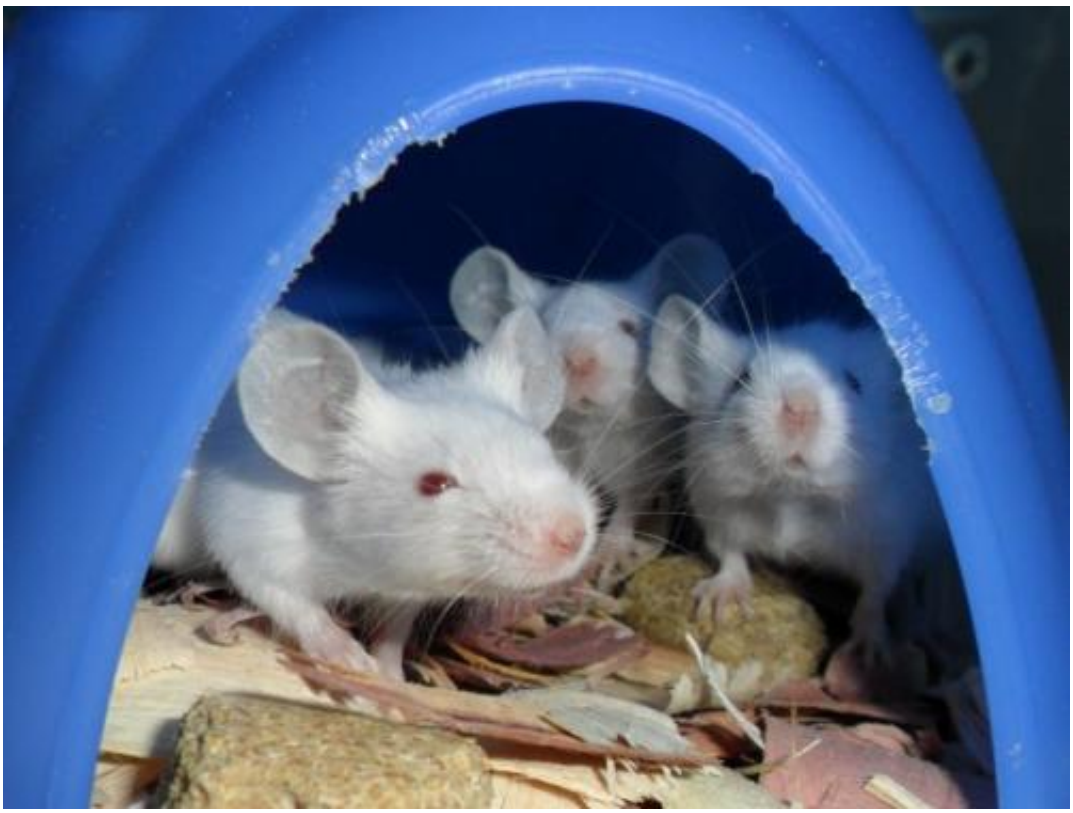
Researchers find chemicals and neurons responsible for turning parental care on and off in mice

May 15 2014, by Bob Yirka



Credit: Martha Sexton/public domain

A team of researchers working at Harvard University has found that a certain type of neuron in a certain part of the mouse brain is responsible for governing parental behavior. In their paper published in the journal

Nature, the team describes several experiments they conducted with mice and the results they observed. Ivan Rodriguez offers a follow-up to the research in a News & Views piece in the same journal issue.

Scientists know that for most animals, males and females behave differently regarding parental care of offspring. With mice, for example, virgin males will attempt to kill any pups they encounter, while females attempt to protect and nurse them. Prior research has shown that male mice cease attacking pups if they have had sex with a female starting approximately about the time that the female gives birth. That behavior only lasts for awhile, however, as approximately 50 days after birth (after they pups have grown up) the males revert to aggression towards pups. In this new effort, the researchers sought to understand the mechanism behind this switch in the mice. Their efforts came in two stages, the first was in experimenting with the vormero-nasal organ in the mouse nose, the second involved studying the parts of the brain that were impacted by the release of chemicals from the vormeor-nasal organ.

Prior research had shown that the vormero-nasal organ in mice was involved in certain behaviors—chemicals released from it for example, drive behavior when two adult males encounter one another. The researchers conducted several experiments involving disabling the organ in male mice and found that doing so caused them to behave less aggressively towards pups they encountered. The researchers followed that up by noting that certain parts of the hippocampus lit up when adults were demonstrating parental care. That suggested a chemical from the vormero-nasal organ was causing changes to neural response in the brain. The team then ran several more experiments where they disabled the neurons they had seen become active during parental care, and found that doing so allowed them to control parental care in the mice—in one experiment they even used optogenetics to allow for switching the behavior on and off using a light. Looking closer, the team found that

the neurons involved produced a protein called galanin when parents of either gender were behaving in a caring manner—when forced in males, the males tended to pups in motherly ways.

The research is still too new to apply what has been learned to humans, but logic suggests that some similar processes are likely occurring, which might help explain some human parental behavior patterns.

More information: Galanin neurons in the medial preoptic area govern parental behaviour, *Nature* 509, 325–330 (15 May 2014) DOI: 10.1038/nature13307

Abstract

Mice display robust, stereotyped behaviours towards pups: virgin males typically attack pups, whereas virgin females and sexually experienced males and females display parental care. Here we show that virgin males genetically impaired in vomeronasal sensing do not attack pups and are parental. Furthermore, we uncover a subset of galanin-expressing neurons in the medial preoptic area (MPOA) that are specifically activated during male and female parenting, and a different subpopulation that is activated during mating. Genetic ablation of MPOA galanin neurons results in marked impairment of parental responses in males and females and affects male mating. Optogenetic activation of these neurons in virgin males suppresses inter-male and pup-directed aggression and induces pup grooming. Thus, MPOA galanin neurons emerge as an essential regulatory node of male and female parenting behaviour and other social responses. These results provide an entry point to a circuit-level dissection of parental behaviour and its modulation by social experience.

See: Researchers identify neurons that regulate parental behavior in both male and female mice