



Josh Zaffos - Environmental Toxins

Patient Handout

From car seats to condoms, nasty compounds have invaded our lives

- **I am half the man my father is.**
 - This disturbing fortune came to me about five years ago, but not from an odd relative or a sadistic girlfriend. Instead, this dinner-table diagnosis came from Theo (short for Theodora) Colborn, an internationally known scientist who has helped develop the field of research exploring how chemical compounds interfere with the hormones that guide human development.
 - Known as endocrine disruption, chemicals found in computer screens and car seats, shower curtains and shampoo, plastic water bottles and prophylactics are skewing our odds against cancers and causing developmental delays and reproductive roadblocks, including declining sperm counts.
 - So, when Colborn informed me of my inferior manhood, I took consolation in the fact that she was indicting my entire generation and her own for loading our natural environment, our workplaces and our homes with tens of thousands of chemical compounds without really having a clue about what we're doing. Our *Stolen Future*, the book Colborn co-authored in 1996, first delivered this bad news to the general public.
 - More than a decade later, scientists are still conducting experiments and measuring results, from cramped basement labs at universities to expansive high-country lakes in the wilderness. The hypotheses generally aren't questions of whether chemicals are pervading and persisting in the environment, but rather how severely they are stunting our development and health. The federal government has investigated these questions with timidity, if not contempt, operating a regulatory system practically beholden to the chemical industry.
 - With half of my manhood at stake and hopes for a better assessment in the future, I'm wondering how we can heed the warning signs and reverse our chemical course.
- **A day in my half-life**
 - For years, I started off each day drinking coffee out of a metallic cup, likely coated with bisphenol-A, a chemical commonly used to line plastic bottles and other food and beverage cans and containers. Anyone who has lugged around a Nalgene bottle made of polycarbonate plastic, trying to save the Earth one paper cup at a time, has gotten his or her share of bisphenol-A, which leaches from containers into liquids to enter our bodies. A U.S. Centers for Disease Control study detected bisphenol-A in 93 percent of all Americans.
 - Inside us, bisphenol-A mimics estrogen, plugging into hormone receptors; this is endocrine disruption. In pregnant or breastfeeding mothers and young and prepubescent children, it can have critical impacts, rewiring our developmental

profiles and opening up our risks for cancers and physical and behavioral abnormalities. Lab tests suggest that chronic, low-dose exposure to bisphenol-A like drinking out of a coated cup or polycarbonate bottle daily may cause women to have greater chances of breast cancer and polycystic ovary syndrome, a leading cause of infertility, and men to have increased odds of prostate cancer and reduced sperm counts.

- That's a lot to think about during the day's first cup of coffee or sip of water. Now I try to stick to ceramic mugs and glasses.
- As my body starts to properly caffeinate in the mornings, I usually sit in front of a laptop and do whatever it is writers do to put off writing checking e-mails and box scores until I'm warmed up. As a computer warms up, particles inside start to fly and some catch a ride on dust. For years, I breathed in polybrominated diphenyl ethers (PBDE's) from my laptop.
- These compounds are flame-retardants, nearly universally used in couch cushions, televisions, cars and carpets. PBDE's have similar chemical structures to thyroid hormones, and, according to lab tests, they can lower our bodies' production of the real thing.
- Over time, thyroid-hormone deficiencies can hurt metabolism. Hypothyroidism causes fatigue, depression, anxiety, hair loss and a waning libido. Women with low thyroid-hormone counts are five times more likely to have children with IQ's that qualify them as mildly retarded, according to one study. A 2005 experiment found that a single low dose of a common PDBE given to rats in utero resulted in a class of hyperactive rodents with persistent low sperm counts.
- Contemplating my future as a fat, bald, sad, edgy, dull and dim-witted bachelor isn't necessarily cause for perilous concern. Still, a generation's lacking aesthetics and sex drive is a wicked trade-off for the low combustion factors of our workspaces, living rooms and vehicles.
- On the mornings when words don't flow from my fingertips, I know it's time to take a shower, an effective and healthy distraction. I used to have a vinyl shower curtain and wash with whatever shampoo was cheapest from the supermarket. Both those products generally contain phthalates (pronounced "tha-lates"), compounds that add flexibility and plasticity to fragrances and cosmetics and almost anything made out of vinyl, including children's toys and IV bags.
- Phthalates are especially tenacious when it comes to tweaking with men's development, affecting androgen, as compared to estrogen, receptors. One of the first low-dose studies on phthalates, from 1999, found that exposure of pregnant female rats led to a dramatic increase in male offspring with sexual abnormalities.
- For humans, studies show that as many as one in 125 newborn boys in the U.S. now arrives from the womb with a hypospadias, a condition in which the urethra does not properly extend to the end of the penis, necessitating surgery. Data suggests the incidence has doubled since the 1970s, and scientists believe phthalates or other endocrine-disrupting chemicals are responsible.
- Recent research on phthalates by Rao Veeramachaneni of Colorado State University has used rabbits, which are better human surrogates than rats because they have infant and adolescent life stages; rodents basically start puberty once they're born. The results show rabbits with in utero exposure to one class of phthalate experienced a 43 percent drop in sperm count compared

