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ECR SPOTLIGHT

ECR Spotlight – Derek Jurestovsky

ECR Spotlight is a series of interviews with early-career authors from a selection of papers published in Journal of Experimental Biology and aims to promote not only the diversity of early-career researchers (ECRs) working in experimental biology during our centenary year, but also the huge variety of animals and physiological systems that are essential for the 'comparative' approach. Derek Jurestovsky is an author on 'Blood python (*Python brongersmai*) strike kinematics and forces are robust to variations in substrate geometry', published in JEB. Derek conducted the research described in this article while a PhD student in Henry Astley's lab at University of Akron, USA. He is now a Postdoctoral Scholar in the lab of Jonas Rubenson and Steve Piazza at Pennsylvania State University, USA, investigating squamate skeletal morphology, biomechanics and their distributions in the past, present and future.

Derek Jurestovsky

Describe your scientific journey and your current research focus

I began my education at Northern Arizona University where I studied geology for my undergraduate degree in the hopes of one day becoming a paleontologist that studies dinosaurs. Continuing this pursuit, I obtained my Master's in Paleontology at East Tennessee State University where I studied and identified multiple fossil snakes (including a new species of hognose) from the Hemphillian-aged Gray Fossil Site under the guidance of Jim Mead. During my Master's, I became interested in the snakes' variable vertebral shape and how this could affect their biomechanics. Next, I obtained my PhD from the University of Akron under the guidance of Henry Astley on snake biomechanics and locomotion, which expanded my interests from purely fossils to include biomechanics and locomotion.

I am currently a Postdoctoral Scholar at Pennsylvania State University, where I study the effects of exercise on the biomechanics and skeletal morphology of guinea fowl under the guidance of Jonas Rubenson and Steve Piazza. While my education has shifted and changed from my initial plans, I have enjoyed my journey of discovery and was even able to achieve my initial goals: becoming a paleontologist and studying dinosaurs (granted…their modern descendants).

How would you explain the main finding of your paper to a member of the public?

We discovered that blood pythons are capable of striking with similar speeds and forces from open ground and backed against a wall. They appear to achieve this surprising feat by using their tail to slide backwards to counteract their strike in the open setup, where they are unable to push against the wall.

What are the potential implications of this finding for your field of research, and is there anything that you learned during this study that you wish you had known sooner?

It shows that pythons (and potentially other heavy-bodied snakes) are capable of exploiting multiple environments to successfully capture prey. I wish I had known that some snakes prefer striking at my advisor whereas others prefer to strike at me – would have saved me a lot of effort!

Which part of this research project was the most rewarding/challenging?

Part of why we chose blood pythons for this study is because they strike readily. However, it was quite a challenge to encourage the snakes to strike defensively. Once we were able to obtain enough data, it was rewarding to see the exciting results despite the difficulty eliciting strikes.

Are there any important historical papers from your field that have been published in JEB?

Two come to mind: Gray's 'The mechanism of locomotion in snakes' published in 1946 (doi:10.1242/jeb.23.2.101), and Gray and Lissmann's 'The kinetics of locomotion of the grass-snake' published in 1950 (doi:10.1242/jeb.26.4.354). These are some of the first manuscripts that began to break down snake locomotion and identify how their serpentine movements result in forward movement. In addition to making sense of the physics underlying limbless locomotion, these papers helped inspire a wealth of studies focused on limbless locomotion by laying the groundwork to understanding their movements. These papers laid the foundations

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Journal of Experimental Biology (2023) 226, jeb245490. doi:10.1242/jeb.245490

Blood python resting on the open strike platform prior to a trial.

for my work on snake biomechanics, which would otherwise have not been possible.

Are there any modern-day papers that you think will be the classic papers of 2123?

Astley's paper 'The biomechanics of multi-articular muscle–tendon systems in snakes' published in 2020 (doi:10.1093/icb/icaa012) is similar to the previously mentioned articles in that it begins to lay the groundwork to understanding a complicated system. His article breaks down the complex relationships between overlapping muscle–tendon systems in snakes using equations to understand how this system functions to result in effective locomotion in snakes. Additionally, Jayne's Review 'What defines different modes of snake locomotion?' published in 2020 (doi:10.1093/icb/icaa017) highlights how much we still don't understand about snake and, in general, limbless locomotion. He identifies multiple types of locomotion of snakes that have garnered little to no research to date. These two articles lay the groundwork for future studies to investigate a variety of questions and open the door for an expansion of studies exploring limbless locomotion.

What do you think experimental biology will look like 50 years from now?

Experimental biology will likely incorporate digital means to a larger and larger degree. We are already seeing examples of this with the introduction of micro-CT scanning, increasingly complex computer models, and digital tracking such as MOCAP or DeepLabCut. As computer processing power and data storage capabilities increase, so too will researchers' use of massive datasets and files. This can give rise to increasingly accurate and complex experimental models made on a computer, more detailed skeletal and soft tissue models from CT scans with increased resolution, and monitoring animal activity through cameras and computer algorithms. While all these techniques can make it possible to answer a massive variety of questions, I hope we continue to work with animals directly instead of exclusively through computer models and video tracking algorithms.

If you had unlimited funding, what question in your research field would you most like to address?

I would love to understand how squamate skeletons function together with their musculature across all limbless clades and how the different shapes of their vertebrae affect their locomotion.

What changes do you think could improve the lives of early-career researchers, and what would make you want to continue in a research career?

Early-career researchers would benefit from additional funding to assist them in getting involved with the field. Programs to support undergraduates' travel expenses to conferences where they can present and network would not only assist early-career researchers in finding mentorships but also open the door to under-represented groups in STEM.

To continue in a research career personally, I'd love to work at an institution that allows me to teach but also use my diverse background to study squamates – specifically their fossils, biomechanics, morphology and ability to adjust to climate change/urbanization.

Reference

Jurestovsky, D. J., Joy, S. P. and Astley, H. C. (2023). Blood python (*Python brongersmai*) strike kinematics and forces are robust to variations in substrate geometry. *J. Exp. Biol.* **226**, jeb244456. doi:10.1242/jeb.244456