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Wrong Number: Plastic ingredient spurs chromosomal defects

By Kendall Morgan 2:16pm, April 2, 2003
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The primary chemical in some plastics causes female mice to produce eggs with abnormal numbers of chromosomes, according to a new study. In people, the condition–called aneuploidy–is the leading cause of miscarriages and several forms of mental retardation including Down's syndrome.

The new finding could shed light on the causes of aneuploidy, but it also raises questions about the safety of bisphenol A (BPA), the prime ingredient of the polycarbonate plastics that make up products ranging from baby bottles (http://www.sciencenews.org/sn_arc99/9_4_99/food.htm) to tooth-protecting sealants (SN: 11/22/97,

p. 324: http://www.sciencenews.org/sn_arc97/11_22_97/fob1.htm).

Earlier this year, scientists conducting a survey of environmental chemicals in blood and urine revealed BPA in some healthy adults who had no known exposure to the chemical (SN: 2/22/03, p. 120: Available to subscribers at Proof of Burden). So far, there is little direct evidence linking BPA exposure to health risks in people. However, several studies in animals have found that the chemical, which mimics the hormone estrogen, may affect reproduction by, for example, altering the size of the prostate gland and shifting the onset of sexual maturity.

When reproductive biologist Patricia A. Hunt of Case Western Reserve University in Cleveland and her colleagues discovered that BPA can affect mouse eggs, they were studying what they call a "big mystery" of human reproduction: Up to 25 percent of fertilized human eggs have an abnormal number of chromosomes. The only factor clearly tied to human aneuploidy is a mother's age. The older the woman, the more likely she is to give birth to a child with Down's syndrome. Hunt suspected that hormonal fluctuations might be responsible.

When she and her colleagues began testing that idea in the laboratory, they observed wildly fluctuating aneuploidy rates in animals not receiving any special treatment. Within this group, 2 percent produced aneuploid eggs one week, and 40 percent did the next. The team had expected the rate to stay the same throughout the experiment. "It was a big disaster," Hunt says.

It was also a clue. The scientists traced the apparent anomalies to the mouse cages. Built of polycarbonate, they had been washed with a harsh detergent. The researchers soon learned that polycarbonate is made with BPA, which can leach from damaged plastic.

To clinch the case against BPA, the team recreated the accidental exposure by housing some mice in newly damaged polycarbonate cages and others in BPA-free cages. Aneuploidy rates skyrocketed in mice exposed to the BPA-laden plastic compared with those of the control mice, the team reports in the April 1 *Current Biology*. In another experiment, the group provided mice with BPA-laced drinking water at concentrations matching those of the accidental BPA exposures. The more BPA the animals ingested, the higher the aneuploidy incidence.

Earlier studies had failed to link environmental factors, including smoking and alcohol, to chromosomal defects in egg cells, notes cytogeneticist Dorothy Warburton at Columbia University. The new work, she notes, "shows that there are things in the environment that can affect aneuploidy."

"It's an utterly incredible result," marvels geneticist R. Scott Hawley of the Stowers Institute in Kansas City, Mo. If an estrogen mimic can induce aneuploidy, then hormonal changes might well underlie the increased rate of chromosomal abnormalities in the eggs of older women, he says.

Whatever the implications of the new finding, BPA pervades the environment at the concentrations that spurred aneuploidy in mice, Hunt says. "It's kind of scary, " she adds.

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Citations

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