Paddlefish sensors tuned to detect signals from zooplankton prey

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Neurons fire in a synchronized bursting pattern in response to robust signals indicating nearby food.

In 1997, scientists at the Center for Neurodynamics at the University of Missouri - St. Louis demonstrated that special sensors covering the elongated snout of paddlefish are electroreceptors that help the fish detect prey by responding to the weak voltage gradients that swimming zooplankton create in the surrounding water. Now some of the same researchers have found that the electroreceptors contain oscillators, which generate rhythmical firing of electrosensory neurons. The oscillators allow the electroreceptors to create a dynamical code to most effectively respond to electrical signals emitted naturally by zooplankton.

The results are presented in a paper appearing in the AIP's journal *Chaos*.

To test the response of paddlefish electroreceptors to different stimuli, the researchers recorded signals from electrosensory neurons of live fish, while applying weak electric fields to the water in the form of computer-generated artificial stimuli or signals obtained previously from swimming zooplankton.

The team then analyzed the power contained in different frequency ranges for the noisy input signals and the corresponding electroreceptor responses, and compared the two. In addition to finding that the paddlefish sensors best encode the signals emitted by zooplankton, the

team also found that as the strength of the input signal was raised, the firing of the fish's sensory neurons transitioned from a steady beat to a noisy pattern of intermittent bursts.

This bursting pattern became synchronized across different groups of electroreceptors, increasing the likelihood of the signal reaching higher-order neurons. This provides a plausible mechanism to explain how reliable information about the nearness of prey is transferred to the fish's brain, the researchers write.

More information: "Sensory Coding in Oscillatory Electroreceptors of Paddlefish" is published in *Chaos: An Interdisciplinary Journal of Nonlinear Science.*

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