maniculatus*, *leucopus*, and *truei*) that occur on the BCR property. The goal will be to see if *P. truei*, which relies heavily on juniper berries in its diet, has a unique microbiome that allows this species to process such a harsh diet (containing phenols, alkaloids, etc.). Sufia also will opportunistically examine other species of rodents on the property to determine their diets. Second, she will use collected scats to provide a checklist of mammals occurring on the property and to compare these data to species diversity and frequency of encounters obtained from camera trap, live trapping, and observational data. Chris Prew, an undergraduate in Caleb’s lab, is assisting Sufia with this and learning the various field and laboratory methodologies.



Zoonotic Survey

Emily Schmalzried, Georgina Brugette, and Robert D. Bradley

Emily, a Master’s student in Dr. Bradley’s lab, is using some newly developed sequencing methods to detect the presence of zoonotic agents within the mammal community at BCR. This method involves a broadbrush assay of mammal tissue samples for the detection of any viruses that might be present at the site. She is just getting started on this project, but we anticipate detecting the normal suspects (hantaviruses, arenaviruses, etc.) but hope to discover novel viruses that have not been reported from this region. Emily is being mentored by Technician Georgina Brugette.



Towards an Inventory of the Invertebrates of Barrel Creek Ranch

Jennifer Girón, Scott Longing, and Aaron Pan

A team including Dr. Jennifer Girón, Dr. Scott Longing, and Dr. Aaron Pan visited BCR at various times of the year to collect invertebrate specimens using different methods. The goal is to get baseline information on the biodiversity present at the site. These trips provide opportunities to train graduate and undergraduate students in field work, collecting techniques, specimen management, and data processing, as well as engaging volunteers to [document invertebrates using iNaturalist](#). This invertebrate biodiversity baseline will help determine if restoration projects are feasible. Many of the specimens collected to date have been prepared, identified, databased, and are available through the [Ecdysis profile for the Invertebrate Zoology Collection](#).



Botanical Survey

Jennifer Girón and Matt Johnson

Dr. Jennifer Girón and colleague Dr. Matt Johnson (Department of Biological Sciences, TTU) are conducting a floral survey of BCR. They are just getting started on this but hope to produce a catalog of plant species occurring on BCR that will serve as a baseline for restoration projects. Specimens will be deposited at the [E. L. Reed Herbarium](#) and field observations are included in the [BCR iNaturalist project](#).



Student Experiences

One of the goals of the BCR endeavor, and a priority for Ms. Watt, is that graduate and undergraduate students be involved wherever and whenever possible. To meet this goal and priority, we have been providing opportunities for students to accompany us on collecting trips and to conduct research in our laboratories and facilities in Biological Sciences and at the NSRL. As you can see from the author lines above, several students have already been active in both fieldwork and lab research to generate data for several of the projects. We anticipate that there will be a continued expansion of student efforts as these projects develop and as new projects come online.



NSRL CURATORS



Dr. Robert D. Bradley is Director of the NSRL, Curator of Mammals, and Professor of Biological Sciences. Dr. Bradley's research foci are systematics and molecular evolution of New World rodents; hybridization; infectious zoonotic diseases; and natural history of mammals. He has been a faculty member since 1994.

He currently is advising 3 PhD, 2 MS, and 7 undergraduate students. He has graduated 21 MS, 2 MA, and 14 PhD students, and he has authored or edited 6 books and 218 peer-reviewed articles, all pertaining to mammals.

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Dr. Nancy McIntyre is the Curator of Birds and a Professor of Biological Sciences. She is a landscape ecologist whose research focuses on how land conversion and climate change are fragmenting migratory habitats for wildlife in the Great Plains of North America. Dr. McIntyre has served as

Curator of Birds since 2006. She currently is advising 1 PhD and 3 MS students.

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Dr. Jennifer Girón is the Curator of Invertebrate Zoology. She handles loan and data requests, organizes and processes incoming specimens, and manages the specimen database hosted in the Symbiota ecdysis portal. She also trains and supervises students and volunteers working in the collection, performs outreach and engagement activities, and conducts research on beetle biodiversity.

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Dr. Richard Stevens is a Curator of Mammals and Professor of Natural Resources Management. He is a bat and rodent community ecologist, macroecologist, and biogeographer. His lab conducts collections-based ecological work in Paraguay, Colombia, Mojave Desert, and Texas. He currently is advising 8 PhD, 4 MS, and 9 undergraduate students.

richard.stevens@ttu.edu



Dr. Caleb D. Phillips is the Curator of Genetic Resources and an Associate Professor of Biological Sciences. The Phillips' lab studies how gene expression and microbiome communities evolve in support of mammalian life histories; bioinformatics; and the evolutionary/developmental process of mammalian divergence. He currently is advising 2 PhD and 2 MS students.

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Heath Garner is the Curator of Collections. His role is to facilitate the daily operations and maintenance of the NSRL collections. His duties include processing, tracking, and cataloging specimens, processing loans, training and supervising student workers and volunteers, documentation of data and collection activities, and preventative conservation of the collections.

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NSRL COLLECTIONS - SUMMARY AND STATISTICS

The Natural Science Research Laboratory (NSRL) is a division of the Museum of Texas Tech University that archives biological samples and their associated data. These collections serve as a library of our natural heritage for education and research purposes. Natural history collections provide the foundation for our understanding of biodiversity. They serve as a historical reference for documenting changes in our environment and the effects of those changes on wildlife and, ultimately, on humans.

The collections maintained by the NSRL are available to researchers at academic, scientific, and government institutions around the world for scientific investigation, discovery, and problem-solving in the natural sciences. The causes and/or effects of animal-borne diseases, environmental pollutants, parasites, climate change, habitat loss, geographic isolation, and natural evolutionary processes and speciation are just a few examples of the investigations that can be conducted utilizing specimens and tissues archived in a natural history collection. Further, the resources of the NSRL are utilized by the academic and scientific communities to train and educate students at the undergraduate and graduate levels for careers in the natural sciences as well as museum science.

Mammal Collection



The Mammal Collection currently contains 158,664 cataloged specimens of an estimated 1,442 species. Specimen preparation types include preserved skins, skeletal materials, alcohol-preserved specimens, and taxidermy mounts. In 2023, the Mammal Collection cataloged 1,265 specimens and granted 13 loans totaling 334 specimens.

Bird Collection



The Bird Collection currently contains 6,092 cataloged specimens, as well as eggs and nests, of 858 species. In 2023, the Bird Collection cataloged 19 newly acquired specimens, and granted 6 loans totaling 117 specimens.

Invertebrate Zoology Collection



The Invertebrate Zoology Collection contains an estimated 4.6 million specimens. These include insects, crustacea, endo- and ecto-parasites, arachnids, and other groups. Specimen preservation methods include dried, fluid, slide-mounted, and frozen. In 2023, the collection cataloged 4,300+ specimens and granted 4 loans totaling 98 specimens.

