

ABCs of BPA

Polycarbonate—one of the plastics that carry the No. 7 recycling symbol—is clear, tough, and lightweight. That makes it ideal for everything from bulletproof glass, riot shields, and computer cases to eyeglass lenses and compact discs.

Those properties also make polycarbonate ideal for hard reusable water bottles (like Nalgene), sippy cups for toddlers, and some food storage containers. And that's where it gets into trouble.

Polycarbonate is made from BPA. So are the epoxy resins that line the insides of food and beverage cans. And small amounts of BPA leach out when the plastic or can lining comes in contact with food or water.

"Close to 100 percent of our exposure occurs this way," says Michael Shelby of the National Institute of Environmental Health Sciences (NIEHS), a division of the National Institutes of Health in Research Triangle Park, North Carolina.

"Low levels of BPA are also found in house dust, the air, and in water," adds Shelby, who is director of NIEHS's Center for the Evaluation of Risks to Human Reproduction.

What worries some scientists is that BPA is an estrogen "mimic." It activates the same receptors in the body as estrogen does. In fact, BPA was first studied in the 1930s as a synthetic estrogen for women. Because hormones are the messengers in the body's endocrine system, chemicals like BPA are called "endocrine disruptors."

"BPA is the largest volume endocrinedisrupting chemical in commerce," says BPA critic Frederick vom Saal, a biologist at the University of Missouri. Worldwide, more than six billion pounds of BPA are manufactured every year.

t could be in the plastic in that impact-resistant baby bottle or spill-proof toddler "sippy" cup. Or the water bottle you drink from on your walks. Or the plastic storage containers in which you stow your leftovers. Or the plastic knives, forks, and spoons you occasionally use. Or the dental sealant in your mouth. It's also in the inside linings of just about every food or soda can.

So it's no surprise that bisphenol A, or BPA, is in the bloodstream of nearly every person in the United States. And studies in animals suggest that, at least for fetuses, infants, and children, BPA may be harmful. But getting a handle on *who* might be harmed *in what way* by *how much* BPA has been anything but easy.

> Vom Saal is convinced that BPA causes a host of problems, including breast and prostate cancer. While some other researchers aren't willing to go that far, they are concerned that BPA may affect the maturing brain.

Dueling Panels

In August 2007, a scientific panel convened by the National Institute of Environmental Health Sciences warned that "the wide range of adverse effects of low doses of BPA in laboratory animals exposed both during development and in adulthood is a great cause for concern..."

The panel worried that the changes seen in animals exposed to BPA might be linked to increased rates of breast and prostate cancer, early onset of puberty in girls, type 2 diabetes, obesity, attention deficit hyperactivity disorder (ADHD), a decline in semen quality, and urogenital abnormalities in male babies.

The panel, chaired by vom Saal, was composed of 38 researchers, many of whom had done laboratory studies on BPA and had expressed concern about its safety.

In November, a second panel of scientists, also convened by the NIEHS, disagreed with most of the first panel's findings. It consisted of 12 toxicologists, pharmacologists, neurobehavioral experts, and other researchers who had not studied BPA.

Two were reproductive toxicologists from drug companies (Pfizer and Schering-Plough, neither of which makes BPA).

Why did the two panels disagree? According to vom Saal, the second panel gave more weight to studies funded by the plastics industry.



Experts worry that BPA may cause harm—especially to fetuses, babies, and young children because it mimics estrogen.

"We're to the point now where 100 percent of industry-funded studies conclude that bisphenol A at any dose causes no harm," he says.

"And there are now hundreds of government-funded studies that show the opposite outcome."

However, Robert Chapin, the Pfizer toxicologist who led the second panel, argues that there was good reason to reject many of the nonindustry studies. "We didn't flippin' care who does the study," he told the *Milwaukee Journal Sentinel* newspaper in December. "There's a lot of bad science out there."

One reason the second panel rejected so many studies: The first panel looked at research in which scientists injected BPA

into test animals. The second panel said that those studies weren't relevant, since that's not how humans are exposed to BPA.

"That's absurd," counters vom Saal.

"We found identical blood levels whether we fed or injected BPA into young mice," he argues, citing a new study he did to test the second panel's conclusion.

While the two panels may not have concurred on much, they did agree on one thing: BPA may cause brain and behavioral disturbances in young animals.

BPA & the Developing Brain

"The biggest concern we have is for neurobehavioral alterations in the young," says Chris Portier, associate director for risk assessment at the National Institute of Environmental Health Sciences.

For example, male rats exposed to BPA were less likely to explore a new environment,

sexual performance.

hormones, so you expect to see certain differences between the sexes," explains neurodevelopmental toxicologist Jane Adams of the University of Massachusetts. (Adams served on the second NIEHS panel. She has received funding for some of her research from Pfizer.)

BPAway

f you're concerned about BPA, take whatever steps you can to reduce your exposure," says Michael Shelby, director of the Center for the Evaluation of Risks to Human Reproduction at the National Institute of Environmental Health Sciences. "That means avoiding polycarbonate baby bottles, the water bottles that hikers and sportsmen use, and canned food."