with healthy animals. Rabbits exposed to phthalates in utero or during adolescence had almost twice as many abnormal sperm as normal cases. These declines in sperm quality and quantity are among the signs of "testicular dysgenesis," which also includes increased rates of undescended testicles and, most severely, testicular cancer.

- Yet another study, led by Shanna Swan of the University of Rochester, suggests prenatal exposure to phthalates correlates with shorter "anogenital distance" (the space from the anus to the testicles, less clinically known as the taint) and greater probability of improper testicular descent and smaller penile volume.
- In other words, size does matter, just not necessarily the way we act like it does.

- **Beast of body burden**

- I can try to avoid plastic bottles and vinyl shower curtains. I can seek out a computer that doesn't use PBDE's; a number of companies have voluntarily phased them out. My few consumer actions are roughly equivalent to fending off an infectious disease with a Kleenex.
- One reason is that the federal government doesn't do much to monitor or regulate chemical concentrations in the environment.
- Congress passed the Toxic Substances Control Act (TSCA) in 1976, the same year I was born. Under the law, manufacturers register commercial chemicals and the U.S. Environmental Protection Agency can test the safety of chemicals produced after 1979 and regulate their use. Or at least that's how it's supposed to work.
- From 1979 to 2004, the EPA received more than 32,000 chemical applications, but agency personnel performed some level of review on fewer than one in eight cases. Eight out of every 10 applications are approved with no restrictions, often in less than three weeks. The agency has implemented restrictions on only five chemical classes, even though in the 1990s it reported that 16,000 compounds warranted concern because of their chemical structure or volume of use.
- "TSCA really doesn't have the teeth to ban chemicals," says Sonya Lunder, senior analyst with Environmental Working Group, a D.C.-based watchdog organization.
- Another catch is something called bioaccumulation. Some chemicals persistently build up inside us, a tally called a body burden. Mothers pass theirs onto babies in utero and through breast milk. I inherit, so to say, the body burdens of animals every time I eat a cheeseburger or splurge on sushi. In 2001, a Canadian health official estimated the average person consumes about half a microgram of PBDE's every 10 days just through meat and dairy. When it comes to endocrine disruption, you are what you eat.
- I have roughly 700 different synthetic chemicals in my body. That number probably won't be going down any time soon. Every single day, the United States produces or imports 42 billion pounds of chemicals, about 140 pounds for every American. I also am what I eat out of, and with, and around.
- The same compounds that bioaccumulate in our bodies also linger in the environment. The heavy-duty pesticide DDT earned its notoriety and nearly worldwide prohibition because its lethal toxicity could kill off dozens of birds after an application. It is also a "persistent organic pollutant" that remains in

the environment for a long time and can mimic estrogen and lead to birth defects. It's probably fair to call DDT the O.G. of endocrine-disrupting chemicals.

- Bans on DDT and other persistent organic pollutants led to the engineering of the new class of chemicals we use today. It's obvious how they've improved our lifestyles, if not our lives. But studies suggest we have traded obvious poisons for insidious ones.

- **Pollution in the park**

- Situated in the ice-sculpted Colorado valley of Glacier Gorge, Mills Lake is considered one of the most stunning features in Rocky Mountain National Park. At nearly 10,000 feet and fed by snowmelt from the Continental Divide, Mills should be among the purest pools of mountain water in existence. But the presence of "intersex" rainbow trout, males with some very female characteristics, suggests otherwise.
- This February, the National Park Service issued a report through its Western Airborne Contaminants Assessment Project (WACAP) detailing measurable levels of chemicals and heavy metals throughout "pristine" corners of our national parks.
- "The transsexual fish was really something we hadn't anticipated," says Dixon Landers, a U.S. Environmental Protection Agency research scientist who participated in the WACAP.
- Based on the project's findings, Landers says most parks' contaminant counts correlate with the local pollution measured in the surrounding snowpack. In Rocky Mountain National Park, that means mercury from power plants along the Front Range and chemicals from agricultural pesticides. Researchers also reported levels of persistent organic pollutants, including DDT, once again proving the compounds' lasting risks.
- DDT, which hasn't been used in the U.S. since 1972, could plausibly be responsible for transsexual fish in the middle of the continent. Scientists also point out that airborne pollution moves around the world, so organic pesticides could be coming from countries that still use them. Then again, the project also detected levels of PBDE's in parks, suggesting another pathway.