Genetic Resources Collection



The Genetic Resources Collection contains ~474,000 samples of tissues, blood, and extracted DNA from >100,000 specimens of mammals and other taxa. In 2023, the GRC granted 27 loans totaling 332 samples. The Collection incorporated 4,148 new samples obtained from 727 individuals.

As a whole, the NSRL hosted 203 visitors and volunteers in 2023, including researchers utilizing the collections, students taking classes, individuals and groups on tours, and volunteers assisting in the collections. The NSRL also filled 121 information requests. The NSRL employed 21 TTU students (5 graduate, 16 undergraduate) and 3 non-TTU undergraduate students during 2023.

NSRL STAFF



Kathy MacDonald is the Collections Manager for the Genetic Resources Collection. Her primary duties include the organization and processing of incoming samples and the subsampling and processing of loans. Other duties include assisting with specimen tracking in the collections and data management and design.

kathy.macdonald@ttu.edu



Heidi Amarilla-Stevens is the Collections Manager for the Mammal Collection. Her duties include assisting in all aspects of the specimen curation process, as well as preparing loans, student training, and databasing. She also conducts research on improving curatorial practices for the long-term care of collections of natural history specimens and tissues.

heidi.stevens@ttu.edu



Lisa Bradley is the Production Editor for Occasional Papers and Special Publications. Her duties include coordinating the review and revision process, copy editing, and final layout and design. She also assists in the writing and editing of scientific articles and books published by NSRL staff, preparation of grant proposals, development of NSRL exhibits for the Museum, and maintenance of the NSRL website.

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NSRL Bird Collection Database Now Available Online

The NSRL is pleased to announce that the Bird Collection database is now available online via the web portals [Consortium of Small Vertebrate Collections](#) (CSVColl) and the [Global Biodiversity Information Facility](#) (GBIF). The online availability of the NSRL Bird Collection is thanks to the efforts of former Museum Science student Ashley Kempken, working in collaboration with NSRL Curator of Birds Dr. Nancy McIntyre, Curator of Collections Heath J. Garner, and Curator of Invertebrate Zoology Dr. Jennifer C. Girón. Ashley is now Collections Manager of Birds at the Delaware Museum of Nature & Science.

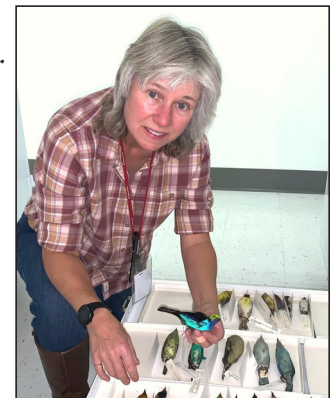
The NSRL bird database currently contains records of 6,092 specimens representing 138 families, 478 genera, and 858 species, with geographic origins from 29+ countries. Users can find information about the NSRL [Bird Collection](#) in CSVColl, and they can use the “Search” function to retrieve data by various criteria such as taxon name, locality, collector, and specimen number.

Further, the Bird Collection is also now available via the NSRL’s [Vertebrate Database](#). Simply enter “Aves” in the “Class” field in the search form.



Former Museum Science student Ashley Kempken proofed, corrected, and entered the Bird Collection data for the CSVColl and GBIF online portals.

Dr. Nancy McIntyre is Curator of the NSRL Bird Collection.



NSRL Volunteer Highlight

Throughout our 50 years, the NSRL has benefited from the efforts of individuals who have volunteered at the NSRL and assisted our staff with many aspects of collections management. In recent years, four volunteers have been particularly dedicated and productive, and we are proud to highlight them here!



Dee Asbury-Robertson

Dee came to learn about the NSRL through her late husband, Dr. Stirling Robertson. Stirling was a Biologist for the Texas Department of Transportation and he conducted collaborative research with Drs. Caleb Phillips and Richard Stevens.

Dee began volunteering in 2021, and has averaged about 10 hours per week working in the Mammal Collection. Her primary efforts have included updating specimen tag data, adding barcode tags, and other tasks related to organizing the collection. At times, she has also cleaned and osteoscribed skeletal material, and she has assisted Heath Garner with other efforts throughout the NSRL. Dee has a fascinating background, with multiple Associate's degrees in addition to her Bachelor's degree in Mathematical Biology and her Master's in Thermal Biology, for which she conducted research on the impacts of global warming on reptiles and amphibians. Her educational background, work experiences, and life experiences also include auto collision repair, art and jewelry making, acting, dog training, horseback therapy, and cattle ranching! She explains that her varied background is a result of her love of being in academic environments and learning new things, and volunteering at the NSRL has been her latest outlet for that passion.



Gene Hess

Like Dee, Gene became involved at the NSRL through a spousal connection—his wife, Sally Shelton, is the Associate Chair of the Heritage and Museum Sciences program at the Museum. Shortly after

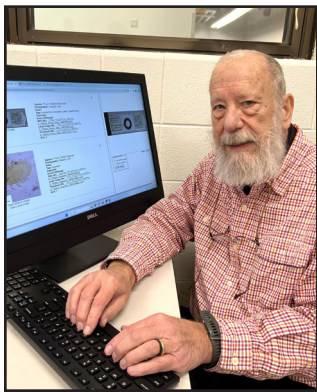
Sally was hired into that position in 2020, Gene began volunteering in the Bird Collection of the NSRL. Gene, who has a degree in Entomology and Applied Ecology, was formerly the manager of the bird collection and the library at the Delaware Museum of Natural History (now known as the Delaware Museum of Nature & Science) and he is the lead author of the book *Birds of Delaware* (2000). His expertise and experience, particularly with the bird egg collection at the Delaware Museum, was a perfect fit for the NSRL, because the NSRL's Bird Collection contained an egg collection that was in desperate need of attention. Recognizing the research value of this collection, Gene devoted himself to identifying, labeling, organizing, and cataloging the collection. Gene was assisted in these endeavors by Museum Science student Ashley Kempken, who upon graduating, was hired in Gene's former position as the Collections Manager of Birds at the Delaware Museum of Nature & Science. Of his volunteer efforts at the NSRL, Gene has stated that "To bring [my] experience to a collection with the goal of making it usable and available to the research community is invaluable and irresistible. I enjoy putting my knowledge of bird collections to work at the NSRL and passing it on to interested students, fellow volunteers, and faculty." Gene also spent numerous hours sorting and alphabetizing the extensive ornithology reprint collection of the Packard Library, and, using his entomology background, he has devoted time to making the Invertebrate Zoology collection data available online.



