

# NSRL NEWS

Natural Science Research Laboratory  
Museum of Texas Tech University

Volume 3, Fall 2016



## ***Research Highlight: Energetic Dimensions of Brazilian Free-tailed Bats***

Frio Cave, like several other Texas caves, is home to one of the largest concentrations of mammals on the planet, Brazilian Free-tailed Bats. The number of bats living in this colony is impossible to determine, although many people have tried—estimates range up to 12 million bats. Every evening, a river of bats flows out of the cave and spreads across the landscape in search of insect prey. For decades,



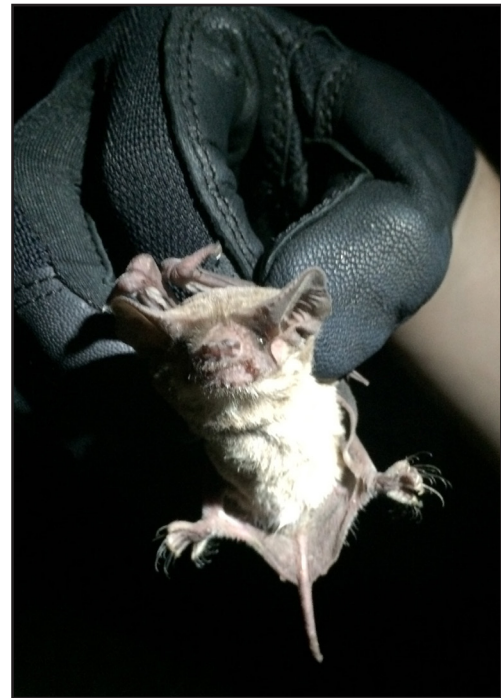
*The air is filled with Brazilian Free-tailed Bats emerging from Frio Cave at sunset. Photo by A. Sommers.*

scientists and tourists alike have wondered at the spectacle of the Brazilian Free-tailed Bat emergence from this cave. With thermal imaging cameras, previous researchers have estimated that 25,000–30,000 bats emerge every minute during the peak emergence period. With so many bats trying to fly out of the cave, some are forced to emerge while it is still daylight, and the emergence continues until well after dark. This same awe-inspiring scene repeats itself night after night throughout the entire summer and into the fall.

But things aren't exactly the same for that entire period. And that's what has drawn the interests of Dr. Caleb Phillips (NSRL Curator of Genetic Resources and Assistant Professor in Biological Sciences) and Dr. Liam McGuire (NSRL Research Associate and Assistant Professor in Biological

Sciences). Drs. Phillips and McGuire are interested in the ecological drivers, mechanisms, and consequences of seasonal variation. How does variation in environmental factors affect genetic and physiological processes in wild animals? And how are genetic and physiological processes affected by changes within animals, such as reproductive status?

Together with a team of graduate students, these researchers are working with the bats at Frio Cave to develop an integrative understanding of how flexible animals can be. The bats



*Brazilian Free-tailed Bat. Photo by E. Rogers.*

at Frio Cave arrive in the spring, having migrated perhaps 500 miles from their winter roosts in Mexico. Over the ensuing months, females go through pregnancy, nurse their pup, and then prepare for the return fall migration. Pregnancy, lactation, and long-distance migration are all extremely energetically demanding. In contrast, males do not experience any reproductive energetic costs through the summer, but rather must cope only with environmental variation.



*Oscar Sandate and Amie Sommers taking a Brazilian Free-tailed Bat out of a mist net. Photo by G. Edwards.*

Dr. McGuire is a physiological ecologist, with a particular interest in phenotypic flexibility; that is, how traits and characteristics of animals change over time in response to varying conditions. Amie Sommers (MS student, TTU Biological Sciences) is studying changes in digestive (e.g., intestines, kidneys, liver) and exercise organs (e.g., flight muscle, heart, lungs) in the context of exercise and energetic tradeoffs. Elizabeth Rogers (MS student, TTU Biological Sciences) will take a biochemical approach to address similar questions, measuring aerobic capacity and lipid metabolism in muscle and liver samples. All of this research will benefit from the use of Dr. McGuire's Mobile Ecological Research Laboratory (MERL). MERL allows researchers to bring the lab out to



*Elizabeth Rogers determining the sex of a Brazilian Free-tailed Bat in MERL. Photo by A. Sommers.*

the field, including a non-invasive body composition analyzer that provides measurements of fat and lean tissue mass.

Dr. Phillips is a mammalian functional genomicist and investigates how microbiomes, the symbiotic bacterial communities that live in and on hosts, interact and help support host physiological processes. In the context of the bats of Frio Cave, Dr. Phillips and Oscar Sandate (MS student, TTU Biological Sciences) are studying the host-microbiome relationship over the course of pregnancy and how these changes relate to energetic demands. They are character-



*Amie Sommers using the body composition analyzer on a Brazilian Free-tailed Bat in MERL. Photo by G. Edwards.*

izing this relationship by studying changes in dietary energy extraction efficiency, changes in intestinal histology, host immunological response, and changes in microbiome community structure and function.

The research questions pursued by the Phillips and McGuire laboratories are being developed in conjunction and are based on the same set of specimens, enabling the emergence of systems-level understandings about physiology, reproduction, and genomics. The support of the NSRL is an invaluable resource for managing field work of this scope, which involves the collection, liquid nitrogen-transfer, cataloguing, and curation of all samples and specimens. Equally important, this research is growing the already world-leading Genetic Resources Collection. Samples collected as part of this research will be available for later studies, decades into the future. With a ready supply of study animals, an on-site mobile laboratory, and the support of the NSRL, the team from Texas Tech is on the cutting edge of research and technology that will contribute many novel insights into our understanding of how organisms cope with change.

## NSRL FACULTY 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 is currently directing 4 PhD and 4 MS students. He has graduated 18 MS, 2 MA, and 10 PhD students, and he has published 158 peer-reviewed articles.

