Evolution of Nervous System Function and Behavior in a Micro-Vertebrate, the Brahminy Blindsnake (Ramphotyphlops brahminus)

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The subterranean brahminy blindsnake (Ramphotyphlops braminus) is an extremely fascinating species. They are among the smallest vertebrate animals on Earth, and they are the most widespread invasive vertebrate species. This study is the first part of a comprehensive analysis of what may be the simplest nervous system in any terrestrial vertebrate on the planet. This series of studies posed the questions (1) Does R. brahminus have eyes?, (2) Can R. brahminus detect light?, and (3) Does R. brahminus use light sensitivity to modify behavior? It was hypothesized that (1) these snakes do have eyes, even if very small and simple, (2) they can detect light, and (3) R. brahminus uses light for simple, non-visual tasks including navigation and predator avoidance. Scanning electron microscopy and visible light microscopy revealed an eye-like structure underneath the skin and scales of the head. Electroretinography showed that the snakes respond to light using their apparently rudimentary eyes. Finally, a series of behavioral experiments revealed the snakes do not respond to shadows (as a means of predator avoidance), but are able to navigate with the aid of light. This research provides new knowledge of the anatomy, physiology, and behavior of one of the world's smallest vertebrate animals. It gives us a much better concept of what is truly needed for vertebrate animals to operate, and provides new insight into the evolutionary adaptations of micro-vertebrate life. Continuing experiments will define the architecture and spectral response of the eye, and the organization of the world's smallest vertebrate brain.

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