- Almost anything in your bathroom, from shampoo to lotions and cleaners, might be affecting you in negative ways that you don't even realize.
- In 2004, University of Colorado scientists surveyed fish in Fountain Creek, downstream of Colorado Springs' wastewater-treatment facilities, and found

intersex flathead chubs and other sexual deformities.

- Around the same time that James Dobson was raising questions over Sponge Bob's sexual preferences, a much more serious case of sexual deviancy was brewing in his backyard stream.
- The Fountain Creek results mirror earlier findings from around the state. The same researchers have identified intersex fish swimming below sewage plants in Boulder and Denver; they couldn't find a single male white sucker in the South Platte River downstream of the state capital. The scientists reported many more female than male fish, female fish with poor reproduction rates, stunted gonads in both sexes, and males producing vitellogenin, the main ingredient of yolks for offspring.
- Concentrations of chemicals and steroid hormones, including synthetic estrogen used in birth control and synthetic testosterone used to bulk up livestock, are typically higher in streams below treatment plants because the contaminants accumulate at the facilities. That is one of the reasons for treatment, but the various processes used in most wastewater plants don't effectively remove many of these compounds.
- A forthcoming study from the University of Colorado scientists and their colleagues has more specifically analyzed why the fish in these locations are suffering these maladies. The researchers report a "complex mixture of endocrine-active chemicals" in Boulder Creek, including bisphenol-A, steroid hormones and alkylphenols, which are estrogen-mimicking compounds used in air fresheners and laundry detergents, and as a spermicide on condoms, diaphragms and other contraceptives.
- Other studies are advancing our understanding of chemicals' impacts on life. A group of Colorado State University researchers led by Thomas Borch, professor of environmental chemistry, is looking at measurable amounts of androgens and estrogens along the Cache la Poudre River, upstream and downstream of Fort Collins, to see what happens to the compounds over time.
- "This particular study stands out because we've tried to address the question: What are the present compounds being broken down to?" Borch says. "It's beyond the fact that these could have endocrine-disrupting effects."
- Borch refers to other research suggesting synthetic chemicals can impact animal's levels of pheromones, a class of hormones that cue behavioral responses in other members of a species.
- "We're just being able to reliably detect these compounds," he adds.
- Meanwhile, the mix of pharmaceuticals, including antibiotics and mood stabilizers, steroid hormones and other compounds passing through standard wastewater treatment processes and into drinking water supplies was the focus of a recent Associated Press investigation. A Senate committee has announced it will hold hearings on the topic.

- **A dangerous double standard**

- Congress, actually the U.S. House of Representatives, is investigating the federal government's regulatory behavior regarding chemicals. An ongoing inquiry should help reveal the extent of industry influence over recommended rules for synthetic compounds.
- Rather than yielding a regulatory hammer, the EPA generally allows the chemical industry to set its own standards voluntarily and conduct its own evaluations on endocrine disruption and chemical impacts on children. In

cases where chemicals have gone through formal reviews, the results haven't always panned out for public health and safety.

- The Environmental Working Group recently exposed that the EPA had removed a government scientist from an external-review panel of deca-brominated diphenyl ester, one of the fire-retardant PBDE's, after the American Chemistry Council complained about her "appearance of bias."
- Other PBDE's have been outlawed in the U.S. since 2004 because of their effects on human thyroid systems and brain development, and their rates of bioaccumulation; body burdens drop when we stop using these chemicals. The impacts of deca weren't as conclusive a few years ago, but recent studies show the compound can break down into other PBDE's and cause endocrine disruption.
- Deborah Rice, an environmental toxicologist with the Maine Center for Disease Control and Prevention and a former EPA scientist, has testified, to her state Legislature, in favor of banning deca.
- That was enough for the chemical industry to claim she was unqualified to serve as the deca panel chair. The EPA complied with the industry's complaint last summer, citing the "perception of a potential conflict of interest."
- "The American Chemistry Council's strong support of science was the basis for its recent letter to the Environmental Protection Agency regarding a member of the agency's external peer-review panel for [PBDE's]," says Tiffany Harrington, a spokeswoman for the council. "The chairperson's pre-existing bias advocating the ban of deca-BDE is not consistent with the scientific standards of an independent peer review."
- Even with an IQ possibly deflated by flame retardants, Rice's prior recommendations, based on peer-reviewed research, don't sound like "bias" to me. Meanwhile, 17 scientists with financial or other ties to the chemical industry currently serve on seven EPA review panels, according to the Environmental Working Group.
- "There's a dangerous double standard coming out of the EPA about who is biased," Lunder says.
- So far, these cases haven't warranted the agency to remove any panelists. The U.S. House Committee on Energy and Commerce is now gathering agency documents on the issue as part of another investigation into regulations on the use of bisphenol-A, specifically in children's products, and the chemical industry's possible manipulation of public opinion relating to chemical safety.
- "The public depends on EPA peer-review panels to help ensure the products they use every day are safe," says Rep. John D. Dingell, D-Mich., the committee chair. "The EPA seems to have a backwards way of composing these panels. The EPA is disallowing scientists who have valid public-health concerns about products, while encouraging participation by so-called experts who are paid by the chemical industry."
- In the midst of the congressional investigation, bisphenol-A has gotten another once-over, even if U.S. regulators aren't changing their stances. The Canadian government announced it will likely label bisphenol-A as a toxic compound. Wal-Mart declared it would remove baby products with the substance from its shelves in Canada and eventually the U.S. Nalgene stated it would remove bisphenol-A from its water-bottle products.
- Perhaps most telling, officials at the U.S. National Toxicology Program released