Dr. Catherine Galley

Catherine is a designer with a PhD in Urban Planning and Policy Development and a JD from George Mason University School of Law, and she is a former Assistant Professor of Architecture at TTU. She has had a passion for nature since childhood, and in particular an interest in the world of "bugs." Several years ago, she began using iNaturalist and BugGuide, and through these apps began interacting with professional entomologists, including Dr. Scott Longing of Texas Tech's Department of Plant and Soil Science. Scott suggested that Catherine

reach out to Dr. Jennifer Girón for a tour of the NSRL's Invertebrate Zoology Collection. That meeting led to Catherine volunteering in the collection on a regular basis. Dr. Girón provided Catherine with training, and she has now been identifying and digitizing the syrphid (hoverfly) specimens since January 2022. Catherine expressed that "Volunteering at the NSRL has allowed me to learn a tremendous amount about entomology and the management of natural history collections. It also has encouraged me to become more active helping the iNaturalist community to identify hoverflies." Along with her husband Carl Seaquist, Catherine also has donated funds to the NSRL in support of the Invertebrate Zoology Collection and the research of Dr. Girón.



Dr. Carl Seaquist

Carl is a retired professor of mathematics at TTU. After retiring, Carl decided that he wanted to actively learn more about nature. When his wife, Catherine Galley, began volunteering at the NSRL, he learned that the Invertebrate Zoology Collection contained a collection of more than

35,000 microscope slides of parasites that had never been photographed to be made available online. He jumped at the chance to assist in efforts to make this collection available to researchers in both human and animal health. So far, more than 1,500 slides have been photographed, their corresponding online data have been updated as needed, and images have been added. Carl and his wife also have spent countless hours working to maintain and enhance the "Arroyo" that was created at the Museum's front entrance. This habitat, containing plants native to the Llano Estacado region, has been attracting bees, butterflies, and other pollinators, as well as birds, and serves as a living outdoor exhibit for educating the public about native West Texas flora and fauna. Carl and Catherine have both spent time volunteering at the Lubbock Lake Landmark, as well, including working to establish a pollinator garden there, and setting up iNaturalist sites for both the Landmark and the Museum arroyo.

The dedication and commitment of our volunteers is extremely important to the continued success and operation of the NSRL. We cannot adequately express our gratitude for their time and assistance in ensuring that the collections of the NSRL continue to be maintained at the highest standards and utilized for advancing scientific research and education.

Undergraduate Highlight



Samantha Stuhr is a senior at Texas Tech University studying Natural Resource Management with a concentration in Wildlife Biology and a minor in Creative Media Industries. She has a strong passion for scientific literacy and relevant, current, and important natural science research. "To me, it is crucial that the public is informed about important research that is going on in the scientific community that can potentially improve their quality of life, whether that research is in the areas of environmental studies, new medical improvements, or scientific discoveries in general. The issue is that scientific information often is not easily accessible to or made available in a way that can be understood by the general public—most people don't go to their local library or read scientific papers to learn more about their world. Therefore, I find that there is a gap in communication between the current advancements in science and what the community knows about these advancements," she says. Ultimately, this is why Samantha has a minor in Creative Media Industries, and her goal is to narrow the gap that separates scientific discoveries and community understanding of them.

One of her class projects in Creative Media Industries was to produce a photo essay, where she was required to produce a publishable media article that explains a complicated subject through narrative and images. Samantha

chose to create this photo essay about RNA degradation, an ongoing research project at the NSRL, thus merging her passions for science and communication into one fun project. As a student working in Dr. Richard Stevens' lab, Samantha became familiar with the NSRL by participating in fieldwork and preparing museum voucher specimens and collecting tissue samples. Therefore, choosing to theme the photo essay around the current RNA degradation project was a "no brainer," she says.

The NSRL is proud to help undergraduate students like Samantha gain valuable hands-on training, research experience, and academic achievements while working at the NSRL and in the laboratories of our Curators and affiliated faculty.



Cotton rat collected by students in Dr. Stevens' lab for research purposes.

Outreach

Tigga Kingston presented a talk entitled "Conservation of Bats and their Role in Antimicrobial Propagation" at the International Veterinary Student Association (IVSA), 2nd Online Asian Symposium.

On Friday, October 27, the NSRL participated in Lubbock's annual Halloween event, "Safety City Trick-or-Treat Street," where businesses, non-profits, and others from the community can meet the public, share information about their business or organization, and hand out candy and other treats. The organizers estimated 3,200 adults and children attended this free event in 2023! **Jennifer Girón**, **Lisa Bradley**, **Heidi Stevens**, and **Annette Castellano** (Museum Development) represented the NSRL at a table that featured study skins of bats, rodents, and other specimens from the Mammal Collection, while informing the visitors about the Museum of TTU, the NSRL, and the value of museums and scientific research. Nearby, the TTU Entomology Club worked a separate table that displayed specimens that Dr. Girón provided from the NSRL's Invertebrate Zoology Collection.



STUDENT SCHOLARSHIPS, GRANTS, AND RESEARCH AWARDS 2023

Touseef Ahmed, PhD. Chair: Tigga Kingston. Verena Fellow in Residence; Verena Travel Support.

Katelyn Albrecht, MS. Chairs: Robert Bradley and Richard Stevens. Bobby Baker Memorial Graduate Scholarship, Department of Biological Sciences, Texas Tech University.

Isham Azhar, PhD. Chair: Tigga Kingston. Research funding, Bat Conservation International.

Nuria Bernal-Hoverud, PhD. Chair: Jorge Salazar-Bravo. Helen DeVitt Jones Fellowship, Texas Tech University; René Fonseca Memorial Scholarship, Department of Biological Sciences, Texas Tech University.

Julia Carmona Cabral, undergraduate. Advisor: Robert Bradley. Bobby Baker Memorial Undergraduate Scholarship, Department of Biological Sciences, Texas Tech University.

Justin Dawsey, MS. Chair: Nancy McIntyre. Helen DeVitt Jones Fellowship, Texas Tech University.

Hannah Girgente, MS. Chair: Nancy McIntyre. Student Research Support Award, TTU Graduate School; TTU Graduate Recruitment Fellowship; TTU Association of Biologists Grants-in-Aid; Grants-in-Aid of Research, Sigma Xi.

Joe Girgente, MS. Chair: Nancy McIntyre. Student Research Support Award, TTU Graduate School; TTU Graduate Recruitment Fellowship; TTU Association of Biologists Grants-in-Aid; TTU Department of Biological Sciences Summer Research Assistantship.

Ashley Kempken, MA. Chair: Nancy McIntyre. Heritage and Museum Sciences Mini-grant, TTU Museum.

Margaret Lee, undergraduate. Advisor: Robert Bradley. Bobby Baker Memorial Undergraduate Scholarship, Department of Biological Sciences, Texas Tech University.

Sufia Akter Neha, PhD. Chair: Robert Bradley. Bobby Baker Memorial Graduate Scholarship, Department of Biological Sciences, Texas Tech University.

Christopher Prew, undergraduate. Advisor: Caleb Phillips. Bobby Baker Memorial Undergraduate Scholarship, Department of Biological Sciences, Texas Tech University.

Ari Rice, PhD. Chair: Joe Manthey. Texas Ornithological Society Award; TTU Graduate School Research Support Award.

Abigail Rutrough, PhD. Chair: Tigga Kingston. Graduate Research Fellowship, National Science Foundation.

