Hormones may affect how brain listens

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From zebra fish to humans, reproductive hormones govern behavioral responses to courtship signals. A new Emory University study conducted in songbirds suggests that hormones may also modulate the way the auditory system processes courtship signals. In other words, hormones may affect how the birds actually listen to courtship songs at certain times of the year when it's time to reproduce.

Like many animals, songbirds put on their reproductive song and dance routine each spring: Male birds perform their finest songs, and female birds respond, hormonally prepped for the breeding season. In this research, Emory neuroscientist Donna Maney examined the auditory areas of the brain to see how estrogen affects the selectivity of song-induced gene expression. Dubbed the "genomic response," this is a highly specific process wherein genes are turned on to perform as they're programmed.

"Our work suggests that estrogen, which is normally high only during the breeding season, may actually alter auditory pathways and centers," Maney says. "The changes in gene expression reflect changes in the brain that are related to auditory learning and attention."

In the study, published in the current issue of the *European Journal of Neuroscience*, Maney and her research group compared estrogen-treated female white-throated sparrows with females not treated with hormones. The birds listened to recordings of either seductive male song or synthetic, frequency-matched beeps.

The birds reacted as expected to the songs, with the hormone-treated females responding by performing their mating moves -- known as "copulation solicitation" -- whereas the untreated females remained unimpressed and did not respond with courtship displays. Both groups essentially ignored the beeps. Although the genomic response in the auditory systems of the hormone-treated females was much higher in response to song than to beeps, as expected, in the untreated females it was the same for the songs and synthetic beeps, making no differentiation between the two.

The most interesting result was the pattern of genomic responses across groups. "The main difference between estrogen-treated and untreated birds was not that estrogen increased the response to song. Rather, estrogen decreased the response to beeps. This decrease could be a mechanism for tuning out what is not relevant, allowing the birds to focus on the signals important for breeding," Maney says.

In the big picture, the results of their work may indicate how hormones affect sensory processing in general. "Our results fit with studies showing that women's preferences for masculine faces, voices and body odors change over the menstrual cycle, as hormones are changing," she says. "What we've started to uncover here is a possible neural substrate for such hormone-induced changes."

Maney is an assistant professor of psychology and a member of the Graduate Program in Neuroscience at Emory. She is a recipient of the Presidential Early Career Award for Scientists and Engineers (2004), and her research is funded by a CAREER award from the National Science Foundation. Coauthors of the paper include Emory researchers Chris Goode and Ellen Cho.

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