an April report that concluded the use of bisphenol-A, even at low levels, should cause "some concern" toward health risks for fetuses, babies and children. Despite the wave of scientifically informed reports and consumer actions, the U.S. Food and Drug Administration, another agency with regulatory oversight over chemicals, claimed there was no reason for Americans to worry themselves over bisphenol-A.

- The Environmental Working Group is pushing for TSCA reform and is also supporting private and local-and state-level efforts to more effectively regulate potentially harmful chemicals. Many computer companies no longer use PBDE's, partly a result of tougher chemical restrictions in Europe.
- Corporations and academics are advocating for and following through on "green chemistry" practices, a comprehensive rethinking of manufacturing processes. Some cities are promoting their own pharmaceutical "take-back" programs, to limit the flushing of unused pills. The federal government's take-back guidelines are considered weak and confusing; in some cases, they encourage flushing pills to avoid drug abuse.
- In February, the EPA announced it would try to eliminate a backlog of 8,000 untested chemicals through a new "computational toxicology" initiative. Robert Kavlock, director of the agency's National Center for Computational Toxicology, says the program will use molecular and cellular tests performed by automated robots, instead of animal testing in labs. Whereas a chemical review through animal-toxicology studies can take five years and cost between \$5 million and \$10 million, the computational program can test thousands of compounds at several concentrations in a single afternoon.
- The breakthrough sounds encouraging, but critics question if molecular and cellular tests can capture health effects that impair entire organisms. Kavlock says the program's first phase will measure results against existing animal-toxicity data for chemicals to address that concern.

- **Global warning**

- During my conversation with CSU's Thomas Borch, I ask him to compare our understanding and acceptance of endocrine disruption with that of another subtle, global environmental epidemic: climate change. Borch says the analogy is apt, believing that the impacts of endocrine-disrupting chemicals we see today are comparable to the signs of global warming that people began to acknowledge in the 1990s. He recognizes this assessment might be conservative; some colleagues, Borch adds, would say the consequences of our society's chemical romance are already measurable and apparent, and they demand appropriate policy changes.
- I started surfing through the evidence five years ago.
- After first meeting Theo Colborn, I began spending time with her, asking lots of questions and reading whatever she handed me. I even worked for her for a short while, organizing files and sorting through research papers and reports.
- Today, at 81, Colborn is sharp as a tack and president of TEDX, Inc., an acronym for The Endocrine Disruption Exchange that rhymes with a certain overnight-delivery company. The nonprofit research clearinghouse compiles and circulates peer-reviewed studies on low-dose chemical exposure, allows scientists to compare results, and helps the media and the public understand what we are doing to our planet and our bodies.
- One day, while I was helping Colborn at her home, where a massive file cabinet piled high with draft studies and award plaques sits in her kitchen, she

opened a drawer to find a report. Instead, she discovered a folder, filled with poetry. "Oh! You need to have this," she told me and pulled out a photocopy of a poem, which is frequently attributed to Goethe and closes with the oft-quoted couplet:

- "Whatever you can do, or dream you can, begin it. Boldness has genius, power and magic in it. Begin it now."
- The inspirational verse on mind over matter is intriguing, coming from Colborn. Backed by decades of research and exchanges with fellow scientists, she firmly believes chemicals amassing in our bodies may not only outweigh, but be diminishing, our mind's capabilities.
- The words are a testimony to the ideal that if we are willing to inform ourselves and commit to intelligent decisions about our use of chemicals, it's not too late to affect change and avert a global crisis.
- Begin it now.

References

- Zaffos, Josh, Chemical Imbalance-From car seats to condoms, nasty compounds have invaded our lives. June 12, 2008. www.csindy.com/gyrobase/Content?oid=oid%3A26500