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Researchers discover the seat of sex and violence in the brain

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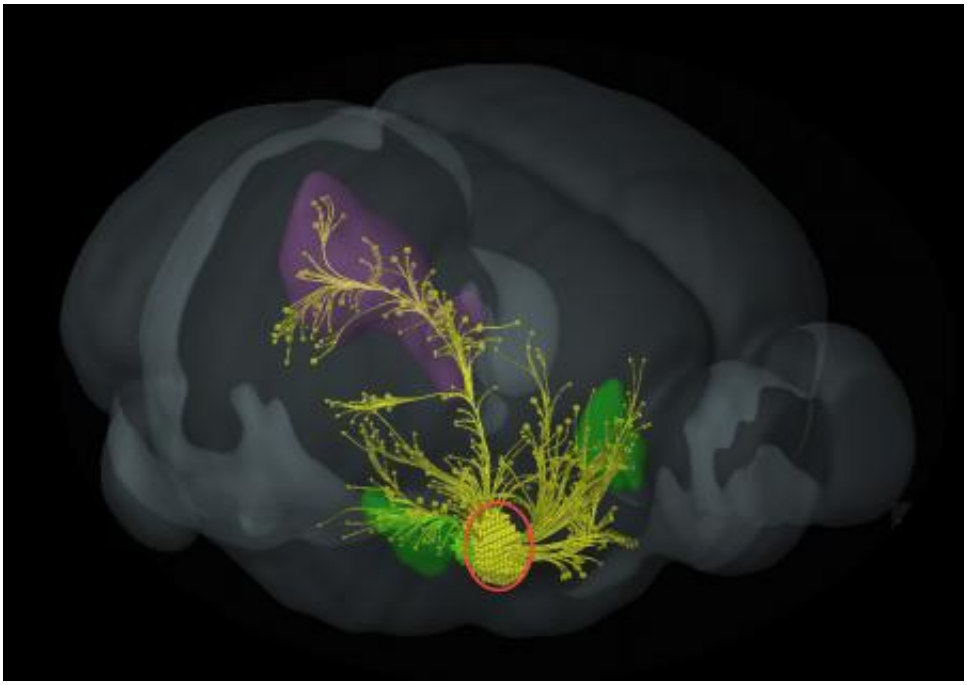

Nerve fibers (yellow lines) emanate from estrogen receptor-expressing neurons in the hypothalamus (yellow dots) that control aggression. Credit: Liching Lo/Allen Brain Atlas and Hyosang Lee/Caltech

As reported in a paper published online today in the journal *Nature*, Caltech biologist David J. Anderson and his colleagues have genetically identified neurons that control aggressive behavior in the mouse hypothalamus, a structure that lies deep in the brain (orange circle in the image at right). Researchers have long known that innate social

behaviors like mating and aggression are closely related, but the specific neurons in the brain that control these behaviors had not been identified until now.

The interdisciplinary team of graduate students and postdocs, led by Caltech senior research fellow Hyosang Lee, found that if these neurons are strongly activated by pulses of light, using a method called optogenetics, a male mouse will attack another male or even a female. However, weaker activation of the same neurons will trigger sniffing and mounting: mating behaviors. In fact, the researchers could switch the behavior of a single animal from mounting to attack by gradually increasing the strength of neuronal stimulation during a social encounter (inhibiting the neurons, in contrast, stops these behaviors dead in their tracks).

These results suggest that the level of activity within the population of neurons may control the decision between mating and fighting.

The neurons initially were identified because they express a protein receptor for the hormone estrogen, reinforcing the view that estrogen plays an important role in the control of male aggression, contrary to popular opinion. Because the human brain contains a hypothalamus that is structurally similar to that in the mouse, these results may be relevant to human behavior as well.

The results of the study were published in journal *Nature* on April 16.

More information: "Scalable control of mounting and attack by Esr1+ neurons in the ventromedial hypothalamus." Hyosang Lee, et al. *Nature* (2014) DOI: 10.1038/nature13169. Received 04 September 2013 Accepted 21 February 2014 Published online 16 April 2014