BPA can adversely affect parenting behavior in mice

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California mice helped Mizzou scientists determine that offspring born to parents who are exposed to BPA receive decreased parental care by both the mother and father. Credit: Roger Meissen, Bond Life Sciences Center

Biparental care of offspring, or care that is administered by both parents, occurs in only a minority of species, including humans. Past studies have shown that maternal care can be negatively affected when females are exposed to widely prevalent endocrine-disrupting chemicals including

Bisphenol-A (BPA); however, no studies have shown how this chemical can affect maternal and paternal care when both parents are exposed. Now, researchers at the University of Missouri have used the monogamous, biparental California mouse species to prove that offspring born to parents who are exposed to BPA receive decreased parental care by both the mother and father. Scientists believe results could have relevance to human parenting as well.

The California mouse is used as a model for examining parental behaviors because they are monogamous and, much like humans, both male and female partners contribute to child-rearing. Male partners exhibit cooperative care of the pups from birth to weaning by cleaning, grooming and providing warmth by huddling over their young when females leave the nest. Impaired care could lead to adverse consequences for the young and, since brain regions and hormones regulating biparental behaviors appear to be similar across species, this study may have human implications.

"Endocrine-disrupting chemicals like BPA mimic the steroid hormones that establish the 'circuitry' for the adult female brain during early development, but little was known about how this chemical might affect the father's behavior," said Cheryl Rosenfeld, associate professor of biomedical sciences in the College of Veterinary Medicine and a researcher in the Bond Life Sciences Center at MU. "Our study set out to address this critical void by exposing both males and females to the endocrine-disrupting chemicals BPA and Ethinyl estardiol (EE), the main active component of birth control pills, and examine the repercussions of rearing offspring."

For the study, researchers developmentally exposed female California mice to one of three diets. One contained BPA, the second contained concentrations of EE and the third was free of endocrine disruptors. Likewise, males were developmentally exposed to the same three diets.

Then, the male and female mice were randomly paired. Since California mice are monogamous, one male was paired with a single female for the duration of the study. After being paired, parents and offspring were observed for a variety of behaviors such as time the females spent nursing the pups, male and female grooming of the pups and time spent in and out of the nest by both parents. Throughout the study, development of the pups, including body weight gain and temperature, was observed.

"The nature and extent of care received by an infant is important because it can affect social, emotional and cognitive development," Rosenfeld said. "We found that females who were exposed early on to BPA spent less time nursing, so the pups likely did not receive the normal health benefits ascribed to nursing. Likewise, we found that developmental exposure of males and females to these endocrine-disrupting chemicals resulted in their spending more time out of the nest and away from their pups, further suggesting that biparental care was reduced."

Findings also suggest that females can tell whether or not the male is compromised by BPA and adjusts her parental care accordingly. These females, although never exposed to BPA or endocrine disruptors, nursed their pups less and spent more time outside the nest. Researchers believed this was in response to whether her male partner was developmentally exposed to one of the endocrine-disrupting chemicals, said Sarah Johnson, a graduate student and lead author of the study.

More information: Disruption of Parenting Behaviors in California Mice, a Monogomous Rodent Species, by Endocrine Disrupting Chemicals, *PLOS ONE*, 2015.

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