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**Dr. Nancy McIntyre** is the NSRL 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 is currently advising or co-advising 2 PhD, 1 MS, and 1 undergraduate students.

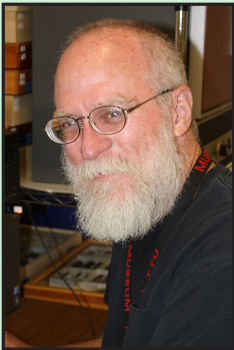
[nancy.mcintyre@ttu.edu](mailto:nancy.mcintyre@ttu.edu)



**Dr. Caleb D. Phillips** is the Curator of Genetic Resources of the NSRL and an Assistant 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 is currently advising or co-advising 5 PhD, 1 MS, and 2 undergraduate students.

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## NSRL CURATORIAL AND SUPPORT STAFF



**James Cokendolpher** is the NSRL Assistant Curator of Invertebrate Zoology and a Research Scientist. His research experience includes work with invertebrates, vertebrates, and botany. He is an authority on two Orders of arachnids and has published papers and books on a variety of animal and plant taxa.

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**Heath Garner** is the NSRL Curator of Collections. His role is to facilitate the daily operations and maintenance of the NSRL collections. His duties include specimen processing, cataloging, and tracking, loan processing, student worker and volunteer training and supervision, documentation, and collections preventative conservation.

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**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 maintaining the NSRL website, assisting with specimen tracking in the collections, and data management and design.

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**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 published by NSRL staff, the preparation of grant proposals, and the development of NSRL exhibits for the Museum.

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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 125,804 cataloged specimens of an estimated 1,441 species. Specimen preparation types include preserved skins, skeletal materials, alcohol-preserved specimens, and taxidermy mounts. From January through June 2016, the Mammal Collection cataloged 4,825 specimens and granted 8 loans of 151 specimens.

## Bird Collection



The Bird Collection currently contains 5,517 cataloged bird specimens, as well as eggs and nests, of approximately 890 species. From January through June 2016, the Bird Collection cataloged 10 new specimens and granted 4 loans of 195 specimens.

## Invertebrate Zoology Collection



The Invertebrate Zoology Collection contains an estimated 4.5 million specimens. These include insects, crustacea, endo- and ecto-parasites, and arachnids. Specimen preservation methods include dried, fluid (ethanol or formalin), slide-mounted, and frozen. From January through June 2016, the collection staff cataloged 25,808 specimens. The entire catalog may be searched here: <http://symbiota4.acis.ufl.edu/scan/portal/collections/>

## Genetic Resources Collection



The Genetic Resources Collection contains >355,000 samples of tissues, blood, and extracted DNA from >98,000 specimens of mammals and other taxa. From January through June 2016, the GRC granted 17 loans totaling 1,248 samples. The Collection grew by 11,594 samples obtained from 2,200 individuals of mammals and birds.

As a whole, the NSRL hosted 302 visitors from January through June, including researchers utilizing the collections, students taking classes, and individuals and groups on tours. The NSRL also filled 72 data requests by researchers. Twenty-eight students (9 graduate, 19 undergraduate) were employed by the NSRL during all or part of the January through June time period.

# Mammalogy at the TTU Center at Junction

by Robert D. Bradley

One of the best kept secrets at Texas Tech University is the Intersession program at the TTU Center at Junction, located on the banks of the Llano River in the Texas Hill Country. During the Intersession program, several “short courses” are offered at the Junction campus, and students can receive 3–4 hours of credit for a select offering of courses in Biology, Natural Resource Management, Geology, English, Journalism and Electronic Media, and Communication Studies. The Intersession program is 15–16 days in length; beginning about two days after Spring final exams on the Lubbock campus and terminating about two days before the First Summer Session begins. It is a whirlwind ordeal, as a typical Junction day is 14–16 hours long and provides the well-earned moniker “Junction Experience”. Obviously, students are immersed into the course they have selected, but it comes with many advantages. First, students get the same course content and credit that they would receive in a long semester on the Lubbock campus but in a much shorter time frame. Second, students get exposed to many things that are not easily provided on the Lubbock campus, such as field trips and hands-on experience. Third, the Junction campus and ambiance is extraordinary! Fourth, they spend a lot of “quality” time with faculty members (maybe more than they bargained for), which can lead to offers to work in someone’s research laboratory or a glowing letter of recommendation for graduate or medical school.

Mammalogy has been one of the long-standing courses during the Intersession program. Robert Packard taught mammalogy during Intersession during the late 1970s. Following Packard’s death, Robert Baker took over, and was then followed by Ron Chesser, J Knox Jones, and Robert D. Owen. I was handed the reins in 1996, and I have taught mammalogy each Intersession since, except 2001–2002, when I had one of my graduate students fill in.

Although Junction is not a hotspot of mammalian biodiversity, it provides students with the opportunity to collect and observe mammals. The Junction setting allows us to conduct fieldwork and specimen preparation along with the standard lecture and laboratory training. For many students, this is their first exposure to fieldwork, and for some, their first outdoor experience. Not only do students learn how to prepare voucher specimens and obtain tissue samples for the NSRL, they are trained in proper animal care and use methods and learn about the value and use of scientific specimens and their associated data. From collecting and preparing deermice, skunks, armadillos, porcupines, and more, students gain a new perspective on anatomy, defense mechanisms, and morphologic specializations. At the same time, they gain a respect and appreciation for the time and effort that it takes to obtain and prepare voucher specimens for natural history museums and teaching collections.



For more information about the TTU Center at Junction, visit <https://www.depts.ttu.edu/junction/>

## STUDENT PRESENTATIONS

During the period January through June 2016, at least 28 graduate and 11 undergraduate students gave 44 oral and 27 poster presentations of their research at 12 local, regional, and national conferences and society meetings.

