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Brain rewards aggression much like it does sex, food, drugs

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New research from Vanderbilt University shows for the first time that the brain processes aggression as a reward—much like sex, food and drugs—offering insights into our propensity to fight and our fascination with violent sports like boxing and football.

The research was published online the week of Jan. 14 by the journal *Psychopharmacology*.

"Aggression occurs among virtually all vertebrates and is necessary to get and keep important resources such as mates, territory and food," Craig Kennedy, professor of special education and pediatrics, said. "We have found that the 'reward pathway' in the brain becomes engaged in response to an aggressive event and that dopamine is involved."

"It is well known that dopamine is produced in response to rewarding stimuli such as food, sex and drugs of abuse," Maria Couppis, who conducted the study as her doctoral thesis at Vanderbilt, said. "What we have now found is that it also serves as positive reinforcement for aggression."

For the experiments, a pair of mice — one male, one female — was kept in one cage and five "intruder" mice were kept in a separate cage. The female mouse was temporarily removed, and an intruder mouse was introduced in its place, triggering an aggressive response by the 'home' male mouse. Aggressive behavior included tail rattle, an aggressive sideways stance, boxing and biting.

The home mouse was then trained to poke a target with its nose to get the intruder to return, at which point it again behaved aggressively toward it. The home mouse consistently poked the trigger, which was presented once a day, indicating it experienced the aggressive encounter with the intruder as a reward.

The same "home" mice were then treated with a drug that suppressed their dopamine receptors. After this treatment, they decreased the frequency with which they instigated the intruder's entry.

In a separate experiment, the mice were treated with the dopamine receptor suppressors again and their movements in an open cage were observed. They showed no significant changes in overall movement compared to times when they had not received the drugs. This was done to demonstrate that their decreased aggression in the previous experiment was not caused by overall lethargy in response to the drug, a problem that had confounded previous experiments.

The Vanderbilt experiments are the first to demonstrate a link between behavior and the activity of dopamine receptors in response to an aggressive event.

"We learned from these experiments that an individual will intentionally seek out an aggressive encounter solely because they experience a rewarding sensation from it," Kennedy said. "This shows for the first time that aggression, on its own, is motivating, and that the well-known positive reinforcer dopamine plays a critical role."

Kennedy is chair of Vanderbilt's Peabody College of education and human development's special education department, which is consistently ranked as the top special education program in the nation. He is also director of the Vanderbilt Kennedy Center for Research of Human Development's Behavior Analysis Clinic.

Couppis conducted her research in affiliation with the Vanderbilt Brain Institute. She is also affiliated with the Vanderbilt Kennedy Center for Research on Human Development and the Vanderbilt Center for Integrative and Cognitive Neuroscience.

Source: By Melanie Moran, Vanderbilt University