When she's turned on, some of her genes turn off

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When a female is attracted to a male, entire suites of genes in her brain turn on and off, show biologists from The University of Texas at Austin studying swordtail fish.

Molly Cummings and Hans Hofmann found that some genes were turned on when females found a male attractive, but a larger number of genes were turned off.

“When females were most excited—when attractive males were around—we observed the greatest down regulation [turning off] of genes,” said Cummings, assistant professor of integrative biology. “It’s possible that this could lead to a release of inhibition, a transition to being receptive to mating.”

The same genes that turned on when the females were with attractive males turned off when they were with other females and vice versa.

This is one of few studies to link changes in the expression of genes with changes in an individual’s behavior in different social situations.

Cummings and Hofmann suggest that the gene sets they studied could be involved in orchestrating mating responses in all vertebrates.

Their research appeared online December 4 in *Proceedings of the Royal Society of London B*.

Female swordtails are attracted to males that are large and have ornaments on their bodies, such as long tails and striking coloration.

In experiments, females were placed in the center of a tank separated into three zones for 30 minutes. When an attractive male was in one of the adjacent zones, females showed typical behaviors indicating that they had chosen the male for mating. The females were also tested with other females, with unattractive smaller males, and in empty tanks.

The researchers immediately extracted RNA from the females and used gene array technology to identify genes that were being up regulated (turned on) and down regulated (turned off) in the females' brains.

The researchers looked at more than 3,000 genes and found that 77 were involved in the females' mate choice behavior.

"We've found a number of new genes that haven't been implicated in mating behavior before," said Hofmann, assistant professor of integrative biology.

The genes turned on or off very quickly during the 30-minute testing period.

"What we have not appreciated until now is how dynamic the genome is," said Hofmann. "It is constantly changing and even in a very short period of time, 10 percent of the protein-coding genome can change its activity. We now have a genomic view of these dynamic processes within a social context."

The biologists next seek to identify specific regions in the brain where the genes are expressed. They also aim to enhance or inhibit specific genes and observe the resulting behavioral change.

“We’d like to take a female who is a ‘high preference gal’ and make her a ‘low preference gal’ and vice versa,” said Cummings.

She said that gaining a better understanding of individual expression of behavior and its underlying genetic causes can shed light on how behavior drives and maintains the evolution and diversification of species.

Source: University of Texas at Austin