Nine students won 11 awards for their presentations, as follows:

**James Q. Francis.** Graduate student. First Place Oral Category for Proposals, 7th Texas Tech Annual Biological Sciences Symposium.

**Laramie L. Lindsey.** Graduate student. First Place Oral Category for Evolutionary Biology, 7th Texas Tech Annual Biological Sciences Symposium.

**Nicté Ordóñez-Garza.** Graduate student. Runner-up, Ecobehavior, 15th Annual Graduate School Poster Competition, Texas Tech University.

**Austin Osmanski.** Graduate student. Second Place Oral Presentation, 7th Texas Tech Annual Biological Sciences Symposium; Best Graduate Poster Presentation, Texas Society of Mammalogists.

**Cristina Rios-Blanco.** Graduate student. Best Presentation in Ecology, 7th Texas Tech Annual Biological Sciences Symposium; First Place, Ecobehavior, 15th Annual Graduate School Poster Competition, Texas Tech University.

**Scott M. Starr.** Graduate student. First Place Poster Presentation, 7th Texas Tech Annual Biological Sciences Symposium.

**John Stuhler.** Graduate student. Second Place, Ecology, 7th Texas Tech Annual Biological Sciences Symposium.

**Kevin Sullivan.** Graduate student. First Place Oral Presentation, 7th Texas Tech Annual Biological Sciences Symposium.

**Whitney Watson.** Undergraduate student. Second Place Oral Presentation in Undergraduate Category, 7th Texas Tech Annual Biological Sciences Symposium.

## STUDENT GRANTS AND AWARDS

**Daniela Arenas-Viveros.** Graduate student. 2016 Latin American Student Field Research Award, American Society of Mammalogists.

**Marina Fisher-Phelps.** Graduate student. Cash Family Graduate Fellowship, TTU.

**Lucas Heintzman.** Graduate student. Elo and Olga Urbanovsky Assistantship (2015–2018); US Chapter of the International Assn. for Landscape Ecology Travel Award (2016); TTU Graduate School Travel Award (2016).

**Narayan Kandel.** Graduate student. Doctoral Dissertation Completion Fellowship, TTU Graduate School (2015–2016).

**Macy Madden.** Graduate student. Texas Tech University AT&T Chancellor's Graduate Fellowship (2014–2018); American Society of Mammalogists, Grants in Aid (2016–2017); Texas Tech University Association of Biologists (2016–2017).

**Kendra Phelps.** Graduate student. Doctoral Dissertation Completion Fellowship (2015–2016), TTU.

**Cristina Rios-Blanco.** Graduate student. Travel Award, American Society of Mammalogists, 2016–2018; Grant in Aid of Research, Texas Tech University Association of Biologists, 2016–2018.

**Scott Starr.** Graduate student. Water Conservation Research Fellowship (2015–2016); TTU Doctoral Dissertation Completion Fellowship (2015–2016); US Chapter of the International Association for Landscape Ecology Travel Award (2016); TTU Graduate School Travel Award (2016); TTU Graduate School Summer Dissertation Research Award (2016).

**John Stuhler.** Graduate student. Grant in Aid of Research, American Society of Mammalogists, 2016–2018; Grant in Aid of Research, Texas Tech University Association of Biologists, 2016–2018.

**Iroro Tanshi.** Graduate student. Bat Conservation International (BCI), Marie Morgan Student Research Fellowship (2015–2019); Michelle Knapp Memorial Graduate Research Award, TTU Biological Sciences.

## FACULTY AND STAFF GRANTS (active January–June 2016)

**Bradley, R. D.** “Natural History: Development of a liquid nitrogen system for the Genetic Resources Collection, Natural Science Research Laboratory, Museum of Texas Tech University”. NSF (Collections in Support of Biological Research).

Griffis-Kyle, K., and **N. McIntyre**. “Synergistic links between ecological traps and climate change in metapopulation dynamics: The keystone role of arid wetlands.” Texas Tech University Proposal Support Program.

Griffis-Kyle, K. L., and **N. E. McIntyre**. “Landscape connectivity of isolated waters in the Sonoran Desert for wildlife.” U.S. Bureau of Reclamation - Desert and Southern Rockies Landscape Conservation Cooperatives.

Griffis-Kyle, K. L., and **N. E. McIntyre**. “Assessment of landscape conservation success for non-target species at risk.” Western Association of Fish & Wildlife Agencies - Grassland Initiative.

Hoffmann, F., and **D. Ray**. “piRNA dynamics in the absence of active TEs.” National Science Foundation.

**Kingston, Tigga**. “Southeast Asian Bat Conservation Research Unit.” National Science Foundation.

Longing, S., R. Cox, **N. McIntyre**, C. McKenney, and C. West. “Demonstration of pollinator conservation practices and a framework for regional implementation on the Southern High Plains.” USDA Natural Resources Conservation Service - Conservation Innovation Grants.

**McIntyre, N. E.**, and K. Hayhoe. “Collaborative proposal: Climatic and anthropogenic forcing of wetland landscape connectivity in the Great Plains.” NSF-Macrosystems Biology.

**McIntyre, N. E.**, S. M. Starr, L. J. Heintzman, K. R. Mulligan, and L. S. Barbato. “Using remotely sensed imagery to document how land use drives turbidity of playa waters in Texas.” Texas Tech University Open Access Publication Initiative.

**Ray, D., R. Stevens, and R. D. Bradley**. “Population status of Texas pocket gophers (*Geomys* and *Thomomys*).” Texas Parks and Wildlife Department.

**Ray, D., and R. Stevens**. “Comparing genetic diversity of the threatened northern long-eared bat across their range using whole-genome and RADSeq approaches.” USDA Forest Service.

Rico-Cernohorska, A., **J. Salazar-Bravo**, et al. “Generación de fortalezas para la determinación de enfermedades zoonóticas en el norte de La Paz (PBE4 - Phase II). Proyectos Concursables De Investigacion E Interaccion Social (IDH), Bolivia.