Sean Sutor, PhD. Chair: Nancy McIntyre. Student Travel Award, International Association for Landscape Ecology-North America.

Md Ashraf Ul Hasan, PhD. Chair: Tigga Kingston. Research funding, Bat Conservation International; research funding, Rufford Small Grants; J. Knox Jones Jr. Memorial Scholarship, Department of Biological Sciences, Texas Tech University; Helen DeVitt Jones Graduate Fellowship, Texas Tech University.

Emily Wright, PhD. Chair: Robert D. Bradley. Horn Distinguished Professors Graduate Achievement Award, Texas Tech University.

In Memory of Frederick B. Stangl, Jr. 1950 – 2024

It is with great sorrow that we announce the passing of Dr. Frederick B. Stangl, Jr., Professor Emeritus of Midwestern State University, and long-time friend, colleague, and Research Associate of the NSRL.

Fred obtained his PhD from Texas Tech University in 1984, where he studied under the direction of Dr. Robert J. Baker and completed a dissertation entitled “Dynamics of a contact zone between two chromosomal races of *Peromyscus leucopus* (Rodentia: Cricetidae).” Prior to his time at TTU, Fred attended Midwestern State University, where he obtained his Bachelor’s and Master’s degrees, the latter under the direction of Dr. Walter W. Dalquest. After obtaining his PhD, Fred returned to Midwestern State University, where he assumed the position of his mentor, Walt Dalquest, upon the latter’s retirement. Fred spent his entire professional career (1984 to 2012) as Professor of Biology at Midwestern State. Fred took great pride in his role as Curator of the ASM-accredited MSU Collection of Recent Mammals. He directed 29 Master’s students to completion, directed 36 additional students in non-thesis or undergraduate research, and published at least 84 papers, primarily on taxonomy and natural history of fossil and Recent mammals. His knowledge of mammalogy, and Texas mammals in particular, were unsurpassed. As a student and in later years, Fred deposited more than 700 specimens in the NSRL Mammal Collection, and he was a frequent collaborator with the faculty and staff of the NSRL on publications and in field research.



Fred was a genuinely kind and gentle soul, and a dear friend to many of us in the “mammal world.” He will be greatly missed. At Fred’s request, the family will hold private services at a later date. His full obituary can be viewed here: <https://www.timesrecordnews.com/obituaries/wtr023203>. His family has suggested that those who wish to honor him can do so by contributing to the NSRL’s [Fund for Excellence](#), in Fred’s memory.



Fred Stangl (right) as a graduate student, ca. 1983, working with specimens in the NSRL alongside Dr. J. Knox Jones, Jr.



Fred Stangl, far right, with (from right to left) his academic brothers John Bickham, Rodney Honeycutt, and Robert Bradley, friend David Schmidly, and PhD mentor Robert J. Baker, at a TSM meeting in 2015.

FACULTY AND STAFF GRANTS (active 2023)

- Boal, C. W., **R. D. Stevens**, and C. Villalobos. TCU 432: Assessing Texas Kangaroo Rat habitat connectivity, management, and monitoring protocols. Texas Parks and Wildlife Department.
- Bradley, R. D.** Gift for NSRL-based research. Antina.
- Bradley, R. D.** Gift for zoonotic research. Convergent Animal Health.
- Bradley, R. D., J. Manthey**, and **C. D. Phillips**. Development of a CODIS-like database for the conservation and management of black bears in Texas. Texas Comptroller's Office.
- Chelikani, P., M. C. Penn, and **C. D. Phillips**. Dietary inulin fiber supplementation for protection against obesity, hypertension and stroke. American Heart Association.
- de la Sancha, N. U., S. A. Boyle, and **N. E. McIntyre**. Impacts of rapid habitat change: Mammalian diversity and its response to deforestation in a global biodiversity hotspot, the Atlantic Forest of South America. Walder Foundation, Biota Awards.
- Dowler, R. C., and **R. D. Stevens**. Survey of the hooded skunk in the Chihuahuan Desert ecoregion of Texas. Texas Comptroller's Office.
- Griffis-Kyle, K., and **N. E. McIntyre**. Sonoran Desert Tortoise Monitoring. Department of Interior, National Park Service.
- Hardy, D., and **R. D. Bradley**. Geographic distribution of prion disease infection and susceptibility in North American deer species. The CH Foundation.
- Jimenez-Ferbans, L., and **J. C. Girón Duque**. Data mobilization for key entomological groups across Caribbean Colombia. European Union, GBIF (Global Biodiversity Information Facility).
- Kingston, T.** Protecting cave roosting bats in Southeast Asia – SEABCRU Workshop. Bat Conservation International.
- Kingston, T.** Scholar Rescue Fund, Myanmar Support for Dr. Moe Moe Aung. Institute of International Education.
- Kingston, T.** Hosting Agreement Support for Dr. Moe Moe Aung. Institute of International Education.
- Kingston, T., L. Davalos, A. Rasmussen**, and S. Anthony. Collaborative Research: Integrated mechanisms of environment host-virome interactions. National Science Foundation.
- Kingston, T., L. Davalos, N. Simmons**, and S. Tsang. Collaborative: AccelNet: The Global Union of Bat Diversity Networks (GBatNet): Bats as a model for understanding global vertebrate diversification and sustainability. National Science Foundation.
- Kingston, T., and C. D. Phillips**. Community processes structuring assembly and disassembly of bat gut-microbial communities across a gradient of habitat degradation. National Science Foundation.
- Longing, S., B. Kelly, N. E. McIntyre, A. Laubmeier**, and **A. Pan**. Advancing biodiversity research to support transdisciplinary conservation innovation in Texas' ecosystems. Texas Tech University, Grand Challenge Catalyst Grant Program.
- Longing, S., J. C. Girón Duque**, and **J. D. Manthey**. Digitization of the bee (Hymenoptera: Anthophila) holdings at Texas Tech University with DNA barcoding for species of interest. Texas Parks and Wildlife Department.
- Manthey, J.** Landscape genomics of co-evolution: a test in carpenter ants (genus *Camponotus*) and their microbial symbionts. National Science Foundation.
- Manthey, J., B. Marks**, and M. Yonas. Comparative and temporal biodiversity genomics of Ethiopian Highland montane forest passerine birds. National Science Foundation.
- Manthey, J., C. D. Phillips**, and **R. D. Bradley**. Morphology, landscape genomics and effective population size of the Palo Duro Mouse, *Peromyscus truei comanche*. USFWS and Texas Parks and Wildlife Department.
- Phillips, C. D.** Patient genetic determinants of chronic wound microbiome composition. National Institutes of Health.
- Salazar-Bravo, J.** and N. Bernal-Hoverud. A molecular analyses of the mammalian communities along an altitudinal gradient in the central Andes of Bolivia. Wildlife Conservation Society.
- Stevens, R. D.** Anthropogenic risk assessment of bat species of greatest conservation need in Texas. Texas Comptroller's Office.
- Stevens, R. D.** Survey of tri-colored bat winter roost sites and associated white-nose syndrome in east and central Texas. US Fish and Wildlife Service/Texas Parks and Wildlife Department.

