

Study: BPA-exposed male deer mice are demasculinized and undesirable to females

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While the U.S. Food and Drug Administration notes "some concern" with the controversial chemical BPA, and many other countries, such as Japan and Canada, have considered BPA product bans, disagreement exists amongst scientists in this field on the effects of BPA in animals and humans. The latest research from the University of Missouri shows that BPA causes male deer mice to become demasculinized and behave more like females in their spatial navigational abilities, leading scientists to conclude that exposure to BPA during human development could be damaging to behavioral and cognitive traits that are unique to each sex and important in reproduction.

"The BPA-exposed [deer mice](#) in our study look normal; there is nothing obviously wrong with them. Yet, they are clearly different," said Cheryl Rosenfeld, associate professor in biomedical sciences in the College of Veterinary Medicine and investigator in the Bond Life Sciences Center. "Females do not want to mate with BPA-exposed male deer mice, and BPA-exposed males perform worse on [spatial navigation](#) tasks that assess their ability to find female partners in the wild. This study sets the stage for [BPA](#) researchers to examine how BPA might differentially impact the behavioral and cognitive patterns of boys versus girls. Investigators looking for obvious BPA-induced differences, such as chromosome deletions or [DNA mutations](#), could be missing subtle behavioral differences that eventually lead to long-term adverse outcomes, including demasculinization of male behaviors with ensuing decreased [reproductive fitness](#)."

In the study, female deer mice were fed BPA-supplemented diets two weeks prior to breeding and throughout lactation. The mothers were given a dosage equivalent to what the U.S. [Food and Drug Administration](#) considers a non-toxic dose and safe for mothers to ingest. At weaning (25 days of age), the deer mice offspring were placed on a non-supplemented BPA diet and their behavior tested when they matured into adults.

When sexually mature, researchers tested each mouse's ability to navigate a maze to safety. This enhanced spatial navigational ability of male deer mice is important because it allows them to find mates that are dispersed throughout the environment. Females do not have to search to find mates and thus their navigational abilities have not been enhanced by evolution. It was these navigational skills, among others, that were tested in the laboratory setting. Each animal had two five-minute opportunities per day, for seven days, to try to find its way into a home cage through one of several holes placed around the edge of an open maze which was marked with a set of visible navigational cues. Many male mice that had been exposed to BPA early in their development never found the correct exit. By comparison, male mice that had not been exposed to BPA consistently found the hole leading to their home cage within the time limit, some on the first day. In addition, the untreated mice quickly learned the most direct approach to finding the correct hole, while the exposed males appeared to employ a random, inefficient trial and error strategy, Rosenfeld said.

In addition, male deer mice exposed to BPA were less desirable to female deer mice. Females primed to breed were tested in a so-called mate choice experiment. The females' level of interest in a stranger male was measured by observing specific preferential behaviors, such as nose-to-nose sniffing and the amount of time the female spent evaluating her potential partner. These behaviors assess a potential mate's genetic fitness. Rosenfeld said that both non-exposed and BPA-exposed females

avored control males over BPA-exposed males on a two-to-one basis.

"These findings presumably have broad implications to other species, including humans, where there are also innate differences between males and females in cognitive and behavioral patterns," Rosenfeld said. "In the wide scheme of things, these behavioral deficits could, in the long term, undermine the ability of a species such as the deer mouse to reproduce in the wild. Whether there are comparable health threats to humans remains unclear, but there clearly must be a concern."

"We can use this evolutionary approach to the study of BPA to determine to best way to assess differences in the risks to boys and girls to early exposure to this chemical," said David Geary MU Curators' Professor of Psychological Sciences.

This research will be published in the *Proceedings of the National Academy of Sciences*.

Provided by University of Missouri-Columbia

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