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What songbirds can teach us about the brain

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(PhysOrg.com) -- Professor Sarah Woolley does research on males who mate for life and help out around the home. If you asked where these creatures can be found, she might direct your attention outdoors.

For Woolley, a neuroscientist and assistant professor of psychology, studies songbirds and what their exemplary mating life might tell us about the human brain. Her work could shed light on afflictions ranging from hearing loss in menopausal women to speech difficulties experienced by autistic children.

“Songbirds, like humans, have the rare ability to learn complex vocalization—what we call ‘song,’” explains Woolley. “This makes them very important for studying vocal communication and auditory perception.”

She primarily focuses on zebra, Bengalese and blackheart finches, which learn to sing from their parents, just as humans learn speech from their parents.

Bird songs play a crucial role in reproduction among songbirds, as males croon and warble to advertise themselves or to defend their territories. They learn to sing from their fathers; the females, who don’t sing at all, respond and select mates based on the qualities of their songs, evaluating volume, spectrum, tempo, and even how frequently the males sing.

Songbirds mate for life, so choosing wisely is important; male birds play

a big role in raising their young, sharing incubating duties, building the nest and helping feed the chicks.

A primary discovery Woolley's team has made is that when a baby male finch of one species is placed with adult males of another, the chicks learn that species' song.

Woolley analyzes the neurological behavior of the baby bird, gathering information on how the brain responds during speech acquisition. "We could, using songbird research, get some insight into what is happening in the brain when the vocalizations you're exposed to during development are abnormal."

More recently, Woolley has made inroads into a still somewhat mysterious connection suggesting that estrogen may modulate women's hearing. Woolley's team places female songbirds in a long cage with an audio speaker on either end, each playing a different song, and observes which song they gravitate toward.

Woolley also records neural activity when the female hears different songs. "We may someday be able to relate that back to exactly what effects estrogen has on the human brain and the human auditory system," she says. One potential use of her findings could be to develop drug therapies for hearing loss.

Woolley grew up near the woods in rural Ohio, raised by parents who were English teachers, and her interest in animals started at a young age. "We were fortunate enough to have a swimming pool, and each morning I would gather my subjects—frogs, toads, salamanders—that had fallen into the pool," she recalls. "I built little villages of them in my parents' garage, with cardboard boxes and pools of water, and I observed how they interacted with each other."

As an undergraduate at the University of Colorado, Boulder, Woolley worked part-time in a lab and happened upon bird researchers at a scientific meeting, where she "became obsessed with songbirds." She went on to the University of Washington, where she received her Ph.D., and then to the University of California, Berkeley, as a post-doctoral researcher.

Woolley joined Columbia's faculty in 2006. Her Schermerhorn Hall office is decorated with Art Deco bird cages, a wooden guinea fowl from Kenya and modernist bird prints by the artist Charley Harper, revealing a fascination with birds that goes beyond their research potential.

"Songbirds are charming and beautiful," she says.

Provided by Columbia University