From humming fish to Puccini: Vocal communication evolved with ancient species

July 17 2008

It's a long way from the dull hums of the amorous midshipman fish to the strains of a Puccini aria – or, alas, even to the simplest Celine Dion melody. But the neural circuitry that led to the human love song – not to mention birdsongs, frog thrums and mating calls of all manner of vertebrates – was likely laid down hundreds of millions of years ago with the hums and grunts of the homely piscine.

By mapping the developing brain cells in newly hatched midshipman fish larvae and comparing them to other species, Andrew H. Bass, Cornell professor of neurobiology and behavior, and colleagues Edwin Gilland of Howard University and Robert Baker of New York University found that the neural network behind sound production in vertebrates can be traced back through evolutionary time to an era long before the first animals ventured onto dry land.

The research is published in the July 18 issue of the journal *Science*.

Bass used fluorescent dyes to identify distinct groups of neurons in the brains of the larvae of midshipman fish, a species known for the loud humming sounds adult males generate with their swim bladders to attract females to their nests.

With laser-scanning confocal microscopy, the research team observed clusters of cells in the larvae's developing hindbrain as they formed connections and grew into the networks that control vocalization in mature fish.

"Confocal microscopy allows you to look at different populations of neurons at the same time – to really be precise about their locations relative to each other," Bass said. He found that the neurons in a compartment of the hindbrain known as rhombomere 8, which are thought to control pattern generation in vocalizing vertebrates, gives rise to the circuitry of the vocal motor nucleus – the system behind the fishes' hums.

Comparing the system to the neural circuitry behind vocalizations of amphibians, birds, reptiles and mammals, including primates, Bass found that while the networks vary in complexity, their fundamental attributes are conserved.

The finding puts human speech – and social communications of all vertebrates – in evolutionary context, Bass said.

The research also provides a framework for neuroscientists and evolutionary biologists studying social behavior in a variety of species, he said – and sends a message to scientists and non-scientists "about the importance of this group of animals to understanding behavior; to understanding the nervous system; and to understanding just how important social communication is – among them, as it is among ourselves."

Source: Cornell University

Citation: From humming fish to Puccini: Vocal communication evolved with ancient species (2008, July 17) retrieved 9 April 2024 from https://phys.org/news/2008-07-fish-puccini-vocal-evolved-ancient.html