

Children are our future, and their mothers are its guardians.

Kofi Annan, former Secretary-General of the United Nations, 1997–2006

DIET AND NUTRITION

The Artificial Food Dye Blues

In 2008 the Center for Science in the Public Interest (CSPI) in Washington, DC, petitioned the Food and Drug Administration (FDA) to ban artificial food dyes because of their connection to behavioral problems in children.¹ Two years later a new CSPI report, *Food Dyes: A Rainbow of Risks*, further concludes that the nine artificial dyes approved in the United States likely are carcinogenic, cause hypersensitivity reactions and behavioral problems, or are inadequately tested.²

Artificial dyes derived from petroleum are found in thousands of foods.³ In particular breakfast cereals, candy, snacks, beverages, vitamins, and other products aimed at children are colored with dyes. Even some fresh oranges are dipped in dye to brighten them and provide uniform color, says Michael Jacobson, executive director at CSPI.

According to the International Association of Color Manufacturers, a trade association for food dye makers and users, artificial color additives enhance and correct natural colors and “provide a colorful identity to foods that would otherwise be virtually colorless,” as well as compensating for natural color loss during storage and providing a way to quickly identify pharmaceuticals and dietary supplements.⁴ Food dye consumption per person has

increased fivefold in the United States since 1955, with three dyes—Red 40, Yellow 5, and Yellow 6—accounting for 90% of the dyes used in foods.²

For its report CSPI reviewed published studies and “found some surprises,” says Jacobson. For example, most chemical carcinogenicity studies use relatively small numbers of animals, do not include *in utero* exposures, and last two years, the rodent equivalent of about 65 human years.⁵ Because cancers may not show up until a rodent’s third year of life, corresponding to the time when cancers also are more likely to appear in humans, the two-year time frame for standard bioassays may reduce the likelihood a carcinogenic chemical will be identified, says James Huff, associate director for chemical carcinogenesis at the National Institute of Environmental Health Sciences.

Red 40, Yellow 5, and Yellow 6 contain benzidine, a human and animal carcinogen permitted in low, presumably safe levels in dyes.² The FDA calculated in 1985 that ingestion of free benzidine raises the cancer risk to just under the “concern” threshold (1 cancer in 1 million people).⁶ Bound benzidine also has been detected in dyes in much greater amounts than free benzidine,^{7,8} but routine FDA tests measure only free contaminants, overlooking the bound moiety.² Intestinal enzymes release bound benzidine, “so we

could be exposed to vastly greater amounts of carcinogens than FDA’s routine tests indicate,” says Jacobson—especially considering today’s children are exposed to multiple dyes and flavoring agents and other added chemicals in foods.⁹

FDA policy is not to comment on topics that are currently under review. This includes CSPI’s open 2008 petition, whose docket of evidence now includes the new report. Ira R. Allen of the FDA Office of Public Affairs did say, “We appreciate the report from CSPI and are reviewing it. We take our commitment to protecting children seriously.” In a statement released after the publication of *A Rainbow*

of Risks, the International Association of Color Manufacturers highlighted its adherence to current FDA protocols, noting, “The FDA has repeatedly stated that these colors are safe based on the available safety data.”⁴

Food manufacturers still use plant-based colorings in some countries. For example, in the United Kingdom Fanta orange soda is colored with pumpkin and carrot extracts while the U.S. version uses Red 40 and Yellow 6. McDonald’s strawberry sundaes are colored only with strawberries in Britain, but Red 40 is used in the United States. With many U.S. consumers desiring fewer synthetic additives, “companies may be better off switching to [plant-based colors],” Jacobson says.

“Natural alternatives may present less of a risk, but I still would like to see their toxic potential assayed before we give them to kids,” says Bernard Weiss, a professor of environmental medicine at the University of Rochester. Weiss argued 30 years ago there was evidence linking artificial food dyes to behavioral problems in children.¹⁰ Yet the FDA still does not require manufacturers to test dyes for developmental neurotoxicity. “Their inaction amounts to approval of an ongoing experiment with children,” Weiss says.

Meanwhile, in Europe, as of July 2010 most foods that contain artificial dyes must carry labels warning they may cause hyperactivity in children.¹¹ Jacobson says, “This warning may be the death knell for [artificial] food dyes in Europe, especially for foods commonly eaten by children.”

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- In August 2010, the U.S. Environmental Protection Agency announced it planned to initiate rulemaking to regulate 48 benzidine-based dyes under the Toxic Substances Control Act. The act has authority for nonfood uses of these dyes in products such as textiles and inks. For more information see <http://tinyurl.com/25ta7pg> [accessed 15 Sep 2010].
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Artificial dyes are not the only way to create brightly colored foods; many countries use vegetable-based dyes (see sample wares in the inset) to achieve the same effect.

INTERNATIONAL ENVIRONMENTAL HEALTH

Invasion of the Bedbugs

The invaders have arrived, and our chemical weapons are practically useless to stop them. They have reached every major city, threatening students in college dorms and taking over stores, apartments, and hotels across the country. People are begging authorities for help and, increasingly, taking matters into their own hands. What sounds like a script for a science fiction movie is, in fact, the reality of the fight against bedbugs.

