

Stockton College Researchers Analyze Locomotion of Modern Day Reptiles, Mammals to Understand How Dinosaurs Moved

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Friday, November 14, 2014

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Galloway Township, NJ- Caleb Bayewu, a junior Biochemistry major, cradled a bearded dragon in his hands as Cory Barnes, a senior Biology major, attached tiny reflective beads to the bumpy skin on the patient reptile's forearm.

Black Beard, as the lizard is nicknamed, is one of three juvenile bearded dragons at The Richard Stockton College of New Jersey taking part in an animal locomotion research project aimed at better understanding how dinosaurs once moved across our planet.

After body measurements were recorded, Black Beard was placed on a treadmill surrounded by a system of three infrared cameras and plastic containers that serve as safety nets in case a reptile runner strays off course.

As soon as Bayewu shook a clear jar of jumping crickets, Black Beard sprang into action. Alex Lauffer, a junior Biology major, flipped the conveyor belt switch, the treadmill kicked on and the cameras began transmitting data to Dr. Matthew Bonnan, associate professor of Biology, and Dr. Jason Shulman, assistant professor of Physics.

Sophomore Biology majors Kieran Tracey and Alex Hilbmann stood close by, making sure Black Beard stayed on the treadmill.

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While Black Beard ran in place, the cameras captured the motion of each reflective bead sending real experimental data at the overwhelming rate of 120 frames-per-second to a computer program that can read and display the data as moving dots.

From behind their monitor, Bonnan, of Hammonton, and Shulman, of Egg Harbor Township, watched each step on their screen.

Stepping Back in Time

“Without a time machine, we can’t put dinosaurs on a treadmill,” said Bonnan, who has been fascinated with dinosaurs since he was 5 years old. Instead, bearded dragons, ferrets, rats and a Savannah monitor are “standing in for their ancestors” at the Best Foot Forward (BFF) Laboratory on the main Galloway, NJ campus.

“Given that the earliest mammals and dinosaurs had a forelimb posture not unlike lizards, they are acting as a model to test hypotheses about the transition from sprawling to upright forelimb postures,” said Bonnan.

The fossil record offers scientists a motionless slice of history. Bonnan and his team have turned to optical tracking technology to tell more of the story.

“Our ultimate goal is to realistically model and place constraints on how fossil vertebrates, such as dinosaurs and early mammals, moved their forelimbs,” Bonnan explained.

The team is quantitatively illustrating the motion of modern day reptiles and mammals and using bone shape as a common denominator to make comparisons between their laboratory stand-ins and dinosaurs.

Bonnan’s lifelong desire has been to “reconstruct long-dead animals and breathe life into old bones.”

Step-by-step, his vision is coming to life with the support of colleagues, student researchers and staff within the School of Natural Sciences and Mathematics.

Blending Physics and Biology

To model motion, math and physics come into play. Bonnan’s friend and colleague, Dr. Jason Shulman, joined the team lending his numerical analysis expertise. “Jason Shulman is a big part of why we’re able to do this. Without him, interpreting the data would be difficult at best,” said Bonnan.

Early in the Physics curriculum, students learn to calculate angles and speed, which means that undergraduates are prepared to take part in real research outside of textbook exercises Shulman said.

Sometimes Physics majors wonder why they need to study Biology and vice versa. The animal locomotion research is an example of how the sciences work together. “It’s important for students to understand concepts outside of their field—that’s an important lesson I hope we convey.

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The interdisciplinary collaboration is perfect for Physics students,” said Shulman.

Campus-wide Support

The bearded dragons were donated to Bonnan by student Kiersten Stukowski, of Gloucester in Camden County. Scientists rarely have the opportunity to work on a long-term project with the same specimens as they mature explained Bonnan.

Justine Ciraolo, director of Academic Laboratories and Field Facilities, connected Bonnan with her sister, who is loaning her ferrets to the team.

When the reptiles and mammals aren't in the lab, they are cared for by John Rokita, principal animal health lab technician, who has been instrumental in acquiring specimens for Bonnan.

“None of this would have been possible without the support of the School of Natural Sciences and Mathematics and Stockton's Institutional Animal Care and Usage Committee. It is rare for undergraduates to get this experience. On every level this is teamwork and everyone has been incredibly helpful,” said Bonnan.

The Student Researchers

Alex Hilbmann, a sophomore Biology major, of West Deptford in Gloucester County, says he's learned all about lizards while building a foundation to better understand the kinematics (or science of motion) during his independent study. “It wasn't always easy to get them to run,” he admitted. Hilbmann plans to go on to medical school after Stockton.

Caleb Bayewu, a junior Biochemistry major who's from Maywood in Bergen County, started out working with rats on the treadmill, but “they didn't always want to move.” Since he joined the team, he's witnessed the differences in movement among different species.

Corey Barnes, a senior Biology major, of Seaville in Cape May County, took Comparative Anatomy with Dr. Bonnan, which he says opened up his interest along the evolutionary tree. The research has really illustrated “how different their walking habits are.” Barnes is a veterinary technician at Beach Buddies Animal Hospital in Marmora and hopes to attend veterinary school.

Alex Lauffer, a junior Biology major, of Point Pleasant in Ocean County, has always had an interest in dinosaurs and reptiles. The research project was “right up my alley,” he said. The aspiring veterinary assistant has three snakes, one tarantula, one dog and a pond of koi fish. However, it was in the BFF Lab that he held his first bearded dragon. They are surprisingly calm, he said.

Kieran Tracey, a sophomore Biology major, of Sea Isle City in Cape May County, said, “I'm having a lot of fun working with lizards and watching them run,” and added that the experience is giving him important exposure to research in preparation for medical school. He looks forward to “analyzing how [the data] relates to dinosaurs.”

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Bridget Kuhlman, a senior Biology major, of Little Egg Harbor in Ocean County, said, "It's a dream come true being able to work with ferrets. It's getting me ready for vet school," she said. She works as an EMT and personally owns five ferrets.

Kelsey Gamble, a senior Anthropology and Biology major, of Williamstown in Gloucester County, said, "Working with live animals is an interesting experience. It's a lot different than my anthropology work," she said. "We are looking at the forelimbs and how they move." The search for patterns and constructing relationships between form and function blend her Biology and Anthropology interests.

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