BPA exposure during pregnancy can alter circadian rhythms

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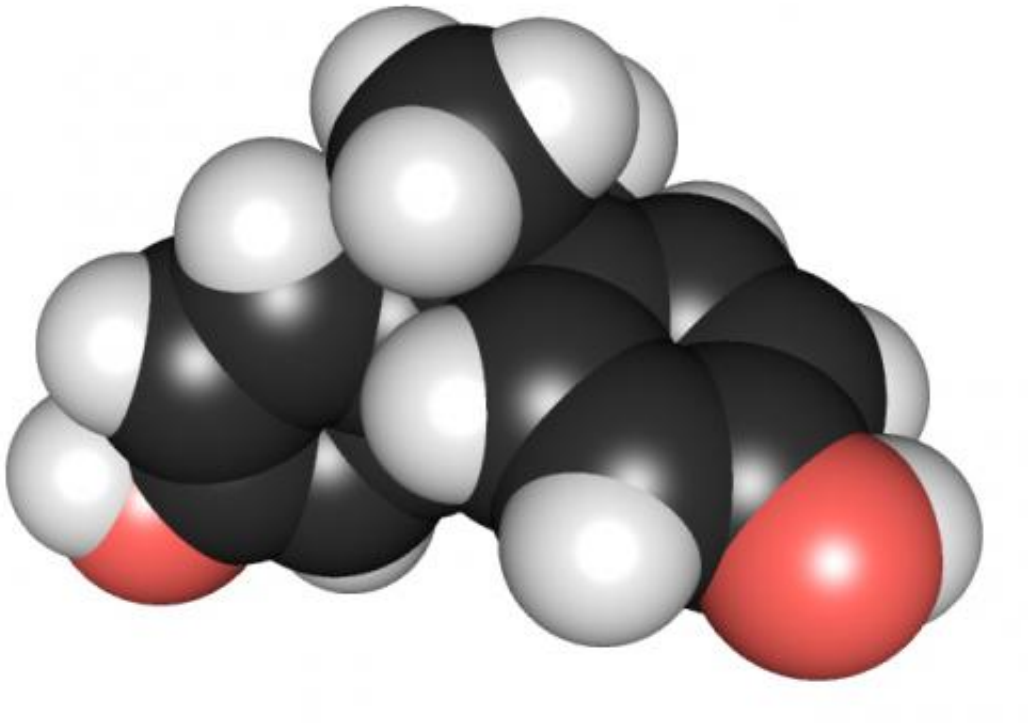

3D chemical structure of bisphenol A. Credit: Edgar181 via Wikimedia Commons

Exposure to the widely used chemical bisphenol A (BPA) during pregnancy, even at levels lower than the regulated "safe" human exposure level, can lead to changes in circadian rhythms, according to a mice study to be presented Monday at ENDO 2019, the Endocrine

Society's annual meeting in New Orleans, La. The researchers report these changes may be a contributing factor in hyperactivity seen in BPA-exposed mice.

"The hypothalamus, which we have identified as a brain region that is particularly susceptible to developmental disruption by BPA, contains the site of the clock cells that govern daily rhythms throughout the body," said researcher Deborah Kurrasch, Ph.D., Associate Professor at the University of Calgary in Calgary, Canada. "We have shown in previous research that BPA exposure in utero can cause defects to the development of hypothalamic nuclei and hyperactivity, and here we explored whether a shift in circadian biology might explain why the animals moved more."

BPA is a chemical that is added to many commercial products, including water bottles, paper receipts, can liners and food storage containers. It is known as an endocrine-disrupting chemical—a chemical that interferes with the body's hormones.

Many animal and human epidemiological studies have demonstrated a link between BPA exposure and adverse health outcomes, Kurrasch noted. "Despite this considerable scientific evidence, governmental agencies around the world, including in the United States, Canada and Europe, declare BPA to be safe," she said. One reason for this disparity is a lack of evidence BPA can affect brain development. "We wanted to provide that evidence," she said.

The study started with two groups of pregnant mice. One group ate regular food while the second group ate food containing low doses of BPA. The babies of these mice were grown to 12 weeks of age, then separated and housed singly in a specialized light-controlled environment. Their sleep/wake cycles and activity were closely monitored over four months.

The mouse pups were kept in a cycle of 12 hours of light and 12 hours of dark for four weeks, and a 24-hour dark cycle for another four weeks. During the 24-hour dark cycle, the pups were subjected to light pulses to examine their ability to adjust their rhythms in response to unexpected stimuli.

The researchers found the mouse pups exposed to low-dose BPA during gestation were significantly more active during the half-light, half-dark days, especially during the last third of the dark period. Disruptions of circadian rhythms were exaggerated in the 24-hour dark cycle.

BPA-exposed mouse pups appear to adapt more quickly to new conditions, both in the shift from half-dark, half-light to total darkness, and in response to short-term light pulses during the total dark cycle.

BPA-exposed mice exhibited alterations in their daily patterns and timing of activity, indicating disrupted circadian signaling. The researchers also observed that these effects were more pronounced when the animals were placed in 24-hour darkness.

"Overall, we conclude that low-dose gestational BPA exposure alters circadian rhythms under various conditions, and that this may be a contributing factor to the observed hyperactivity in BPA-exposed mice." Kurrasch said.

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