

Safety Dance over Plastic

Just how harmful are baby bottles, eyeglasses and other bisphenol-A plastics? Patricia Hunt, who helped to bring the issue to light a decade ago, is still trying to sort it all out **BY ADAM HINTERTHUER**

On the day Patricia Hunt's career veered into an entirely different field, her graduate students at Case Western Reserve University were grumbling, itching to use some exciting new data in their own experiments, but were told to wait while Hunt (just one last time) checked on her subjects.

Hunt, a geneticist, was exploring why human reproduction is so rife with complications. She had a hunch the chromosomally abnormal eggs that plague human pregnancies were tied to our hormones. A paper outlining the results of Hunt's experiments on the hormone levels of female mice was ready for publication. All she needed was to ensure that her control population, the mice left alone in the study, was normal. Instead Hunt stumbled on a disturbing result—40 percent had egg defects.

Hunt shelved hopes of publication and scrutinized every method and piece of lab equipment used in her experiment. Four months later she finally fingered a suspect.

It was the janitor. In the laboratory. With the floor cleaner.

A single breach in protocol had turned the rodents' safe environs into acutely toxic habitats. A maintenance worker had used an abrasive floor cleaner, instead of the usual mild detergent, to wash out cages and water bottles. The acidic solution scarred the hard, polycarbonate surface of the plastic and enabled a single chemical culprit to leach out—bisphenol-A (BPA).

Hunt's unnerving discovery, in 1998, led her to speak out on the

possible human health threats of BPA; she and Frederick vom Saal, a biologist at the University of Missouri–Columbia, have become prominent scientists sounding the alarm. To critics, however, Hunt and vom Saal have been alarmists; they argue that there have been no documented cases of BPA-based plastic harming humans and that fears of the chemical are overblown.

First synthesized in 1891, bisphenol-A came into use as a synthetic estrogen in

the 1930s. Later, chemists discovered that, combined with phosgene (used during World War I as a toxic gas) and other compounds, BPA yielded the clear, polycarbonate plastic of shatter-resistant headlights, eyeglass lenses, DVDs and baby bottles.

But during the manufacturing process, not all BPA gets locked into chemical bonds, explains Tim A. Osswald, an expert in polymer engineering at the University of Wisconsin–Madison. That residual BPA can work itself free, especially when the plastic is heated, whether it's a Nalgene bottle in the dishwasher, a food container in the microwave, or a test tube being sterilized in an autoclave.

In recent years dozens of scientists around the globe have linked BPA to myriad health effects in rodents: mammary and prostate cancer, genital defects in males, early onset of puberty in females, obesity and even behavior problems such as attention-deficit hyperactivity disorder.

For her part, the 54-year-old Hunt, now at Washington State University, focuses on aneuploidy, or an abnormal number of chromosomes in eggs that causes birth defects and miscarriages. Last year she co-authored a paper in *PLoS Genetics* that, she says, makes her original discovery look like “child's play.” Hunt exposed pregnant mice to BPA just as the ovaries in their developing female fetuses were producing a lifetime supply of eggs. When the exposed fetuses became adults, 40 percent of their



PATRICIA HUNT

THE ACCIDENTAL TOXICOLOGIST: A geneticist by training, she discovered that bisphenol-A (BPA), an estrogen mimic, was leaching from polycarbonate plastics, which harmed her lab mice and ruined her experiments.

BIG ISSUE: In 2004, 6.4 billion pounds of bisphenol-A were created for compact discs, eyeglasses, baby bottles and other consumer products. Production grows 10 percent every year.

CAUSE FOR ALARM? When Hunt's first report came out, other scientists took note. Says colleague Frederick vom Saal: “In the field one thing people say is, ‘Pat does not get it wrong.’”

eggs were corrupted, which spelled trouble for *their* offspring. BPA's effects, it seemed, were not confined to the mouse receiving the dose. "With that one exposure," Hunt says, "we're actually affecting three generations simultaneously."

Although experts debate whether mice make good models for human effects, the

crux of the argument over BPA is that experimental results have not been reproduced. A 2004 report from the Harvard Center for Risk Analysis found "no consistent affirmative evidence for low-dose BPA effects." According to I. Glenn Sipes of the University of Arizona, a co-author of that paper, it is this inconsistency that bothers

skeptics. "I've never had a problem saying that we can see biological effects in these low-dose studies," he says. "But why are we seeing these studies that can't be repeated?" A onetime result in a rodent model, Sipes argues, cannot be extrapolated to mean negative impacts for human health.

