Researchers find epigenetic factor in monogamy for voles

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Male and female prairie voles develop strong partner preference after mating and stay together for life. After developing the strong bond, they become aggressive and exhibit mate-guarding towards intruders of opposite sex. Finally, after they have pups, both mom and dad participate equally in taking care of them. Credit: Dr. Zuoxin Wang

(Phys.org) —A team of researchers at Florida State University has found an epigenetic factor involved in voles' lifelong pair bonding. In their paper published in the journal *Nature Neuroscience*, the researchers

describe how they found the act of mating—along with time spent alone—led to permanent brain changes in the voles involved in the study.

Voles are famously monogamous, leading some to note that switching the letters around in their name spells the word "love." But the factors that lead to such pair bonding have remained somewhat of a mystery. Researchers have known for some time that vole pairs have higher levels of neurotransmitters—vasopressin and oxytocin—in their brains, but until now, haven't been able to explain why. In this new study, the researchers have found that the act of mating, combined with time spent along together, causes permanent changes to chromosomes that lead to changes in genes that are responsible for creating monogamous behavior.

Suspecting an epigenetic factor (chemical changes to chromosomes that impact how genes are transcribed) was at play, the researchers tested captive voles in a variety of circumstances for neurotransmitter levels. Some voles were housed together for six hours but weren't allowed to mate—others were housed together long enough to encourage mating (typically a full day). Some of the voles that were not allowed to mate also had the histone trichostatin A (TSA) injected into a part of their brain—the nucleus accumbens—it's known to play a part in their monogamous behavior. Other voles without injections were allowed to behave naturally.

In studying the results of their experiments, the researchers found that voles housed for just six hours with prospective mates that also received TAS injections, became bonded mates regardless of whether they actually mated or not—and genes for the neurotransmitter receptors had been transcribed, which meant the changes were permanent. Subsequent testing of such pairs showed the bonded animals exhibited the same raised levels of neurotransmitters as those who mated naturally in the wild. They also found that voles being housed together was just as important as the chemical injection—those housed for shorter times,

despite the dose of TSA, did not bond. This, they say, suggests that the bonding that occurs has more than one component. Spending time together before mating, they note, causes some sort of mental imprinting that when combined with raised neurotransmitter levels, causes the voles to want to mate with just their partner for the rest of their lives.

More information: Histone deacetylase inhibitors facilitate partner preference formation in female prairie voles, *Nature Neuroscience* (2013) doi:10.1038/nn.3420

Abstract

In the socially monogamous prairie vole (Microtus ochrogaster), mating induces enduring pair-bonds that are initiated by partner preference formation and regulated by a variety of neurotransmitters, including oxytocin, vasopressin and dopamine. We examined potential epigenetic mechanisms mediating pair-bond regulation and found that the histone deacetylase inhibitors sodium butyrate and trichostatin A (TSA) facilitated partner preference formation in female prairie voles in the absence of mating. This was associated with a specific upregulation of oxytocin receptor (OTR, oxtr) and vasopressin V1a receptor (V1aR, avpr1a) in the nucleus accumbens (NAcc), through an increase in histone acetylation at their respective promoters. Furthermore, TSA-facilitated partner preference was prevented by OTR or V1aR blockade in the NAcc. Notably, mating-induced partner preference triggered the same epigenetic regulation of oxtr and avpr1a gene promoters as TSA. These observations indicate that TSA and mating facilitate partner preference through epigenetic events, providing, to the best of our knowledge, the first direct evidence for epigenetic regulation of pair-bonding.