



Research Highlight #3203

Sierra Miller, Ph.D.

West Texas A&M University

Teaching Undergraduates and Informing Cutting-Edge Neuroscience Research

Sierra Miller, Ph.D., didn't think she would end up becoming a neuroscientist. She applied to graduate schools in the hope of joining an endocrinology or diabetes lab, but a turn of events led her to a rotation in a neuropharmacology lab during her graduate program at the University of Texas Medical Branch in Galveston, Texas. Quickly learning that there's hormone signaling in the brain and a lot of other interesting processes at play during different behaviors, Sierra switched her Ph.D. focus to neuroscience and started looking at behavioral, neuroanatomical, and computational contributions of Neuromedin U and its receptor in the prefrontal cortex.

Decision-Making During Motivated Behavior

After completing her Ph.D. in Human Pathophysiology and Translational Medicine, Sierra started a postdoctoral fellowship at the University of Alabama, Birmingham, as part of Sofia Beas's lab. The Beas Laboratory is primarily focused on explaining how different neuronal processes guide motivation—a critical process that can ensure animals complete specific goals and fulfill their basic needs, such as finding food and water. During her postdoctoral fellowship, Sierra had several projects that relied heavily on the use of Inscopix miniscopes with the Proview Express Kit (PEK). She elaborates more on her time there and how she used the miniature microscope and surgical tools to study freely behaving animals;

“My main job in the Beas Lab was to get the miniscope up and running. We were looking at the prefrontal cortex as part of beta testing for the PEK. We were particularly interested in neurons that project between the paraventricular thalamus and the prefrontal cortex because that's a really important pathway for decision-making during motivated behavior. I used the miniscope with the PEK for the prefrontal cortex, and then I also had a cohort of animals, where we ran the same behavior but looking in the paraventricular thalamus as well”

- Sierra Miller, Ph.D.



ABOUT THE RESEARCHER

Sierra Miller, Ph.D., is an assistant professor of biology at West Texas A&M University. She obtained her Bachelor of Science in chemistry and double minors in math and biology from West Texas A&M University in 2016. After graduation, her first job was at the US Department of Agriculture-Agriculture Research Service, where she spent her time doing research to identify bacterial populations driving gas production in feedyards. She then started her doctoral work at the University of Texas Medical Branch in Galveston, Texas, within the Human Pathophysiology and Translational Medicine Program. Here, she was looking at the Role of Neuromedin U and its receptor in the medial prefrontal cortex in feeding and anxiety-like behaviors. She obtained her Ph.D. in Human Pathophysiology and Translational Medicine in 2023 and completed a Postdoctoral Research Fellowship at the University of Alabama, Birmingham in 2025 while part of Sofia Beas's Lab.

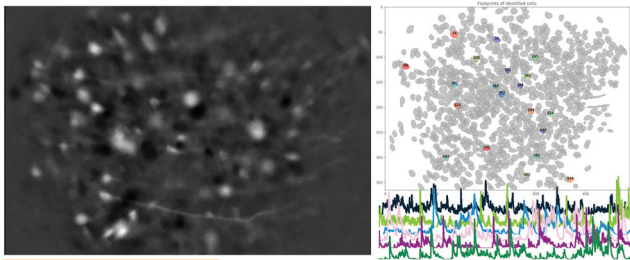
Website Links:

The Beas Laboratory:

<https://www.thebeaslab.com>

West Texas A&M University:

<https://www.wtamu.edu>



Inscopix miniscope field of view in the mouse prefrontal cortex (left), and the identified cell map and representative neuronal traces (right).

Another technique Sierra uses is fiber photometry, which gives great information on population-level activity and is featured in the pre-print paper, “The encoding of interoceptive-based predictions by the paraventricular thalamus D2+ neurons,” under revision in bioRxiv. However, Sierra wants to dive deeper into subpopulations in the paraventricular thalamus that drive behaviors by using miniscope microscopy, which can provide a more comprehensive understanding of the brain with neuron-specific data.

Bringing New Opportunities to Undergraduate Students

In August of 2025, Sierra took a position as an assistant professor of biology at West Texas A&M University, which is also where she got her undergraduate degree in chemistry. This new position replaced the individual that had been responsible for getting her interested in scientific research in the first place, which Sierra describes as a “really cool coincidence.” Though this job does not include some of the cutting-edge instrumentation she used in her postdoc, she sees it as an exciting opportunity to practice her love of teaching and to bring undergraduate students into the ever-growing field of biology:

“I’ve always known that I enjoyed teaching. I was a TA in college for chemistry and physics labs, but I was also a private tutor for some high school math students. They were in algebra, and one of my students was barely passing, and after working with him for about 6 weeks, we got him up to an A. Then, for the state testing in Texas, he actually ended up with an outstanding score at the end of the year. That moment was so rewarding.”