If you do that, you've probably eliminated most of your exposure.

How to Minimize Your Exposure to BPA

- Avoid plastic containers made of polycarbonate. Any bottle or container made of polycarbonate has the recycling No. 7 on the bottom. But the number can also appear on plastics that don't contain BPA.
- When possible, prepare or store food—especially hot foods and liquids—in glass, porcelain, or stainless steel dishes or containers.
- If you have polycarbonate plastic food containers, don't microwave them. The plastic is more likely to break down and release BPA when it's repeatedly heated to high temperatures.
- Don't wash polycarbonate plastic containers in the dishwasher. The detergent may break down the plastic, which could release BPA.
- Use infant formula bottles that are made of glass or BPA-free plastic. BornFree (newbornfree.com) is one of many companies that make them.
- When you can, replace canned foods with foods that are fresh, frozen, or packaged in aseptic (shelf-stable) boxes (see "No Can Do," p. 11). At least one manufacturer—Eden Foods—lines its cans with a BPA alternative made from plant extracts.
- A good alternative to polycarbonate is polyethylene terephthalate (PETE), which has the recycling No. 1 on the bottom (see "Unlucky '7," p. 10).
- Avoid older versions of Delton dental sealant. (Dental sealants are plastic resins that a dentist bonds into the grooves of the chewing surface of a tooth to help prevent cavities. Delton is made by Dentsply International of York, Pennsylvania.) Most dental sealants are free of BPA. However, older Delton sealants contain a compound that breaks down into BPA, mostly during the first day after it comes into contact with saliva. The newer Delton Plus (or Delton+) sealants don't contain the compound, but Dentsply still sells the old sealants to dentists who prefer them.

Sources: Adapted from the National Institute of Environmental Health Sciences and Dentsply.

a trait more characteristic of female rodents. In other studies of young animals exposed to BPA, mice were more anxious, female rats were less playful and more sexually motivated, and male rats were more defensive and showed impaired

"Some behaviors are influenced by

"When the magnitude of those differences changes, you worry about a hormonal influence," says Adams.

For example, mothers ordinarily treat their male offspring differently than their female offspring. But "if maternal behavior changes because the right signals aren't coming from the mother's pups, then you fear that really subtle hormonal effects on the pups could disturb their brain development and later behavior," says Adams.

But the evidence is still murky, she adds.

"There's really no cohesive picture. No

two studies looked at the same thing. One would focus on a maternal behavior index, another on prenatal exposure of pups at one age, another at exposure of pups at other ages, others on different behaviors."

Still, Adams's panel found enough well-designed studies that picked up subtle behavioral changes in animals that "we just felt something might be going on and needs to be studied further."

Part of what impressed the second panel was that the animals also showed changes in nerve cells—"the density of cells, the number of cells, things like that," says Adams in areas of the brain that respond to hormones.

"If the changes had been in an area that had nothing to do with any of this stuff, we wouldn't have been persuaded," she adds.

Adams isn't just worried about the youngest brains.

"Adolescents have a growth spurt in brain development that's on the magnitude

of what we see in early infancy, and we know very little about it," she notes.

(Could BPA cause problems in adults? Researchers haven't looked extensively at the brain cells or the behavior of animals that were exposed to BPA as adults. One study, however, hinted at subtle changes

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in the behavior of exposed mother mice.)

And what, if anything, do the changes in the brain cells or the behavior of lab animals mean for human fetuses, infants, and young children?

Researchers don't know. "There's un-

certainty about the possible effects," says the National Institute of Environmental Health Sciences' Michael Shelby.

"If you're concerned, the thing to do is to take whatever steps you can to reduce exposure. And the published literature

Unlucky "7"

he recycling numbers that appear on the bottoms of most plastic bottles and other containers were designed by the plastics industry in 1988 to help recyclers separate different types of plastics. Some—but not all—plastics with the recycling No. 7 are polycarbonate, which has BPA. Here's what each number means.



Polyethylene Terephthalate (PETE): Many soda bottles, water bottles, vinegar bottles, medicine containers. The easiest plastic to recycle.



High-Density Polyethylene: Many milk and water jugs; containers for laundry and dish detergents, fabric softeners, bleach, shampoos, conditioners, motor oil. **Can be recycled into more bottles or into bags.**



Polyvinyl Chloride: Many meat wraps, cooking oil bottles, baby bottle nipples, shrink wraps, coffee containers. Difficult to recycle.



Low-Density Polyethylene: Many wrapping films, grocery bags, sandwich bags. Can be recycled into more of same.



Polypropylene: Tupperware and many other food storage containers, syrup bottles, yogurt and margarine tubs, diapers, outdoor carpet. **Can be recycled into fibers.**



Polystyrene: Some take-out food containers, Styrofoam cups and containers, disposable cutlery and cups, bakery shells, meat trays, packing "peanuts." **Recyclers don't want it because it's bulky and light weight.**



Photo: © AGphotographer/fotolia.com

Other (mostly polycarbonate or mixtures of the other plastics): Food can liners, Nalgene-type water bottles, disposable cutlery, sippy cups. Recyclers don't want it.

suggests that close to 100 percent of the exposure comes from water and food."