FACULTY AND STAFF GRANTS (active 2023) (cont.)

Stevens, R. D. Use of highway structures by bats in East Texas: Inventory of bats and assessment of relative contributions of characteristics of landscape, habitat and highway structures in determining day-roost utilization. Texas Department of Transportation.

Stevens, R. D., others, and R. D. Bradley. Advancing Digitization of Biodiversity Collections: Collaborative Research: Ranges: Building capacity to extend mammal specimens from Western North America. National Science Foundation.

Stevens, R. D., and R. D. Bradley. Digitation PEN: BatPEN! - A partnership to facilitate scientific inquiry into the vast functional trait diversity of phyllostomid bats. National Science Foundation.

Karamysheva, Z., and J. Salazar-Bravo. Ribosome remodeling as a mechanism of translational control during stress. National Institutes of Health.

OCCASIONAL PAPERS AND SPECIAL PUBLICATIONS OF THE MUSEUM OF TEXAS TECH UNIVERSITY

The NSRL produces two peer-reviewed publication series, Occasional Papers and Special Publications, both of which are edited by Dr. Robert D. Bradley, Director of the NSRL. These series provide outlets for scholarly works resulting from museum-based natural history research. Relevant topics include, but are not limited to, taxonomic studies, faunal lists, species descriptions, zoonoses research, distributional records, and field and museum techniques and methodology, including molecular methods that are applicable to field or museum research. Publication in these series is available to all authors without regard to their association with Texas Tech University. Authors who plan to submit manuscripts to these series should refer to the Museum Publications Policy and the Guidelines and Procedures for Authors, available at www.depts.ttu.edu/nsrl/publications/authors.php, for more information.

Lisa Bradley serves as the Production Editor for both series. Feel free to contact Lisa, lisa.bradley@ttu.edu, if you are interested in submitting manuscripts or monographs to the Occasional Papers or Special Publications series.

Publications produced in 2023:

Occasional Paper 387. Genetic divergence and mtDNA lineages in six subspecies of *Aoudad*. Emily A. Wright and Robert D. Bradley.

Occasional Paper 386. Notes on terrestrial mammals of the Ocotillo Hills, Eddy County, New Mexico. Jennifer K. Frey, Jason L. Malaney, and Michael T. Hill.

Occasional Paper 385. Significant range expansion in eight species of North American mammals. Emily F. Barnes and Justin D. Hoffman.

Special Publication 79. Mammals of Oklahoma records of occurrence: A companion to *Mammals of Oklahoma, Second Edition*. Lynda Samanie Loucks, Michelle L. Haynie, Brad Watkins, and William Caire.

Special Publication 78. Genetic identification of pocket gophers (genera *Cratogeomys*, *Geomys*, and *Thomomys*) in Texas and surrounding areas. Robert D. Bradley, Annie T. Pham, Kinsey A. Rich, Emma K. Roberts, Taylor J. Soniat, Cassie M. Poehlein, Mariah N. Mills, Morgan Ballard, Richard M. Pitts, Laramie L. Lindsey, Michaela K. Halsey, David A. Ray, Richard D. Stevens, David J. Schmidly, and Emily A. Wright.

Special Publication 77. Taxonomic catalogs for the Recent terrestrial vertebrates (species and subspecies) described from Texas. David J. Schmidly, Robert D. Bradley, Lisa C. Bradley, and Franklin D. Yancey, II (editors).

View and download Occasional Papers and Special Publications at the NSRL website:
www.depts.ttu.edu/nsrl/publications

2023 PUBLICATIONS BY NSRL FACULTY, STAFF, AND STUDENTS

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- Baskauf, S. J., J. C. Girón, M. Nielsen, N. S. Cobb, R. Singer, K. C. Seltmann, Z. Kachian, M. Pérez, D. Agosti, A. M. L. Klompen. 2023. Implementation experience report for controlled vocabularies used with the Audubon Core terms subjectPart and subjectOrientation. *Biodiversity Information Science and Standards* 7:e94188. <https://doi.org/10.3897/biss.7.94188>.
- Benson, D. J., J. C. Perkins, K. P. Jefferson, R. C. Dowler, C. C. Rega-Brodsky and R. D. Stevens. 2023. Examination of two Plains Spotted Skunk (*Spilogale interrupta*) burrow systems. *Southeastern Naturalist* 22:352–363.
- Bermúdez-H., M. F., J. Gamboa, F. Serna, and J. C. Girón. 2023. Dryophthorinae (Insecta: Coleoptera: Curculionidae) de Colombia: lista de especies, distribución y taxones vegetales asociados. *Caldasia* 45(3). <https://doi.org/10.15446/caldasia.v45n3.105771>.
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- Crawford, D. E., R. Martin, C. D. Phillips, et al. 2023. Microbiomes in post-digital rectal exam urine samples are linked to prostate cancer risk. *JU Open Plus* 1(12):e00075.
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- Salazar-Bravo, J., et al. 2023. Systematics and diversification of the Ichthyomyini (Cricetidae, Sigmodontinae) revisited: evidence from molecular, morphological, and combined approaches. *PeerJ* 11:e14319. doi: 10.7717/peerj.14319. PMID: 36655048; PMCID: PMC9841913.
- Schmidly, D. J., R. D. Bradley, L. C. Bradley, and F. D. Yancey II (editors). 2023. Taxonomic catalogs for the recent terrestrial vertebrates (species and subspecies) described from Texas. Special Publications, Museum of Texas Tech University 77:iii+1–385.
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GUEST ARTICLE

The Entomology Club at Texas Tech University: A Home for Bug Lovers

by Jill Forrest and Lillian Prescott

The origins of the Invertebrate Zoology Collection of the Natural Science Research Laboratory (NSRL) at the Museum of Texas Tech are linked to the former existence of the Department of Entomology at Texas Tech University. Starting in the 1950s through the 1980s, the Entomology Collection was fast-growing under the care of professors including Donald Ashdown, Russel W. Strandmann, Oscar F. Francke, and Robert W. Sites. That was a golden age for entomology at Texas Tech, when professors and students worked together growing and curating the Collection, and that was when the TTU Entomology Club was first established.

Sadly, after the Entomology Department merged into the Department of Plant and Soil Sciences, and as entomology professors retired or left, the Entomology Club disbanded. In the fall of 2019, a few students got together with Dr. Scott Longing, entomologist and professor in the Plant and Soil Science Department, with a plan to revitalize the organization. From then through spring 2023, the club gained a dozen members, while attending campus and community functions. During the Fall of 2023, we became officially reinstated as a [Texas Tech student organization](#). The club meets every month for general business and every week for feeding our live specimens and socializing. Current club officers are Jill Forrest (President), Helena Ruiz (Vice President), Aysia Middleton (Secretary), and Lillian Prescott (Treasurer).