**Salazar-Bravo, J.** “Multiple dimensions of host-pathogen biodiversity: rodents, virus in South American habitats.” Texas Tech University’s International Research Seed Grants competition.

**Stevens, R.** “Distribution, abundance and use of artificial roosts by critically imperiled bat species in Louisiana.” USFWS/Louisiana Wildlife and Fisheries.

**Stevens, R.** “Habitat affinities and day roost characteristics of the northern long-eared bat (*Myotis septentrionalis*) in Louisiana.” USFWS/Louisiana Department of Wildlife and Fisheries.

**Stevens, R. D.** “Winter day-roost characteristics of the northern long-eared bat (*Myotis septentrionalis*) in Louisiana.” U.S. Forest Service.

**Stevens, R.**, and M. Barnes. “White-nose Syndrome (WNS) surveillance in Louisiana.” USFWS/Louisiana Department of Wildlife and Fisheries.

**Stevens, R. D.**, and S. Fritz. “Fort Wolters bat surveys.” Texas Army National Guard.

**Stevens, R. D., D. Ray, R. N. Platt, and R. D. Bradley**. “RFP No. 209f for Endangered Species Research Projects for the Texas Kangaroo Rat.” Texas State Comptroller.

Williams, G., J. Cañas, J. Dwyer, S. Jang, and **N.E. McIntyre**. “RMR-TTU: Recruitment, mentoring, and research in mathematics and science at Texas Tech University.” NSF-PRISM (Proactive Recruitment in Introductory Science and Mathematics).

## 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 both the Museum Publications Policy and the Guidelines and Procedures for Authors, available at our website, [www.nsrl.ttu.edu/publications](http://www.nsrl.ttu.edu/publications), for more information.

Lisa Bradley serves as the Production Editor for both series. Our goal is to produce 10–12 Occasional Papers and 1–2 Special Publications per year. Feel free to contact Lisa, [lisa.bradley@ttu.edu](mailto:lisa.bradley@ttu.edu), if you are interested in submitting manuscripts or monographs to the Occasional Papers or Special Publications series.

### Publications produced January–June 2016:

**Special Publication 64.** United States Biological Survey: A Compendium of its History, Personalities, Impacts, and Conflicts. David J. Schmidly, William E. Tydeman, and Alfred L. Gardner, editors.

**CHECK THE WEBSITE FOR MORE RECENT PUBLICATIONS!**

**View and download Occasional Papers and Special Publications at the NSRL website:**

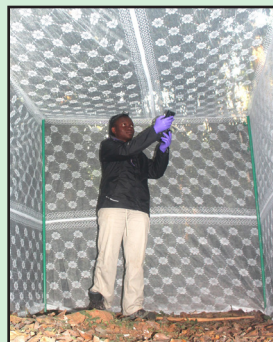
[www.nsrl.ttu.edu/publications](http://www.nsrl.ttu.edu/publications)

## OUTREACH NEWS AND EVENTS

This spring, **Tigga Kingston** visited the Guernsey Grammar School in the Channel Islands, United Kingdom, and presented a talk on “Bat Ecology and Conservation” to three classes of 10th grade students.

**Tigga Kingston** was an invited speaker at the Texas Pollinator Pow-Wow, held at the Museum of Texas Tech University, and presented “Wind farms, wetlands, and white-nose: Challenges to bat conservation on the High Plains.”

**Iroro Tanshi**, graduate student of Tigga Kingston, was featured in a CNN video regarding her research on bats in the Afi Mountain region of Nigeria. See her interview here (about three minutes into the video): <http://edition.cnn.com/videos/world/2016/03/29/inside-africa-nigerian-wildlife-spc-b.cnn>



*Iroro Tanshi recording bat calls in a flight tent in Nigeria.*

**Caleb Phillips’** research on the the genetic mechanism behind the anti-coagulating properties of vampire bat saliva was featured in the online magazine of the TTU Office of the Vice President for Research, “Texas Tech University Discoveries”: <http://www.depts.ttu.edu/vpr/discoveries/features/a-design-for-blood.html>



*Caleb Phillips in his laboratory in Biological Sciences.*



*Students of Richard Stevens at the “Scales, Tails, and Trails” event.*

On May 7th, the **Richard Stevens’ Lab** took part in the 3rd Annual “Scales, Tails and Trails,” a nature outreach event at the Lubbock Lake Landmark that is organized by the Association of Natural Resources Scientists of the Department of Natural Resources Management.