Beyond the Brain

Once you look beyond BPA's impact on the developing brain,



You're always safe when you microwave in glass.

the picture is no clearer...and the opinions are no less heated.

Take cancer.

In studies by Frederick vom Saal, exposing fetal mice to very small amounts of BPA stimulates the growth of epithelial cells in the mammary glands of females and accelerates the proliferation of epithelial cells in male prostate glands.

"We're talking about an animal carcinogen that mis-programs the cell, and these are the cells that later transform into the tumor," says vom Saal.

"There are now clear molecular mechanisms that explain how bisphenol A alters human and animal cells at concentrations at and below one part per trillion," he adds.

"And that's over a thousand times below the levels that you virtually are certain to have in your body, according to the CDC. So if that doesn't get you a little nervous, nothing should."

Yet when other studies expose animals to much larger amounts of BPA from conception through adulthood, the animals have no higher rates of breast or prostate cancer.

"It's a real head-scratcher," says Michael Shelby. "Here's this body of research reporting that very small amounts of BPA can cause effects in animals that might be interpreted as precursors or early stages of problems like infertility and cancer.

"Yet when we do large, more robust standardized studies, the kind of tests toxicologists and risk assessors have relied on for decades, using very small or larger amounts of BPA for longer periods of time, birth defects and other possible problems raised by some low-dose studies just don't show up."

That's reassuring, but it still leaves doubts and unanswered questions, especially for parents of young children.

"People think the government has tested environmental chemicals and shown them to be safe," says vom Saal. "That's a big lie."

No Can Do

What's Next?

Concern over BPA is picking up speed.

The National Institute of Environmental Health Sciences is preparing to release its BPA recommendations this spring. The U.S. Environmental Protection Agency (EPA) has announced that it will begin reviewing the safety of BPA this year. And the California Environmental Protection Agency is considering whether to include BPA in its annual Proposition 65 list of chemicals that cause cancer or birth defects.

The FDA approved BPA for use in materials that come in contact with food three decades ago, when there was little research about its risks. Now the agency says that it will review the findings of the two recent NIEHS panels.

"If it causes us to change our mind, we will take appropriate action," says Mitchell Cheeseman, deputy director of the agency's Office of Food Additive Safety.

But that could take years. Meanwhile, if BPA does cause harm, especially to the very young, its impact may be irreversible. Says NIEHS associate director for risk assessment Chris Portier: "There's sufficient evidence now to give people who want to be prudent—especially parents a reason to avoid BPA."

The Bottom Line

- Young animals that are exposed to BPA in the womb or soon after birth show abnormal behavior and abnormal changes in brain cells and receptors, but there's no direct evidence that the same occurs in young humans.
- Some animal studies suggest that BPA increases the risk of cancer, obesity, diabetes, or other health problems, but other studies find no effect.
- There is no evidence that BPA causes neurobehavioral or other problems in adults, but little research has been done.
- To play it safe, women who are pregnant or breastfeeding, infants, young children, and adolescents should try to avoid BPA.
- If you want to avoid BPA, see "BPAway" (p. 9) and "No Can Do."

Want to avoid plastic packages that leak BPA? Check the recycling symbol on the bottom. If it's No. 7, the plastic may be polycarbonate, which contains BPA. (Not all No. 7 plastics are polycarbonate, though.)

But the odds are that you won't find a No. 7.

For example, we didn't see No. 7 on plastic containers that hold baked goods (cakes, muffins, cookies, etc.), berries, grape tomatoes, margarine, butter, milk, cottage cheese, or yogurt. Nor are you likely to see a No. 7 on the plastic clamshell containers used at salad bars.

And even if you run across a No. 7, that doesn't mean it contains BPA. For example, Gerber baby food plastic containers carry a No. 7 because they're composed of layers of different plastics, none of which are polycarbonate, says the company.

(No. 7 is the "Other" category, which covers mixtures of plastics and plastics that don't carry their own recycling symbols—see "Unlucky '7." p. 10.)

So where's the BPA? Unless you carry a Nalgene reusable water bottle, the linings of canned foods and sodas are the most likely source for adults. Here's how to avoid them:



- Look for BPA-free cans. At least one company—Eden Foods—uses cans that aren't lined with the epoxy resins that can leach BPA into food.
- Buy soup that's dried or in cartons. Imagine, Trader Joe's, and many other companies use aseptic (shelf-stable) cartons. You can also look for dried soups in cups (like Dr. McDougall's) or in bags (like Bean Cuisine). Or make your own.
- Switch to fresh or frozen vegetables. You might get less salt to boot.
- Buy tuna or salmon in pouches. You'll also have less water to drain.

BPA ONLINE. For more information about BPA, including links to scientific reviews and to companies that make BPA-free products, see nutritionaction.org/bpa.