The Entomology Club at Texas Tech University is a student organization of undergraduate and graduate students in a wide range of majors from agriculture to engineering to psychology. Our goal as an organization is to educate students and the Lubbock community about the importance of insects. We hope to show our community that yes, although some insects may bite or sting, they should not be feared. Being familiar with the insects around us gives us a better understanding of what benefits they bring in the form of pollination, pest control, environmental clean-up, medical applications, as a food source for wildlife, and their aesthetic value. We wish to educate the future generations about entomology and encourage kids to get outside and observe nature to learn about the most diverse group of animals on Earth. If we can get even one kid interested in entomology or

get one adult to overcome their fear of insects, then we have done our job. The TTU Entomology Club also provides professional and social opportunities for all students interested in entomology.

The Entomology Club takes part in designing and hosting [areas 1 and 2](#) of the Texas FFA (Future Farmers of America) [Entomology contest](#), as well as the state Texas FFA Entomology contest. In these contests, high school students compete in teams to test their knowledge on various topics in entomology. These contests are an amazing way for us to encourage high school students to get into the field of entomology.

One of our favorite activities that we do as an organization is going to local elementary schools and teaching kids about the importance of insects and other arthropods. We love doing these events to help teach the future generations not to fear insects and instead admire their beauty, understand their habits and their associations with humans, and help us protect them. Getting to see the kids' faces when they get to touch a Madagascar hissing cockroach or see a gorgeous butterfly up close is the highlight of our day. For some of these kids, this is their first introduction to insects or the science behind them. We also enjoy attending community events outside of the school setting where we can inform the public about these amazing creatures.



Entomology Club members sell arthropod-based art at the Oddities Art Market.

As we grow as an organization, our opportunities to reach people grow as well. The Oddities Art Market has allowed us to set up tables and co-host events with them to help us reach more teenagers and adults. We use these events as fundraisers for the Club, allowing us to maintain our live specimens and update our outreach supplies. These events have helped us grow as a club and allowed students to further their money management skills as well as their social skills as we interact with up to hundreds of people at these events.

When we aren't at events and the weather is nice, we enjoy spending time in the Texas Tech Horticultural Gardens, specifically in the pollinator gardens. The pollinator gardens were started several years ago by Dr. Longing with the goal of increasing native plant populations, having native seeds for harvest, and growing a safe space for our native pollinators. This area certainly comes in handy for entomology students working on building their insect collections, and it also helps us improve the university's teaching collection and our FFA collection.

We are also coming full circle, as we have now partnered with the Invertebrate Zoology Collection of the Natural Science Research Laboratory (NSRL) at the Museum of Texas Tech University, with the support of Dr. Jennifer C. Girón, Curator of the Collection. Thanks to student assistants and volunteers at the NSRL, we have been able to spread the word about our organization and gain new members. We have had the pleasure of touring the facilities at the NSRL and getting up close and personal with the Invertebrate Zoology Collection.



Entomology Club members enjoy a pinning party at the NSRL.

We enjoyed a “pinning party” where we learned how to properly pin and preserve insects for museum display and archives, and we attended Lubbock’s Safety City Trick-or-Treat Street alongside the Museum of Texas Tech in October 2023 to promote the Club and the Collection.

We are incredibly grateful for the support of our community, of Davis College, and our friends at the NSRL in our journey to becoming an official student organization, and we can't wait to see what the future holds for the Entomology Club.

Promotion Announcement



We are pleased to announce that in September 2023, Dr. Jennifer Girón was appointed as the NSRL’s Curator of Invertebrate Zoology. This appointment was made possible with support from the TTU Office of the Provost. In Jennifer’s previous part-time position as Acting Curator, she was performing many important duties in the collection and as a valued member of the NSRL team, including processing incoming and outgoing loans, digitizing the collection, supervising student workers, and conducting outreach and engagement activities. Jennifer’s appointment as Curator fills a vital role at the NSRL and the Museum, and we are excited for the future of the collection in terms of its care, enhancement, research potential, and education and outreach value. She is already making her presence felt with an array of volunteers, collaborating on grant proposals, and growing the collection through fieldwork. The Invertebrate Zoology Collection is in good hands!

TTU FACULTY ASSOCIATES OF THE NSRL

The following faculty at Texas Tech University have research programs that both contribute to and benefit from a working relationship with the Natural Science Research Laboratory. Graduate and undergraduate students of these faculty members, as well as those of the faculty Curators of the NSRL, conduct field-based research studies that result in growth of the NSRL collections and conduct laboratory-based research utilizing the resources of the NSRL to advance the sciences of mammalogy, ornithology, invertebrate zoology, wildlife ecology, and many other disciplines. The NSRL's strong history of field-based and organismal research, and continued commitment to such endeavors, set us apart from many other natural history programs.



Dr. Tigga Kingston is a Professor of Biological Sciences. Her research and activities are dedicated to the conservation ecology of Paletropical bats. She has been working on the conservation ecology of bats of Southeast Asia for more than 20 years, with projects in Malaysia, Indonesia, Myanmar, Philippines, and Vietnam. More recently, she has student projects and collaborations in Africa, specifically Nigeria, Kenya, and South Africa.

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Dr. Joseph D. Manthey is an Assistant Professor of Biological Sciences. His research group uses a combination of fieldwork, specimens, ecological data, genomics, and bioinformatics to study how organisms (mostly birds) evolve across both geographic and genomic landscapes. Major research themes include: (1) how and why species' genomes change through evolutionary time, (2) diversification at different spatial and temporal scales in sky islands, and (3) impacts of fragmentation on population connectivity in sky islands.

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Dr. David A. Ray is a Professor of Biological Sciences. The Ray laboratory focuses on the study of genomes and genome evolution with an emphasis on transposable elements and their role in the diversification of species. Model organisms include bats, several other mammals, and crocodylians.

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Dr. Jorge Salazar-Bravo is an Associate Professor of Biological Sciences. His research revolves around two basic themes: developing and testing phylogenetic hypotheses for mammalian taxa at various hierarchical levels; and using first principles in ecology and evolution to understand the triggers for disease emergence. Research topics he has pursued, as represented in his publications, include: systematics, biogeography, evolution, and conservation of Neotropical mammals; the ecology and evolution of virus/host co-evolution; and the interplay between ecology and disease.

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<http://www.depts.ttu.edu/biology/people/Faculty/Salazar-Bravo/>

STUDENT PRESENTATIONS 2023

During 2023, 26 graduate students gave 41 presentations and 8 undergraduate students gave 9 presentations (28 oral and 22 poster) of their research at 5 local, 3 state or regional, 3 national, and 6 international conferences and society meetings.

UNDERGRADUATE RESEARCH 2023

During 2023, at least 37 undergraduate students conducted research under the direction of 8 NSRL faculty and staff associates.



Students of McCool Academy visiting the Biodiversity of the Llano Estacado exhibit, April 2023.

STUDENT PRESENTATION AWARDS 2023

Isham Azhar, graduate student, Tigga Kingston. Vernon Bailey Award, Texas Society of Mammalogists (poster).

