Shining Light on the Blind: Evolutionary Regression and Adaptive Progression in the Micro-Vertebrate Ramphotyphlops braminus, Year Three

Grace, River

The subterranean brahminy blindsnake (Ramphotyphlops braminus) is among the smallest vertebrate animals on Earth. Snakes in general have small eyes, but the fossorial R. braminus has extremely minute eyes that are located underneath the scales, invisible from the exterior. This study is the capstone in a comprehensive analysis of what may be the simplest nervous system in any terrestrial vertebrate, designed to develop an understanding of the most fundamental components of vertebrate brains. The goals of this study were (1) to produce a complete, detailed atlas of the R. braminus brain, (2) to create a baseline for light-modified behaviors in normally-sighted snake species, and (3) to determine how light exposure may affect R. braminus behavior. Light microscopy revealed a highly miniaturized blindsnake brain, with greater cell density than larger species but with far fewer total cells. Additionally, many R. braminus brain regions appeared similar to those of other snakes, suggesting a reduction in complexity but not general construction. Behavioral studies in normally-sighted species showed that, as hypothesized, they do not tend to alter activity due to light level changes. However, blindsnakes significantly increased their acceleration when exposed to light for sustained periods of time, strongly suggesting their use of negative phototaxis as a survival mechanism. This research provides a novel platform for understanding the fundamental architecture of the vertebrate nervous system, brings forth new insight into the evolutionary adaptations of micro-vertebrate life, and provides new knowledge of the survival mechanism of an extremely widespread invasive species.

Awards Won:
Fourth Award of $500