

'Winner effect' linked to changes in brain circuitry, study finds

July 19 2010, By Sarah Perdue

The next time the Brewers go on a road-trip skid, it might not be their fault. The "winner effect," in which animals that win a competition win subsequent ones, occurs because of changes in their brain's circuitry. Those changes are even stronger if the animal had a home-field advantage, according to a study by University of Wisconsin-Madison researchers.

Their findings were published online in the journal *Proceedings of the National Academy of Science*.

"A lot of species have been shown to have a winner effect, but no one understands exactly how that occurs," said zoology graduate student Matthew Fuxjager , the lead author of the study.

"We looked at how winning a territorial dispute can change the brain, and we looked at how animals could win disputes guarding their territory versus an unfamiliar location," Fuxjager said.

Using a highly territorial species of mouse, Fuxjager and his colleagues first let the male mice accrue three wins in either their home cage or an unfamiliar cage. Then they gave the mice a test dispute in either a home or unfamiliar cage and measured the number of [androgen receptors](#) in the mice's brains after winning this fourth dispute. Androgen receptors respond to testosterone levels; the more receptors present, the greater the effects of testosterone on the mouse.

Three of the nine brain regions they looked at showed an increase in androgen receptors after the test dispute. One of those regions showed an increase regardless of the dispute location, suggesting receptor levels went up because of the fight.

The other two regions, however, only showed an increase if the mouse accrued wins at home and then had its test dispute at home. [Androgen receptor](#) levels did not increase in these two brain regions if the mouse had its fourth dispute in an unfamiliar location, even if it had its first three wins at home.

The affected regions of the brain are known to be involved in social aggression or reward reinforcement, Fuxjager explained.

The researchers also wanted to know if the levels of androgen receptors correlate with how a mouse reacts to a dispute. They observed the mice and assigned them a winner index based on a mouse's behavior in a dispute. Then they measured receptor levels.

"When they're in their disputes and engaging one another, it's easy to determine who wins and who loses based on their ritual behaviors," Fuxjager said of assigning the winner index, adding that the winning mice tend to win based on their dominant behaviors and do not maim the losing mice.

The researchers found that animals that only had home disputes -- and therefore more androgen receptors -- displayed a higher degree of winning behavior. Animals with lower levels of androgen receptors displayed less winning behavior.

"Some winner effects are long-lasting and we hypothesize that these may be related to neural circuitry changes," said Larry Wolf, a professor of biology at Syracuse University who did not work on the study. "(These)

results clearly show changes in neural [circuitry](#) and relate those changes in several brain areas to aggression levels."

Fuxjager was quick to caution that these results have only been shown in this species of territorial mice, so perhaps the Brewers are not off the hook yet. He said this study is more indicative of how an animal that wins a fight against an intruder on its own territory is primed to fight the next one.

Still, he said, "there are interesting parallels here to humans."

More information: See the study here:
www.pnas.org/content/107/27/12393

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