Rebecca Gabriliska, graduate student, Caleb Phillips. Graduate Student Poster Award, Microbiology division, Texas Chapter of American Society of Microbiologists (poster).

Sufia Neha, graduate student, Robert Bradley. Clyde Jones Graduate Award, Texas Society of Mammalogists (poster).

Amanda Newman, undergraduate student, Richard Stevens. Vernon Bailey Award, Texas Society of Mammalogists (poster).

Sofia Rodriguez, undergraduate student, Jennifer Girón. 1st place, Energy and Environment division, TTU Undergraduate Research Conference (poster).

2023 GRADUATES

Garrett Behrends, MS. Chair: Joe Manthey. Thesis title: Comparative phylogeography of six Highland Ethiopian passerines in the eastern Afrotropical biodiversity hotspot. Current position: PhD student, University of St. Louis – Missouri.

Samantha Garcia, MS. Chairs: Richard Stevens and Liam Mcguire. Non-thesis.

Ashley Kempken, MA. Chairs: Nancy McIntyre and Stance Hurst. Thesis title: Educational objectives of taxidermy-centered exhibits in museums within the United States. Current position: Curator of Birds, Delaware Museum of Nature & Science, Wilmington.

Ben Obitte, PhD. Chair: Tigga Kingston. Dissertation title: Why hunt: the socio-ecological drivers and ecological consequences of bat hunting in an Afrotropical system. Current position: Post-doctoral researcher, Biological Sciences, Texas Tech University.

Susana Revollo, MS. Chair: Jorge Salazar-Bravo. Thesis title: Identifying areas of conservation importance based on spatial patterns of evolutionary diversity: non-volant mammals in the Andean Puna. Current position: PhD student, Biological Sciences, Texas Tech University.

Craig Tipton, PhD. Chair: Caleb D. Phillips. Dissertation title: The chronic wound microbiome: complex communities shaped by microbial interaction and environmental selection. Current position: Director of Biostatistics, RTL Genomics and MicroGen DX, Lubbock.

Emily Wright, PhD. Chair: Robert D. Bradley. Dissertation title: Mitochondrial and nuclear genomes reflect different evolutionary trajectories of two ungulate species: tales from aoudad (*Ammotragus lervia*) and bighorn sheep (*Ovis canadensis*) in Texas. Current position: Postdoctoral Fellow, CDC, Atlanta, Georgia.

BatPEN!: CT Scanning and Digitization of Phyllostomid Bats

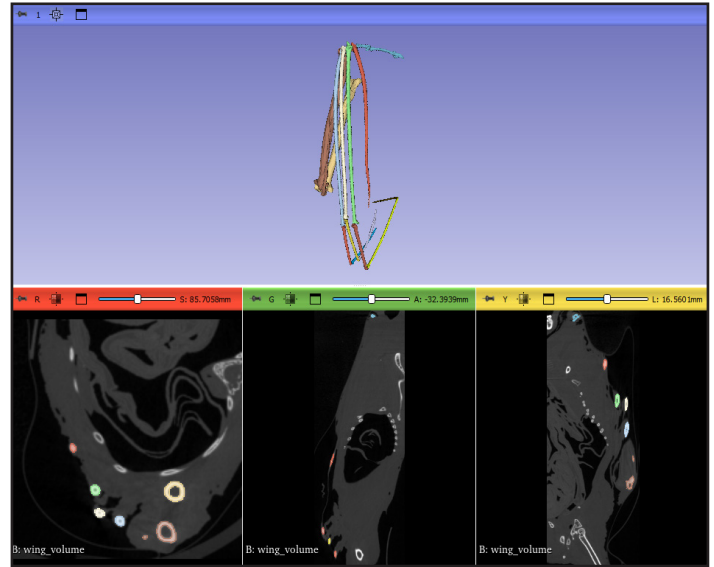
by Katelyn Albrecht, MS student

In 2022, Drs. Richard Stevens and Robert Bradley, in collaboration with former TTU graduate Cody Thompson, now Curator of Mammals at the Museum of Zoology, University of Michigan, received an NSF grant to obtain morphological information through CT (computed tomography) scanning methodologies. The project, entitled BatPEN! (Bat Partners in Existing Networks), is a partnership within the open Vertebrate Thematic Collections Network (oVERT-TCN). oVERT-TCN involves obtaining and storing morphological data from vertebrate collections from all across the US, and making this data available in an open-access format.

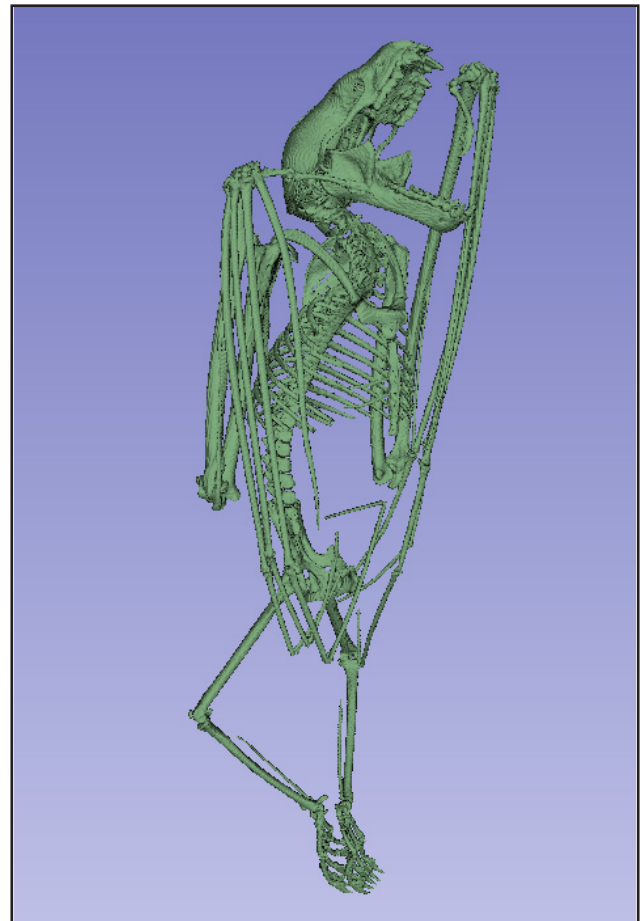
BatPEN! specifically aims to create a digital collection of phenotypic characters from members of the bat family Phyllostomidae (Order Chiroptera), or New World leaf-nosed bats. Phyllostomids are the second most species-rich family, with around 214 species, and display an incredible amount of phenotypic and ecological variability. In addition, Phyllostomid bats span every major feeding strategy (insectivory, piscivory, omnivory, carnivory, frugivory, nectarivory, granivory, and sanguivory). BatPEN! will generate nearly 1,000 high-resolution CT-scans from fluid-preserved, whole-body specimens to capture intraspecific representation using species with large geographic distributions, as well as an ontogenetic series from species exhibiting variable and distinct degrees of sexual dimorphism.