*Outreach continued on page 11*



## RECENT PUBLICATIONS BY NSRL FACULTY, STAFF, AND STUDENTS

- Aguirre, L. A., F. Montano, M. M. Gavilanez, and R. D. Stevens. Taxonomic and phylogenetic determinants of functional composition of Bolivian bat assemblages. *PLoS One*, In Press.
- Baker, R. J., S. Solari, A. Cirranello, and N. B. Simmons. Higher level classification of phyllostomid bats with a summary of DNA synapomorphies. *Acta Chiropterologica* 18:1–38.
- Bohn, S. J., J. M. Turner, L. Warnecke, C. Mayo, L. P. McGuire, V. Misra, T. K. Bollinger, and C. K. R. Willis. Evidence of ‘sickness behaviour’ in bats with white-nose syndrome. *Behaviour*, In Press.
- Bradley, R. D., and M. R. Mauldin. Molecular data indicate a cryptic species in *Neotoma albigula* (Cricetidae: Neotominae) from northwestern México. *Journal of Mammalogy* 97:187–199.
- Cirranello, A., N. B. Simmons, S. Solari, and R. J. Baker. Morphological diagnoses of higher-level phyllostomid taxa (Chiroptera: Phyllostomidae). *Acta Chiropterologica* 18:39–71.
- de Moraes Weber, M., R. D. Stevens, J. A. F. Diniz-Filho, and C. E. V. Grelle. Is there correlation between abundance and environmental suitability derived from ecological niche modeling? A meta-analysis. *Ecography*, In Press.
- Hidalgo-Cossio, M., J. Salazar-Bravo, and T. Tarifa. Nuevas localidades en el centro de Bolivia para la especie endémica *Abrocoma boliviensis* (Rodentia: Abrocomidae). *Mastozoología Neotropical* 23:165–170.
- Kingston, T. Bats. Pp 59–82 in *Core Standardized Methods for Rapid Biological Field Assessment* (T.H. Larsen, ed.). Conservation International, Arlington, VA.
- Kingston, T. Review of: Berthinussen, A., Richardson, O. C., and Altringham J. D. 2014. *Bat Conservation: global evidence for the effects of interventions*. Synopses of Conservation Evidence Series Vol. 5. Exeter: Pelagic. *Acta Chiropterologica* 17:445–446.
- Konstantinos, E. P., N. L. Ward, C. D. Phillips, et al. Prevention of antibiotic-associated metabolic syndrome in mice by intestinal alkaline phosphatase. *Diabetes, Obesity and Metabolism*. DOI: 0.1111/dom.12645
- McIntyre, N. E., J. C. Drake, and K. L. Griffis-Kyle. A connectivity and wildlife management conflict in isolated desert waters. *Journal of Wildlife Management* 80:655–666. DOI: 10.1002/jwmg.1059.
- Menzies, A. K., Q. M. R. Webber, D. E. Baloun, L. P. McGuire, K. A. Muise, D. Cote, S. Tinkler, and C. K. R. Willis. Metabolic rate, latitude and thermal stability of roosts, but not phylogeny, affect rewarming rates of bats. *Physiology and Behavior* 164:361–368. dx.doi.org/10.1016/j.physbeh.2016.06.015.
- Monjaraz-Ruedas, R., O. F. Francke, and J. C. Cokendolpher. Three new species of *Agastoschizomus* (Arachnida: Schizomida: Protoschizomidae) from North America. *Revista Mexicana de Biodiversidad* 87:337–346.
- Muylaert, R. L., R. D. Stevens, and M. C. Ribeiro. Threshold effect of habitat loss on bat richness in savanna-forest landscapes. *Ecological Applications*, In Press.
- Pardiñas, U. F. J., P. Teta, J. Salazar-Bravo, P. Myers, and C. A. Galliari. A new species of arboreal rat, genus *Oecomys* (Rodentia, Cricetidae) from Chaco. *Journal of Mammalogy*. DOI: http://dx.doi.org/10.1093/jmammal/gyw070
- Patrick, L. E., and R. D. Stevens. Phylogenetic community structure of North American desert bats: influence of environment at multiple spatial and taxonomic scales. *Journal of Animal Ecology* 85:1118–1130.
- Platt, R. N. II, L. Blanco-Berdugo, and D. A. Ray. Accurate transposable element annotation is vital when analyzing new genome assemblies. *Genome Biology and Evolution* 8:403–410.
- Ray, J. D., N. McIntyre, M. C. Wallace, and M. G. Schoenhals. Tracking Burrowing Owls. *Bird Watcher’s Digest* Jan/Feb:40–45.
- Ray, J. D., N. E. McIntyre, M. C. Wallace, A.P. Teaschner, and M. G. Schoenhals. Factors influencing Burrowing Owl productivity in prairie dog colonies in the Southern High Plains of Texas. *Journal of Raptor Research* 50:185–193.
- Rios-Blanco, M. C., and J. Perez-Torres. Dieta de las especies dominantes del ensamblaje de murcielagos frugiveros en un bosque seco tropical (Colombia). *Mastozoología Neotropical* 22:103–111.
- Sabino-Santos, G., Jr, F. G. M. Maia, C. B. Jonsson, D. G. Goodin, J. Salazar-Bravo, and L. T. M. Figueiredo. Serologic evidence of mammarenaviruses among wild rodents in Brazil. *Journal of Wildlife Diseases*. DOI: http://dx.doi.org/10.7589/2015-09-252
- Sagot, M., C. D. Phillips, R. J. Baker, and R. D. Stevens. Human-modified habitats change patterns of population genetic structure and group cohesion in Peter’s tent-roosting bats. *Ecology and Evolution*, In Press.
- Starr, S. M., L. J. Heintzman, K. R. Mulligan, L. S. Barbato, and N. E. McIntyre. Using remotely sensed imagery to document how land use drives turbidity of playa waters in Texas. *Remote Sensing* 8:192. DOI: 10.3390/rs8030192.
- Stevens, R. D., M. Johnson, and E. S. McCulloch. Geographic variation of wing morphology of *Artibeus lituratus*: environmental, genetic and spatial correlates of phenotypic differences. *Biological Journal of the Linnean Society*, In Press.
- Stuhler, J. D., and J. L. Orrock. Historical land use and present-day canopy thinning differentially affect the distribution and abundance of invasive and native ant species. *Biological Invasions* 18:1813–1825.
- Stuhler, J. D., and J. L. Orrock. Past agricultural land use and present-day fire regimes interact to determine the nature of seed predation. *Oecologia* 181:463–473.
- Vandewege, M. W., S. Mangum, T. Gabaldon, T. A. Castoe, D. A. Ray, and F. G. Hoffmann. Contrasting patterns of evolutionary diversification in the olfactory repertoires of reptile and bird genomes. *Genome Biology and Evolution* 8:470–480.
- Vandewege, M. W., R. N. Platt II, D. A. Ray, and F. G. Hoffmann. Transposable element targeting by piRNAs in Laurasiatherians with distinct transposable element histories. *Genome Biology and Evolution* 8:1327–1337.

