IN CONCLUSION

CROCODILIAN CONNECTIONS

Some 100 million years ago, the world's biggest land predator, Spinosaurus, competed for dominance among a host of equally voracious species inhabiting parts of Northern Africa. Although Spinosaurus roamed a lush riverine landscape very different from the current environment in that region, life was still intensely competitive, and obtaining the food needed to sustain the enormous creature's 15-foot height, 50-foot length and 22-ton bulk was a definite challenge. Paleontologists who unearthed Spinosaurus fossils were hardpressed to explain how a dinosaur of such size could thrive in a "land of giants," as one of the investigators said. Daphne Soares, assistant professor of biological sciences, had the most likely answer, which first came to her when she was doing research involving crocodiles and sharing the back of a pickup truck with an alligator in Louisiana.

As presented in a program filmed for the Smithsonian Channel, World's Biggest Beasts, Spinosaurus may have had a sensory advantage. While working on her doctoral dissertation, Soares showed that crocodiles and alligators are able to sense minute disturbances with their skin, despite being heavily armored. Computerized tomography (CT) scans of a Spinosaurus skull revealed that a series of foramina, or small windows, along the jaw seem to be the openings for nerves connecting the skin to the brain. These are features of a unique sensory system found today in alligators and crocodiles, both often referred to as "crocodilians." The sensory research that attracted the attention of the Spinosaurus investigators began in that pickup truck when Soares noticed a series of dark, raised dots along the upper and lower jaw of her appropriately restrained alligator companion.

Eventually, Soares devised a series of experiments integrating behavior, physiology, anatomy and paleontology to test her hypothesis that the dark dots in the crocodilian skin are sensory organs. She tested the behavior of relatively small alligators by harmlessly covering the dots with a plastic elastomer and blocking their ears. Then, while they were in a tank in a dark room, she let drops of water fall into the tank to simulate vibrations caused by prey entering the alligators' natural environment. With all of their senses neutralized, the alligators did not respond in any way to the falling drops of water; however, they did respond vigorously when just the elastomer over the dots was removed, confirming Soares' discovery of a sensory modality that for millions of years has given crocodilians an important advantage by detecting and locating prey in or near their aquatic environment.

The connections between Soares' crocodilian insights and the mystery of Spinosaurus highlight the breadth of her research, which has been published in prominent journals including Nature and BioScience, and brought to the attention of a wider audience in popular media produced by the Smithsonian Institution and National Geographic Society. For Soares, the research she plans to pursue and the questions she will ask about sensory adaptation and evolution will undoubtedly lead in new and unexpected directions – in the classroom and laboratory at NJIT, in other countries and in the distant past.

biology.njit.edu