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INSIDE JEB

Lateral line sensory cells are not swamped by natural flow

An adult toadfish (*Opsanus tau*). Photo credit: Mensinger lab.

If you had to tickle a toadfish, you'd better aim for its lateral line. Lateral line sensory cells, which are distributed along a fish's flank, are fine tuned to gentle movements in the surrounding water, sensing ripples caused by nearby fish and detecting the direction of water flow; which is fine when the fish are static. But how sensitive are the sensory cells to delicate disturbances when water is rushing past while they swim? Are the cells overwhelmed by water surges to the point where they no longer respond to other disturbances, or do they suppress their response to flows in order to pick out other water features? Having previously developed a micromanipulator that can implant signal-detecting electrodes into sensory cells, Allen Mensinger and Loranzie Rogers from the University of Minnesota-Duluth, USA, with Jacey Van Wert, from the Woods Hole Marine Biological Laboratory, USA, decided to find out what lateral line cells on the sides of toadfish (*Opsanus tau*) are signalling when the fish are tickled by water.

Allowing the wired-up fish to swim freely around a tank at speeds between 6 and 14 cm s^{-1}, Van Wert recorded that the lateral line cells fired off at rates ranging from 11 to 50 spikes s^{-1}; the sensory cells responded with increasing intensities as the fish swam at higher speeds. But how would the cells respond to other disturbances in the water while the fish were moving?

Rigging up a small vibrating plastic sphere, Van Wert tethered one of the fish to a small cart and recorded the electrical signals generated by the lateral line as she towed the fish toward it. Impressively, the cell firing rate increased as the fish approached the sphere and when Van Wert turned up the sphere's vibrations, the sensory cells began firing in time with the vibrations. Van Wert also released wired-up fish to swim freely in the water and recorded that their lateral line cells fired gently (~10 spikes s^{-1}) until they swam within range of the vibrating sphere, when the spike rate rocketed to 40 spikes s^{-1}. And when she introduced a robot fish into the tank beating its tail at 3, 5 and 10 Hz to simulate the experience of swimming alongside another animal, the lateral line sensory cell firing rate increased when she turned up the tailbeat frequency from 3 to 5 Hz.

So, swimming toadfish do not suppress the nerve signals generated by the natural flow of water while swimming and the sensory cells are not swamped by the water's passage, allowing them to pick up on all the other tickly messages passing through the water.

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