Her new position will be spent working almost exclusively with undergraduates and will predominantly use fiber photometry. West Texas A&M University serves many students from rural and economically disadvantaged backgrounds, so being able to introduce students to neuroscience techniques is an important step in the growth of both their education and the field of life sciences. Sierra also plans to educate her students about newer tools that are currently being used in the field, such as miniscopes, for advanced studies on brain activity:

“It blows my mind every time I watch a miniscope video. Every time I get to see a recording, I’m like, this is why I do this. I’m really excited to get to expose them to all of these techniques that I had no idea existed when I was an undergrad: getting to bring that home and show them that we can image individual neurons in an animal while they’re doing something.”

Outside of the classroom, Sierra is planning to hire undergraduates to spend 10-15 hours per week in the lab to explore foundational questions:

“Those fundamental research questions, like, what are the expression patterns of less studied receptors in the mouse brain? There are some questions that I’m sure have been answered, but they are questions that you just need someone to be able to sit and analyze. And that’s what I’m hoping to do with my undergrads, some more of those basic studies that will help inform other people’s research.”

Bridging Gaps in Science and Medicine

Sierra’s route to becoming an established neuroscientist wasn’t a straightforward path, but her experiences have given her a unique capability to be an effective advisor for pre-medical students. Her Ph.D. program actually required her to go through the first year of medical school with hopes of better understanding the differences between medical and graduate education. Sierra elaborates on why she thinks this is important;

“Science and medicine have to play together. You can see a weakness when you consider that most doctors don’t know any scientists, and lots of scientists only know their own personal doctors. So, I’m trying to help all of these pre-med students that I’ll be working with understand where the medicine they’ll be using comes from, and how important science and medicine working together is. That is another big goal that I have.”

In addition to advising these pre-medical students, she will be serving as West Texas A&M University’s Faculty Director for the state of Texas’s Joint Admission Medical Program. Leveraging her experiences in both medical and graduate school will help break down some of the language barriers between the two fields and allow better communication and a more holistic education for students.

Continuing Studies with Neuropeptides

Her new position is roughly broken down to 70% teaching and 30% research. For the research, she plans on continuing some of her work with Sophia Beas at UAB and expanding her own research at WTAMU by looking at alternative neuropeptides and their role in modulating the neurocircuits involved in regulating food intake and feeding behaviors. She will also be drawing one of her most exciting findings from her graduate work. She found that knocking out the Neuromedin U receptor isoform 2 did not impact feeding behavior, but rather induced an anxiety-like phenotype in her rats. Follow-up studies in mice promise even more exciting findings on the intersection of emotions and eating.

Sierra's experiences in the lab using cutting-edge miniscope technology and surgical tools with the PEK have not only allowed her to create new insights into feeding behaviors and motivation, but also put her in a unique position to teach undergraduate students about what advanced technology exists and what applications are possible to explore with different approaches

Learn More

To learn more about Inscopix miniscopes and the ProView Express Kit, visit [here](#)

Complementary Publications

- Machen, Briana, Sierra N. Miller, Al Xin, et al. "The Encoding of Interoceptive-Based Predictions by the Paraventricular Nucleus of the Thalamus D2R+ Neurons." Preprint, *bioRxiv*, August 15, 2025. <https://doi.org/10.1101/2025.03.10.642469>.
- Borzou, Ahmad, Sierra N. Miller, Jonathan D. Hommel, and J M Schwarz. "Cocaine Diminishes Functional Network Robustness and Destabilizes the Energy Landscape of Neuronal Activity in the Medial Prefrontal Cortex." *PNAS Nexus* 3, no. 3 (2024): pgae092. <https://doi.org/10.1093/pnasnexus/pgae092>.
- Kasper, James M., Ashley E. Smith, Sierra N. Miller, et al. "Role of Neuropeptide Neuromedin U in the Nucleus Accumbens Shell in Cocaine Self-Administration in Male Rats." *Neuropsychopharmacology* 47, no. 11 (2022): 1875–82. <https://doi.org/10.1038/s41386-021-01234-9>.

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Sierra and her students discussing prominent brain structures involved in emotion, memory, and motivation.

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