# Learning Hub in Songbirds' Brain Aids in Voice Lessons

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Created *05/29/2012 - 4:10pm*

Male society (Bengalese) finches are able to learn songs quickly because of their brain's basal ganglia. (Photo: Nicole Aletta Planken-Kooij/Photos.com [1])

For songbirds, practice makes perfect. To learn the melody that will one day woo mates, male songbirds repeat their fathers' tune over and over again—sometimes hundreds of times a day—making slight adjustments in pitch. These trial-and-error voice lessons take about 50 days for male society finches to complete, when the finches are three months old and sexually mature. But achieving the ideal tune to impress the ladies is no easy task. Luckily, the finch's brain is equipped with the basal ganglia, a cluster of interconnected brain regions that act as a learning hub, receiving information from other regions of the brain in order to improve the bird's song.

While other studies suggest the basal ganglia are important for learning, researchers at University of California San Francisco have confirmed this theory in a paper published this month online in *Nature* [2].

"People thought the basal ganglia were involved somehow in learning but no one knew how," explains Jonathan Charlesworth, a recent graduate in the school's neuroscience PhD program and the first author of the paper.

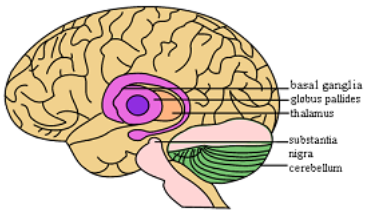
For previous experiments, researchers at the lab of Michael Brainard created a computer program that recognized every syllable adult finches sang, delivering a white noise-like sound when they uttered a certain note. The birds aren't fond of the noise and, within a few hours, they altered the pitch of the note to avoid the unpleasant white noise. But the researchers wanted to know how the finch's quick learning was controlled by the brain.

Charlesworth and his colleagues at Brainard's lab blocked the output of a basal ganglia circuit while male finches were training their song to the unpleasant white noise blasts. "We prevented the basal ganglia from performing experiments so there was no influence of behavior on the training process," Charlesworth says.

When the circuit was blocked, the finches were unable to adjust their pitch to avoid the white noise. But when they removed the block, the birds adjusted their pitch instantaneously.

"We saw that when we allowed the basal ganglia to again influence behavior, the basal ganglia were immediately able to implement or to cause the bird to sing much better," Charlesworth explains. "It had gained the ability to tell the motor pathway what to do even though it hadn't told the motor pathway what to while the behavior was being performed."

Charlesworth thinks understanding how the basal ganglia work in the finches might assist scientists in interpreting symptoms of human neurological disorders like Huntington's disease and Parkinson's disease.




Location of the basal ganglia and related structures in a human brain. (Photo: John Henkel/Food and Drug Administration [3])

"By understanding how the basal ganglia circuit works, we could ultimately improve treatment for those diseases," he says.

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