# NSRL and Biology Faculty Provide Research Opportunities for Undergraduate Students

by Robert D. Bradley

Since its inception as a research collection, the NSRL has been fortunate to have been affiliated with many highly qualified undergraduate students. Historically, depending on the nature of the research project, undergraduate students had the opportunity to work directly in the NSRL collections (natural history or specimen-based projects) or use the research laboratories of faculty in the Department of Biological Sciences (DBS) to conduct more specialized research (chromosome, allozyme, physiology, etc.). Given that the Museum does not offer an undergraduate degree, most students were recruited through their participation in a Biological Science course and then introduced to the NSRL by faculty in the DBS. Courses such as Mammalogy, Natural History of the Vertebrates, and General Biology were responsible for many students taking their first step into the world of research. For the most part, this trend continues today as DBS faculty recruit some of the brightest and most motivated undergraduates into their research labs and then use the resources at the NSRL to design an appropriate project that matches the student's goals.



*Matt Mauldin, BS 2008, PhD 2014. Current ORISE Fellow, Centers for Disease Control and Prevention, Atlanta, Georgia.*

Back in the day (ca. 1970s), mammalogy professors Robert Packard and Robert Baker often took undergraduate students on field trips and put them to work in their research laboratories. Many aspiring mammalogists (David J. Schmidly, Jim Reichman, and others) got their foot in the door this way; James Bull (Professor at UT Austin and a recent addition to the National Academy of Sciences), published two scientific articles on snake chromosomes resulting from his undergraduate experiences in Robert Baker's lab. Many other students used their undergraduate research experience to "résumé build" for medical school or other professional health programs. Most of these students were volunteer researchers (no formal pay), although the end result (graduate or medical school acceptance) certainly justified their time and effort.

The undergraduate research experience gained momentum in the 1980s, when TTU was awarded a Howard Hughes Medical Institute (HHMI) grant. This program paid a stipend to students so that they could be encouraged to give research a try. From the late 1990s into the early 2000s, TTU received five HHMI grants, and the TTU administration matched a portion of the funding on many of the grants. As a result, the number of undergraduates participating in research grew exponentially. Given this success, TTU developed the Center for the Integration of STEM Education and Research (CISER) to help maintain and continue the focus on undergraduate research.

It is impossible for us to fully document the number of undergraduates that have used the resources of the NSRL as a support vehicle for their research projects—there is no telling how many undergraduate students Packard, Baker, J Knox Jones, Clyde Jones, and others introduced to field-based or laboratory-based natural history research. Since 1994, I personally have had the privilege of directing 68 students conducting undergraduate research in my laboratory or at the NSRL. Each one of these students conducted a specimen-based research project, and many accompanied me on collecting trips. Several have gone on to graduate research here at TTU or at other universities, whereas many others have become teachers or health-care professionals.

**Sidebar:** During January–June 2016, at least 18 undergraduate students were conducting research under the direction of 8 NSRL faculty associates.



Whitney Watson. Senior, Microbiology.

Although I could portray many of these former students as examples of “successful undergraduates,” I have selected two for comment—Dr. Matt Mauldin and Ms. Whitney Watson. Matt was recruited into my lab several years ago by one of my PhD students, John Hanson. John was a teaching assistant for one of our undergraduate courses, and he informed me that Matt was a promising student and that I

should consider inviting him to do undergraduate research. Matt spent a year as an undergraduate researcher (2008–2009) and did a good job. Matt then asked if I would accept him as a Master’s degree candidate, and I agreed. Within a very short period of time, Matt blossomed as a researcher, we switched him into a PhD program, and as they say, the rest is history. Matt used microsatellites and other DNA markers to examine natural hybridization between *Neotoma micropus* and *N. floridana*. Dr. Mauldin is now an ORISE Fellow at the Centers for Disease Control in Atlanta and certainly has established himself as an outstanding researcher. The second example is of Whitney Watson, a current undergraduate in my lab. Whitney is using tissue samples from the Genetic Resources Collection to investigate the evolution of the zonadhesion gene (sperm-egg fusion protein) to test the proposed subordinal boundaries in rodents. Whitney and her research were featured in a recent “Spotlight on Innovators” story by the TTU College of Arts & Sciences. See link for the full article: <http://www.depts.ttu.edu/artsandsciences/students/prospective/WhitneyWatson.php>

Regardless of their professional career choices, I would like to think that the experiences and opportunities offered by the NSRL have made each of these students a better scientist and/or citizen. Certainly, the experiences provided them with a better understanding of natural systems and the ins-and-outs of research. We hope to continue to expand the role of the NSRL in undergraduate research and look forward to mentoring future undergraduate students as they explore research opportunities and widen their career horizons.

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## OUTREACH NEWS AND EVENTS

**Dr. Jorge Salazar-Bravo** and colleagues are developing two symposia for the 12th International Mammalogical Congress, which will take place 9–14 July 2017, in Perth, Australia. The first symposium, "Latin American Mammalogy: Perspectives and Challenges after a Quarter of a Century," is being co-organized by Jorge and Dr. Alexandre Percequillo (Universidade de Sao Paulo, Piracicaba). The second symposium, “Mammals and their Parasites - Exploring the Coevolutionary Paradigms, Progress Since the Publication of DAMA, and Prospects for the Future,” is being organized by Dr. Scott Gardner (Univ. Nebraska-Lincoln), Jorge, and Dr. Mitsuhiro Asakawa (Rakuno Gakuen University, Japan).

