Researchers ID chemical that influences songbirds' song choice

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New research in songbirds sheds more light on the decision-making process in the brain. In this study, researchers discovered that sensory input from the locus coeruleus—the area of the brainstem known

primarily for mediating arousal and modulation of sensory processing—has a direct impact on motor action. In other words, these inputs mediate the switch between the highly variable exploratory skill birds produce when practicing their song alone compared to the low variability songs birds produce to impress their female counterpart. The findings were recently published in the *Journal of Neurophysiology* (*JNP*). The article has been chosen as an APSselect article for September.

The six-year study was conducted using up to eight male zebra finches. This specific species of songbird is known to use high variability when singing to themselves, but they transition to low variability when singing to a female. The switch is mediated by increases in norepinephrine (neurotransmitter between nerve cells) on the motor system. This discovery could lead to advances in how drugs are used to treat attention-deficit/hyperactivity disorder (ADHD).

The Centers for Disease Control and Prevention (CDC) estimates at least 6.1 million children in the U.S. have been diagnosed with ADHD, as of 2016. Approximately 388,000 are between the ages of 2 and 5, while 2.4 million are ages 6–11, and 3.3 million are ages 12–17. Boys are 12.9% more likely than girls to have ever been diagnosed with ADHD, according to the CDC.

The research team uncovered three additional key findings:

- Activating the locus coeruleus—which increased arousal in songbirds, making them sing more—also transformed the variable exploratory song that birds sing in the absence of a female to a song that was low variability.
- This switch was caused by a direct effect on motor areas in the brain, where norepinephrine effectively stopped variability signals generated by the basal ganglia (area of the brain

responsible for involuntary motor movements) from influencing motor output.
- This study is the first of its kind to show norepinephrine can act directly on the motor system to bias skill performance.

"Regulation of vocal precision by noradrenergic modulation of a motor nucleus" is published in the *Journal of Neurophysiology* (JNP).

More information: Zachary P. Sheldon et al. Regulation of vocal precision by noradrenergic modulation of a motor nucleus, *Journal of Neurophysiology* (2020). DOI: 10.1152/jn.00154.2020

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