But Hunt counters that there is plenty of corroboration to consider BPA a problem. In response to the Harvard study, she helped to produce a "state of the evidence" paper for *Reproductive Toxicology* in 2007. Along with 36 other researchers, led by vom Saal, the group analyzed hundreds of government-funded studies and found that 90 percent had concluded BPA was a health risk. It was the dozen or so industry-funded studies, vom Saal says, that failed to replicate other BPA research.

More important than these conspiratorial undertones, Hunt says, is one of communication between toxicology (the way skeptics look at BPA) and endocrinology (the way she looks at it). For instance, according to a statement on www.bisphenol-a.org, a Web site created by the American Chemistry Council (which represents dozens of companies engaged in plastics manufacturing), the toxicology of BPA is "well understood," and "BPA exhibits toxic effects only at very high levels of exposure." Current U.S. Food and Drug Administration guidelines, based partly on these findings, set a safe daily exposure to BPA at 50 micrograms per kilogram of body weight.

But according to Hunt, treating BPA like a traditional toxin is dangerous because it "doesn't play by the rules." Standard toxicology states that if a chemical is bad, "then higher doses are worse and an even higher dose is even worse," Hunt explains. But with hormones (and estrogen mimics like BPA), she says, high doses can sometimes "shut down" the body's response, and low doses are enough to exert effects.

Indeed, her lab rodents show BPA effects at just 20 micrograms per kilogram; other labs have found similar thresholds, making them one-half to one-third the FDA levels. These experiments yield bodily concentrations of BPA in ranges of parts per million, but some recent studies have even found that when BPA interacts with hor-

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That means basically any exposure to BPA could have consequences, an alarming conclusion, considering that in 2004 the Centers for Disease Control and Prevention found unmetabolized BPA in the urine of 93 percent of more than 2,500 human subjects. According to the National Toxicology Program of the U.S. Department of Health and Human Services, BPA has also been detected in human blood and breast milk.

With such ubiquitous exposure, one might expect to see numerous problems already afflicting humans. And perhaps this lack of any definitive effects most bothers skeptics. "Why do we have to work so hard to try to replicate and show these low doses really have an effect?" Sipes asks. "Why don't [reactions to BPA] stand out in black and white?"

Hunt is asking the same question. She is now working on a paper about how diet can alter responses to the chemical. It is one of many unstudied facets of the issue that, she says, may be making it difficult

Treating bisphenol-A like a traditional toxin is dangerous because, Hunt says, it "doesn't play by the rules."

for scientists to reproduce their research: "There's a lot of complexity and a lot of things we just don't understand."


While scientists grapple to get a better handle on BPA, the public domain has made up its mind. On April 17 the National Institutes of Health raised concerns about BPA's established "safe" levels. Four days later Health Canada, the Canadian version of the FDA, announced a ban on

polycarbonate baby bottles, citing concerns over BPA. The moves rattled the industry, as consumer outcry led stores such as Wal-Mart and CVS to announce they would phase out some polycarbonate products. And Nalgene, a company synonymous with its popular shatter-resistant bottles, decided to pull them from shelves.

The actions may seem premature given the need to solve the mysteries surrounding BPA. But recalling past hazards with mercury and lead in consumer products, Hunt feels caution is justified. "It's not like this has never happened before," she notes. "Now what we have to do is raise awareness and start looking at these products differently—and ask questions about whether they should be making their way into our everyday environment." ■

Adam Hinterthuer is a freelance writer based in Madison, Wis.

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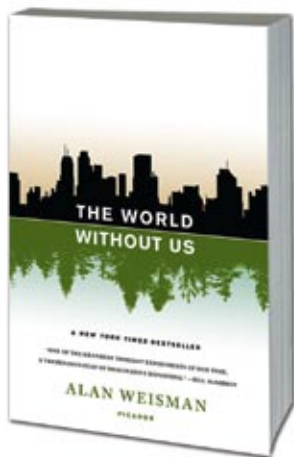
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