BPA replacements in plastics cause reproductive problems in lab mice

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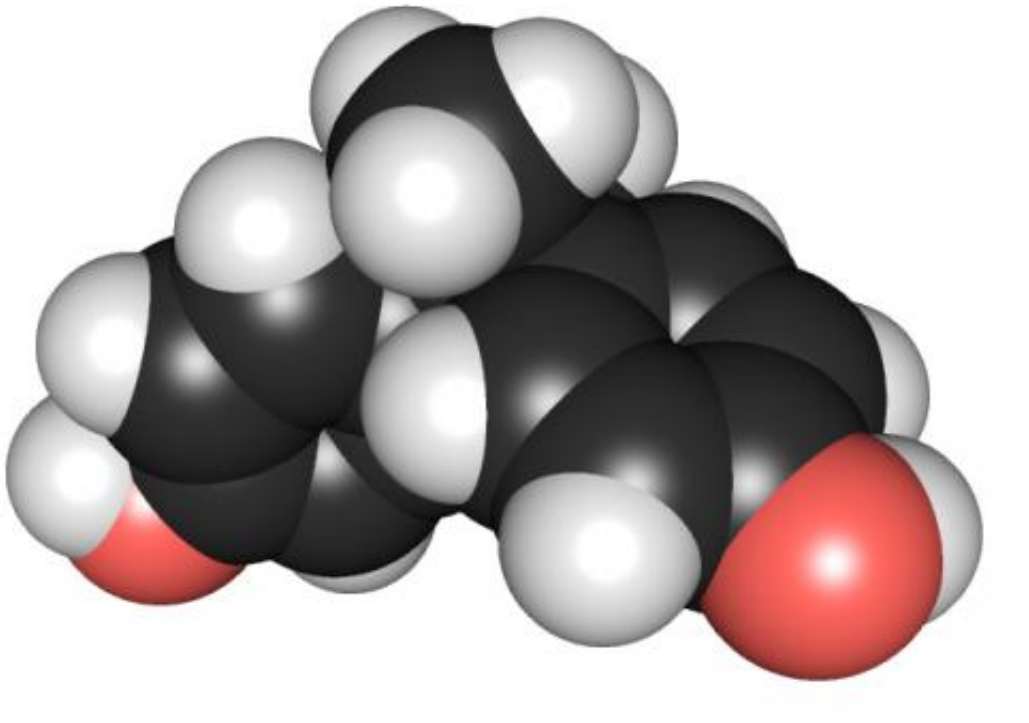

3D chemical structure of bisphenol A. Credit: Edgar181 via Wikimedia Commons

Twenty years ago, researchers made the accidental discovery that the now infamous plastics ingredient known as bisphenol A or BPA had inadvertently leached out of plastic cages used to house female mice in the lab, causing a sudden increase in chromosomally abnormal eggs in

the animals. Now, the same team is back to report in the journal *Current Biology* on September 13 that the array of alternative bisphenols now used to replace BPA in BPA-free bottles, cups, cages, and other items appear to come with similar problems for their mice.

"This paper reports a strange déjà vu experience in our laboratory," says Patricia Hunt of Washington State University.

The new findings were uncovered much as before as the researchers again noticed a change in the data coming out of studies on control animals. Again, the researchers traced the problem to contamination from damaged cages, but the effects this time, Hunt says, were more subtle than before. That's because not all of the cages were damaged and the source of contamination remained less certain.

However, she and her colleagues were able to determine that the mice were being exposed to replacement bisphenols. They also saw that the disturbance in the lab was causing problems in the production of both eggs and sperm.

Once they got the contamination under control, the researchers conducted additional controlled studies to test the effects of several replacement bisphenols, including a common replacement known as BPS. Those studies confirm that replacement bisphenols produce remarkably similar chromosomal abnormalities to those seen so many years earlier in studies of BPA.

Hunt notes that the initial inadvertent exposure of their animals was remarkably similar to what might happen in people using plastics in that the exposure was accidental and highly variable. Not all of the animals' cages were damaged, and so the findings differed among animals in different cages.

She adds that—although determining the levels of human exposure is difficult—their controlled experiments were conducted using low doses of BPS and other replacement bisphenols thought to be relevant to exposure in people using BPA-free plastics.

These problems, if they hold true in people as has been shown in the case of BPA, will carry over to future generations through their effects on the germline. The researchers showed that, if it were possible to eliminate bisphenol contaminants completely, the effects would still persist for about three generations.

Hunt says more work is needed to determine whether some replacement bisphenols might be safer than others, noting that there are dozens of such chemicals now in use. She also suspects that other widely used and endocrine-disrupting chemicals, including parabens, phthalates, and flame retardants, may be having similarly adverse affects on fertility that warrant much more study.

"The ability to rapidly enhance the properties of a chemical has tremendous potential for treating cancer, enhancing medical and structural materials, and controlling dangerous infectious agents," the researchers write. "Importantly, this technology has paved the way for 'green chemistry,' a healthier future achieved by engineering chemicals to ensure against hazardous effects. Currently, however, regulatory agencies charged with assessing chemical safety cannot keep pace with the introduction of new chemicals. Further, as replacement bisphenols illustrate, it is easier and more cost effective under current chemical regulations to replace a chemical of concern with structural analogs rather than determine the attributes that make it hazardous."

Hunt's advice to consumers now is simple: BPA-free or not, "plastic products that show physical signs of damage or aging cannot be considered safe."

More information: *Current Biology* (2018). Horan et al.: "Replacement Bisphenols Adversely Affect Mouse Gametogenesis with Consequences for Subsequent Generations" https://www.cell.com/current-biology/fulltext/S0960-9822(18)30861-3 , DOI: 10.1016/j.cub.2018.06.070

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