**Dr. Robert Bradley** was recently interviewed by KAMC News (Lubbock) for a report on the legendary “chupacabra.” The interview was a follow-up story to a local report of a possible dead chupacabra seen along a roadway in Hockley County; upon examination by a game warden, the alleged chupacabra was determined to be a coyote with mange. Reporter Alyssa Goard and a camera crew visited the

NSRL to conduct the interview of Dr. Bradley. The story, video, and photographs may be viewed here: <http://www.everythinglubbock.com/news/kamc-news/chupacabra-sighting-in-hockley-county-the-legend-continues-in-west-texas>

April 26th marked the 30th anniversary of the explosion at the Chernobyl Nuclear Power Plant in Soviet Ukraine. In recognition of that event, **Dr. Ron Chesser** and **Dr. Carleton Phillips** were interviewed by several local news stations about their research on the effects of radiation in the area using mammal specimens and tissues archived at the NSRL that they and others have collected from the region since the early 1990s. The resulting articles and videos may be viewed here: (1) <http://www.fox34.com/story/31822425/tech-researchers-study-effects-of-radiation-after-chernobyl-disaster>; (2) <http://www.everythinglubbock.com/news/klbk-news/30-years-later-tech-researchers-are-still-learning-from-chernobyl-disaster>; (3) <http://www.kcbd.com/story/31825139/ttu-professor-studying-chernobyl-after-effects>.

# NSRL Collection Enhancements Celebrated

On April 27th, the NSRL hosted an event to celebrate two significant recent improvements to the collections at the NSRL, and to thank the donors and supporters that made these improvements possible. The celebration was attended by more than 60 invited guests, including TTU administrators, faculty, staff, students, donors, and the local media.

The collection enhancements being unveiled and celebrated included the liquid nitrogen system for the Genetic Resources Collection, which was funded by a grant from the Collections in Support of Biological Research program of the National Science Foundation. The extensive facility renovations necessary to accommodate the new system, as well as two of the five freezers, were generously funded by the Offices of the Provost and the President of Texas Tech University.



*Dr. Lawrence Schovanec, then Texas Tech University Provost (now TTU President), speaks to the media and guests at the NSRL event.*

Also unveiled were the compacting shelving units in the Fluid Collection and the Packard Library of the NSRL. The shelving system was donated by a local business, R. E. Janes Gravel Company, who was looking to relocate the compactors from a building they had purchased. The CH Foundation granted the funding for the parts and labor necessary to dismantle, move, retrofit, and reassemble the system.

The renovation of the Genetic Resources Collection and successful installation of the liquid nitrogen freezer system, and the installation of compacting shelving systems in the Fluid Collection and the Packard Library, significantly enhance the level of care, the capacity, and the functionality of these collections. The NSRL faculty, staff, and students are grateful to everyone who donated funds, time, and effort toward these improvements.



*Kathy MacDonald speaks to guests about the value of the GRC to research and the reasons why liquid nitrogen preservation is the "gold standard" for frozen tissue collections.*



*Heath Garner speaks to guests about the value of the NSRL's Fluid Collection and the improvements in capacity and functionality made possible by the compactor system.*

## MAY 2016 GRADUATE

**Nicté Ordoñez-Garza, Ph.D.** Chair: Robert D. Bradley. Dissertation title: Diversification of cricetid rodents in the montane regions of Mesoamerica: Is the Isthmus of Tehuantepec a vicariant barrier? Current position: Postdoctoral Fellow, Natural Science Research Laboratory, Texas Tech University.

## High School Students Experience NSRL

On May 6th, the NSRL hosted a tour by the Biology class of Seminole High School. The instructor, Alex Jacobs, is a TTU alum who had first learned about the NSRL when he took Dr. Bradley's Mammalogy course in 2009. The 30+ students toured the entire NSRL facility and learned about the importance of natural history collections to science and society, and the college majors and careers available to them in the biological and natural sciences and museum science.



Jacobs explained his reasons for bringing his students to the NSRL as such: "I wanted to introduce them to a valuable resource for many researchers in the fields of biology, zoology, ecology, genetics, and others. There is only so much that I can show them in a contained classroom through lecture, labs, and projects. They needed to see that there are actual people, practically in their own backyard, who are actively involved in valuable research. Secondly, I wanted to give them an opportunity to meet and greet with a college professor before they begin their higher education. I honestly had no idea how intimidated many of my seniors could actually be when they are out of their element and being taught by someone like Dr. Bradley. However, they needed that kind of experience, and I think that it will greatly benefit them in the future."

Jacobs went on to discuss his own experience of the NSRL as a student: "It was in [Dr. Bradley's] class that I really started to enjoy dissection, because he allowed us to actually go through the process of collecting tissue samples and logging them appropriately. As a teacher I have realized that assignments such as those are the ones that hold the most value, because it makes the student take ownership of his/her work. In essence, I already learned a little bit about education in a non-education class. Through field trips and labs, Dr. Bradley did a great job in providing a quality experience for his students. In a way, I wanted my students to be given a similar opportunity, and my hope is that we can continue to have this field trip in the future."

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## So You're a Biology Major: Now What?

*by Robert D. Bradley*

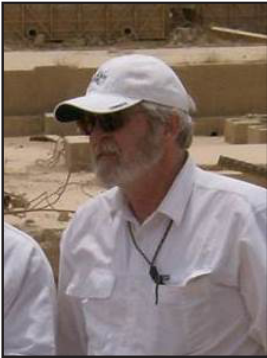
In 2015, I began teaching a new course for the Department of Biological Sciences that is specifically aimed toward freshman Biology majors. This 1-credit seminar, "So You're a Biology Major: Now What?", was suggested and developed in response to the recognition that, because of prerequisites and core requirements, many freshman Biology students do not even take a course in the Biological Sciences department until their sophomore or junior year! This "late start" exposure to their major prevents many students from learning about and taking advantage of undergraduate research opportunities, or fully understanding the myriad career and graduate-level education options that a Bachelor's degree in Biology would provide to them. In other words, I fussed about the situation and was rewarded with the old adage—"put up or shut up". So now I have a new course to teach!