These data will assist in contextualization of morphological characters to identify functional phenotypic units, develop a better understanding of the relationship between phenotypic expression and multiple aspects of ecology and life history, and, most importantly, be made available for future research within its online databases. Importantly, this project utilizes museum specimens, which allows for increased connection between biological researchers and natural history collections. Advancements in these collaborations will help prepare the next generation of museum scientists for protocols central to curation and management of collections.

This project has become the backbone for my Master's thesis research. Using CT-scans created from specimens archived in the Natural Science Research Laboratory (NSRL) of the Museum of Texas Tech

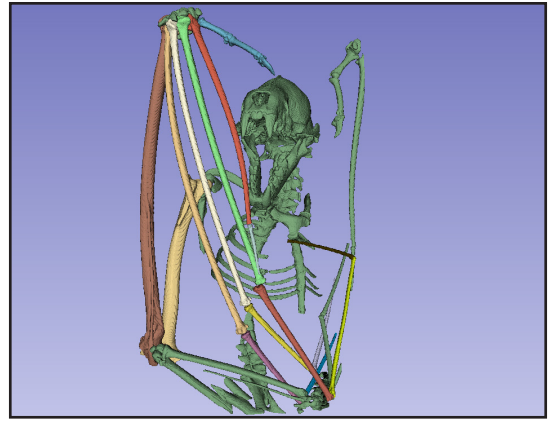


Views of the wing of *Brachyphylla cavernarum*, showing both 3D skeletal wing structure (top) and 2D wing tissue volume (bottom).



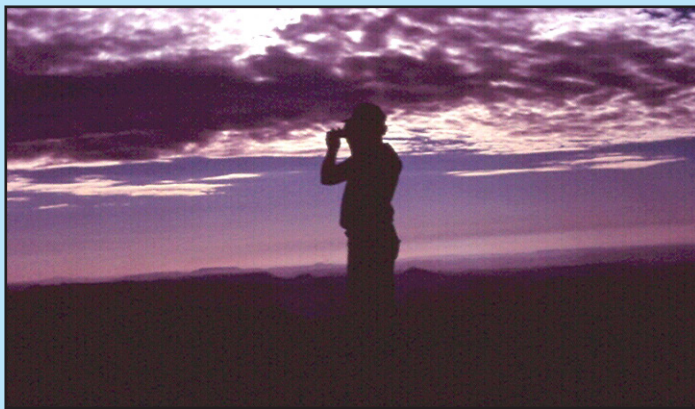
3D image of the skeleton of *Brachyphylla cavernarum*, the Antillean Fruit-eating Bat.

University and the University of Michigan, Museum of Zoology (UMMZ), my project will quantify the biostatistical trends present in the wings of Phyllostomid bat species, as well as investigate the mechanisms behind variability of wing characters. These specimens, of which over 114 species have been scanned, are imported into imaging software (Dragonfly ORS and 3D Slicer) for 2D and 3D visualization. From there, each individual element of the right wing (from the humerus to distal phalanges, excluding the carpals) is visually isolated within segmentation layers. These segmentations allow for accurate identification of bone boundaries that can then be individually exported into 3D modelling software such as Blender, Maya, or MeshLab. Each bone is measured, cataloged, and used to characterize patterns of allometry, modularity, and secondary-sexual dimorphism. A better understanding of allometry will provide context for how individual morphological elements respond to changes in body size, whereas modularity can be used to identify functional units, or areas of the wing that may be under different selective pressure for conformity within certain elements relative to others. My research will add to chiropteran literature in a manner that moves the emphasis on allometry and modularity beyond the post-cranial skeleton and explores wings from perspectives of more than flight performance alone.



3D image of the skeleton of *Chrotopterus auritus*, the Big-eared Woolly Bat, with wing view fully segmented.

My hypothesis is that functional wing units are related to foraging behavior and will exhibit biostatistical trends among species. Further, I predict that subfamily designations closely follow feeding behaviors (guilds). As BatPEN! continues to add to its database, and as additional phenotypic characters and accompanying parameters are incorporated, my project may expand to address new hypotheses and research objectives. For now, I am busy examining terabytes of bat CT scans and searching for patterns that can be used to explain the evolutionary significance that accompanies the extraordinary morphological diversity within the Phyllostomidae.



Looking for good students! Bradley in Davis Mountains, Texas.

A Message to Prospective Students:

Faculty and staff associated with the NSRL are very active in field- and specimen-based research. Our faculty and students have interests in mammalogy, ornithology, invertebrate zoology, molecular systematics, genomics, ecology, and museum science. Most of the undergraduate and graduate students that are affiliated with the NSRL receive degrees in the Department of Biological Sciences or the Department of Natural Resources Management. We also have students who are part of the Museum Science program.

Together, we have a strong core of faculty and undergraduate and graduate students, and we are always on the look-out for potential new students. If you are interested in pursuing a graduate degree or undergraduate research opportunities, please contact any of the faculty members highlighted in this newsletter.

NSRL News is produced by Lisa Bradley with assistance from the staff, students, and associates of the NSRL. Please contact Lisa to request a hard copy or to submit comments or contributions for upcoming issues of *NSRL News*.

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NSRL, Museum of Texas Tech University, Lubbock, TX 79409

From the TTU Development Office

2023 marked a significant year of celebration for Texas Tech University. Our University campus celebrated its Centennial. At the Museum, our Natural Science Research Laboratory (NSRL) celebrated its Golden Jubilee — fifty years of research, scientific discoveries, and accomplishments that have improved this great state and the world!

Reflecting on the accomplishments of the NSRL is quite an undertaking. In the last 50 years, society has gone through so many advancements in science and research. Along the way we have not missed a beat. As a matter of fact, the NSRL is now a global leader in biodiversity research and education. It can be proud in the following:

- A significant scientific community of curators, faculty, and students who have engaged in major research endeavors bringing in more than \$25 million in external research awards and endowments
- While not a degree granting entity, the NSRL has enabled and facilitated a multitude of research projects and the education of more than 250 TTU graduate students and more than 500 undergraduate students.
- The generation of more than 2,000 peer reviewed scholarly publications.
- Recognition, nationally and internationally, as a leader in curatorial science and collections management practices.
- Housing the largest biological collection in Texas, 2nd largest natural history collection in Texas, 2nd largest genetic resources collection in the western hemisphere, 3rd largest invertebrate collection in Texas, and 4th largest mammal collection in an academic institution in the US.

Impressive doesn't begin to describe the Natural Science Research Laboratory. As our growth continues and the momentum builds, we are always looking to cultivate additional partnerships that will help to build the connection between conservation, biodiversity, research, education, and stewardship. Preservation and knowledge of this great State of Texas is vital and the biodiversity, essential beauty, and iconic wildlife it provides us should be cared for and used to educate and enrich future generations.


It is with sincere gratitude, I thank YOU for your consideration and support of our great institution. We welcome the opportunity for YOU to join us in making a difference as we build our next 50 years!




Assistant Director of Development

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