

NEUROSCIENCE

Mirror Neurons May Help Songbirds Stay in Tune

The discovery of so-called mirror neurons a decade ago has fueled much discussion in neuroscience ever since. The original experiments identified neurons in monkeys that fire when an animal reaches out an arm or sees another animal make a similar movement. Brain-imaging studies have found analogous neural activity in the human brain in a variety of other contexts, prompting speculation that mirror neurons could have roles in perception, learning, and empathy (*Science*, 13 May 2005, p. 945).

In this week's issue of *Nature*, researchers describe mirror neurons in songbirds that fire when a bird sings or hears another bird sing a song similar to its own. The finding may pave the way to insights into how songbirds learn

Duke University mounted an ultralight-weight device on the heads of swamp sparrows that enabled them to record the activity of individual neurons as the birds sang and listened to samples of recorded songs. In a brain region called HVC, part of a forebrain circuit that mediates singing, the researchers identified neurons that fired in a consistent pattern when the bird sang a particular song. (Swamp sparrows typically have several songs in their repertoires.) During singing, for example, a neuron might fire at the onset of a particular sequence of notes. When the researchers played the bird's own song through a speaker, the same neuron would again fire whenever that sequence appeared. Sometimes the same neuron would also fire

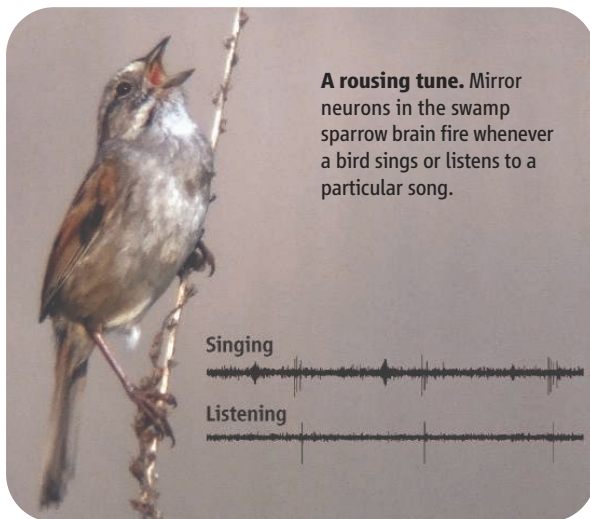
in response to another swamp sparrow's song—but only when the other bird's song contained a similar sequence of notes. Mooney's team also found HVC neurons with similar responses in Bengalese finches, another songbird.

"These were damned difficult experiments," says Daniel Margoliash, a birdsong researcher at the University of Chicago in Illinois. Margoliash says the findings are exciting because the HVC neurons identified by the Duke team may help explain how individual songbirds are able to maintain their complex and distinctive songs

for life. The activity of these neurons during singing may be a neural representation of what the bird intended to sing that it compares against auditory feedback of what it actually sang, Margoliash says. Such a comparison is probably necessary for adult birds to maintain their songs, he says, and it almost certainly plays a role as young birds first learn their songs as well.

The HVC neurons may also help songbirds decode each other's songs, Mooney says. Male swamp sparrows sing back and forth to defend their territories, and hearing the song of a rival would activate some of the HVC neurons that fire when a bird sings a similar song itself, Mooney says. That might enable a bird to compare his rival's song to his own repertoire—and select an appropriate retort.

—GREG MILLER



A rousing tune. Mirror neurons in the swamp sparrow brain fire whenever a bird sings or listens to a particular song.

and maintain their complex songs—one of the few instances of learned communication aside from human language. Some researchers see broader implications as well.

"This is the first description of a mirror system in a species other than primates," says Pier Ferrari, a neuroscientist at the University of Parma in Italy, a current member of the team that made the original mirror neuron discovery in monkeys. Ferrari thinks mirror neurons may turn out to be "a basic feature of the vertebrate brain" that initially evolved to help animals refine their movements and eventually became co-opted, at least in some species, for more complex functions, such as understanding the behavior of others.

In the new study, neuroscientists Jonathan Prather, Richard Mooney, and colleagues at

Cheer Up, Physicists

The Bush Administration plans to ask Congress for another double-digit increase next year for the Department of Energy's (DOE's) Office of Science. Budget documents obtained by *Science* indicate that the president, as part of a 2009 budget to be unveiled next month, will propose boosting the office's current \$4 billion budget to at least \$4.7 billion. (The 2008 request for \$4.4 billion was ultimately trimmed back at the last minute by Congress.) Raymond Orbach, DOE undersecretary for science, would not confirm the final 2009 number but said in an interview last week (www.sciencenow.org/cgi/content/full/2008/115/1) that it "will be a wonderful budget request." The documents show initial agreement on a \$118 million increase for high-energy physics over the 2008 level as of November.

Orbach also told *Science* that DOE wants to stay involved in the \$6 billion ITER fusion project despite last month's decision by Congress to wipe out its planned \$150 million contribution for 2008. DOE told its partners it would defer its payment this year and keep a small staff working on the project at Oak Ridge National Laboratory. Earlier this month, DOE shuttered the Intense Pulsed Neutron Source, a 26-year-old user facility at Argonne National Laboratory that is considered a predecessor to the new Spallation Neutron Source at Oak Ridge National Laboratory. —ELI KINTISCH

New Vaccine Strategy

NEW DELHI—In a new approach to vaccine development, a U.S. university will dispatch faculty members to India to help run a new vaccine research center with Indian partners. Until now, U.S. researchers have spent only a few months at a time in India, says Altaf A. Lal, a malaria researcher with the U.S. Embassy in New Delhi. Emory University's School of Medicine in Atlanta, Georgia, will spend \$3 million over 3 years to hire three faculty members for the Emory Vaccine Center, a joint venture with the International Centre for Genetic Engineering and Biotechnology (ICGEB) in New Delhi.

Tops on the center's list is developing a DNA vaccine against clade C of the HIV virus, developed by a team led by Emory University's Rama Rao Amara, a researcher running U.S. phase I clinical trials on a related virus. ICGEB Director Virander Singh Chauhan says the new center does not intend to use Indians as unwitting guinea pigs for new vaccines—an allegation that has dogged some of the more recent Indo-U.S. vaccine trials in India.

—PALLAVA BAGLA