Actually, it has been a very enjoyable experience. I get to talk about all of the research areas in the Department and highlight the opportunities available to the students. Students are given a variety of assignments that "force them" into thinking about undergraduate research, various courses that might expand their curriculum, volunteering, internships, shadowing, employment, and graduate school. One of my favorite assignments requires students to study the websites of the various Biology faculty members, and to make appointments with two faculty members whose research programs particularly interest them. The students then have to spend at least 15 minutes with the faculty member and "interview them." Their assignment is to start a dialogue (where are you from, do you have pets or children, what are your hobbies, etc.); the goal is to get students to discuss a faculty member's background, experiences, research programs, and what led them to biology in the first place. Once the ice is broken and students are a little more comfortable, the conversation usually shifts toward the student and what they want from a biology degree. Although many freshman students are reluctant or timid about the idea of visiting one-on-one with a faculty member, afterward many admit that it has helped them face their "fear" of approaching professors; some even have commented that it was the most valuable experience in their college career (to date, anyway).

The course has been offered twice and appears to be well-received by students—the Department had to limit the enrollment to 50 because of available room size. To date, I know of at least 16 students (of 98 enrolled in the course) that have signed up for undergraduate research during their freshman or sophomore years. So far, not too bad!

## TTU FACULTY ASSOCIATES OF THE NATURAL SCIENCE RESEARCH LABORATORY

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. Ron Chesser** is a Professor of Biological Sciences and the department Chair. His research program focuses on assessing radioactive contamination, reconstructing flow of radioactive materials into the environment, and modeling the impacts and recovery of mammal populations affected by radiation. He has conducted research at Chernobyl, Ukraine, since 1992. He worked in Iraq for eight years (2005–2013) dismantling the former nuclear infrastructure, and he has contracted with the US Department of State, Department of Energy, International Atomic Energy Agency, Great Britain Ministry of Industry, US Civilian Research & Development Foundation, and the European Commission.

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**Dr. Tigga Kingston** is an Associate Professor of Biological Sciences. Her research and activities are dedicated to the conservation ecology of Paleotropical 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. Liam McGuire** is an Assistant Professor of Biological Sciences. His research focuses on the ecology and physiology of bats and birds in situations of energy limitation (e.g., migration, hibernation) and the strategies these animals use to cope with environmental variation, often in the context of conservation issues. He takes an integrative approach using techniques ranging from molecular biology and biochemistry, to whole animal physiology, behavioral and movement ecology. Current research foci include the physiological ecology of bat migration, and the physiological ecology and pathophysiology of hibernating bats affected by white-nose syndrome, a devastating fungal disease responsible for killing millions of North American bats.

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**Dr. David A. Ray** is an Associate 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. Brenda Rodgers** is an Associate Professor of Biological Sciences. Her research centers on the impacts of radiation on small mammals, mechanisms of adaptation to low dose radiation in pregnant females and fetuses, and human health issues in contaminated environments. She has worked on mammal population impacts at Chernobyl, Ukraine, since 1997. She worked for eight years in Iraq evaluating human impacts in contaminated regions and training scientists on laboratory practices, and she has contracted with the US Department of Energy (Low-dose Program), US Department of State, and the Civilian Research & Development Foundation.

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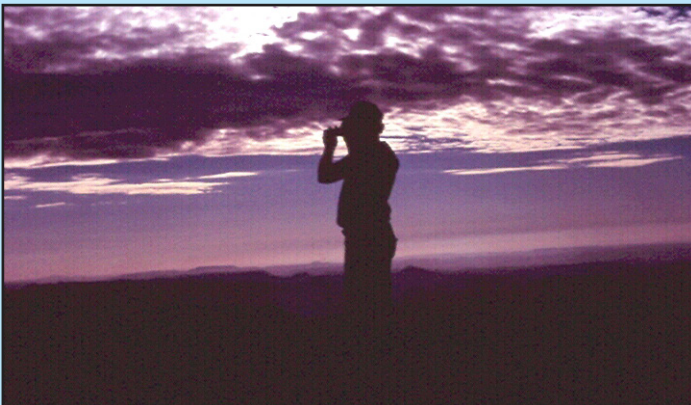
<http://www.depts.ttu.edu/biology/people/Faculty/Salazar-Bravo/>



**Dr. Richard Stevens** is an Associate 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. They also conduct morphometric studies to try to better understand the relationship between form and function in bats as well as how phenotypic variation contributes to large-scale patterns of biodiversity.

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*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.



## PLEASE SUPPORT THE NSRL

Dear Former Students, Colleagues, and Friends:

In 2015, a fund-raising initiative for the NSRL was established. The NSRL Fund for Excellence is designed to help support the many collections activities of the NSRL. Our goal is to use these funds to establish a student curatorial position. This position would enable the NSRL to improve curatorial and collection management activities, as well as help support students with a professional interest in natural history collections. As this fund grows, we envision that we will be able to financially support multiple students.

Your contribution to the Natural Science Research Laboratory Fund for Excellence is very important to the future of the NSRL. With limited, and often declining, funding from state and federal sources, the NSRL needs your help to ensure our continued service to the academic and scientific communities. We appreciate your consideration in giving a tax deductible donation in support of the NSRL's operations and research. Many of you benefited from the resources provided by the NSRL, now we ask that you help the NSRL continue its quest to be among the premier natural history collections in the world.

Donations to the NSRL Fund for Excellence may be made through the Texas Tech Foundation, Inc. To donate by check, please make the check payable to Texas Tech Foundation, designate NSRL Fund for Excellence on the memo line, and mail to: Texas Tech University System, Financial Services, Box 45025, Lubbock, TX, 79409-5025. To give by phone, call toll free: 1-866-448-3888. To donate online, visit the website of TTU Institutional Advancement at <http://donate.give2tech.com/> and enter Natural Science Research Laboratory Fund for Excellence in the search box.

**YOUR SUPPORT IS APPRECIATED! THANK YOU!**

*NSRL News* is produced biannually by Lisa Bradley with assistance from the staff, research scientists, and graduate students 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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