Bedbugs have been annoying humans since ancient times. They are mentioned in medieval European texts and in classical Greek writings back to the time of Aristotle.¹ Following the introduction of the pesticide DDT in the 1950s, bedbugs virtually disappeared in the United States. But now they are making a comeback. Anecdotes about infestations can be found in blogs and newspapers in virtually every major city.

The extent of the problem is suggested by a survey conducted by the National Pest Management Association, Inc. (NPMA) and the University of Kentucky, which had respondents from 43 countries.² Of 521 responding U.S. pest management companies, 95% reported encountering a bedbug infestation in the past year. Similar numbers were reported for Canada (98%), Europe (92%), and Africa/Middle East (90%). By comparison, before 2000 only 25% of U.S. survey respondents reported bedbug infestations, according to a 26 July 2010 press release from the NPMA.³

The common bedbug (*Cimex lectularius*) is about a quarter-inch long with a reddish-brown, oval, flattened body. It feeds solely on the blood of warm-blooded animals, preferably humans. Bedbugs usually bite people at night while they are sleeping. Some people show little or no reaction to the bites. Others develop welts that cause severe itching and, in rare cases, anaphylaxis. Anecdotal evidence indicates anxiety about bedbugs can be as bad as an actual infestation, even causing “delusional parasitosis,” a condition in which people mistakenly believe they are infected with parasites.

Bedbugs are not known to transmit disease except for possible associations with hepatitis B⁴ and Chagas disease.⁵ They are classified by the U.S. Environmental Protection Agency (EPA) as “a pest of significant public health importance” under the Federal Insecticide, Fungicide, and Rodenticide Act.⁶

Experts are not certain of the cause for the bedbug resurgence. The increased movement of people domestically and

internationally is thought to be one factor. Another is the resistance bedbugs have developed to pesticides. “Bedbugs have been treated so many times, they have developed a resistance to commercially available products allowed for use by the EPA,” says Dini Miller, an associate professor of entomology at Virginia Polytechnic Institute and State University.

Propoxur (sold as Baygon[®]) is one commercially available chemical that is still effective in killing bedbugs. This carbamate pesticide is widely used in commercial settings in the United States and was once approved for use in residential environments. However, propoxur is toxic to humans if ingested. Pesticide manufacturers, recognizing that indoor use of certain pesticides would not pass the more stringent testing requirements under the Food Quality Protection Act (FQPA) of 1996, agreed to drop their registration of propoxur for residential use.

The removal of propoxur and similar pesticides has left pest management companies with a limited array of tools to combat infestations. Steamers and rapid freezing equipment will kill bedbugs on contact. But the insects are experts at hiding, and repeated treatments are required to be effective. At an NPMA-estimated cost of \$500–1,200 per session, such treatments are unaffordable for many people.

State and local government officials say they are being overwhelmed with complaints of bedbug infestations. They also are hearing of widespread misuse of pesticides. Miller visited one home in which the resident had set off 30 “bug bombs” at once.⁷ Another blew the walls out of his apartment after setting off a bug bomb and failing to turn off the pilot light (aerosol propellants can ignite in an enclosed room). Officials in the state of Ohio have become so concerned that they have asked the EPA to grant them an exemption under Section 18 of the FPQA, allowing them to use propoxur in residential environments.

That exemption request is still pending, according to spokeswoman Kaleigh Frazier of the Ohio Department of Agriculture. “The EPA has not issued a formal denial on this request,” she says. “We continue to work with the EPA to get this matter resolved.” However, EPA scientists believe the use could present an unacceptable risk to children who might be exposed to propoxur in and around rooms being treated for bedbugs, according to Dale Kemery, a press officer with the EPA.



An exterminator fumigates a Queens, New York apartment for bedbugs, 28 July 2010.

In August 2010, the EPA and the Centers for Disease Control and Prevention issued a joint statement promoting an integrated pest management (IPM) approach to bedbug control.⁸ IPM includes heat treatment, vacuuming, nonchemical pesticides (such as diatomaceous earth), and “judicious use” of chemical pesticides.⁹ The EPA says it is actively working with industry and researchers to develop new compounds (or new uses of existing compounds) to control bedbugs.

That can't come soon enough for Miller, who has requested government funding to study the bedbug's genetic and mechanical resistance mechanisms. “Our hope is to eventually manipulate those mechanisms,” Miller says. “In the meantime, we are essentially defenseless.”

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7. Most bug bombs—or total release foggers, in official terms—contain pyrethroid pesticides, which may cause gastrointestinal effects and worsen allergies and asthma. To minimize improper use of these products, the EPA has ordered pesticide manufacturers to implement clearer labeling by 30 September 2011. For more information, see <http://tinyurl.com/2d6dvk9> [accessed 15 Sep 2010].
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9. The NPMA has posted a warning to consumers noting that, although some exterminators use propane heaters to treat bedbugs, these are not the same type of heaters that are used for camping or outdoor cooking. Using these devices indoors produces carbon monoxide and can be fatal. For more information, see <http://tinyurl.com/25rhdxu> [accessed 15 Sep 2010].

EXPOSURE SCIENCE

BPA in Canadian Population Highest Among Teens

For the first time, estimated bisphenol A (BPA) concentrations in the general Canadian population are available, and teenagers are leading the way in terms of exposure.¹ Data collected during 2007–2009 show that 91% of Canadians tested had detectable levels of BPA in their urine, indicating widespread exposure to the chemical among the general population. Among age groups, teenagers (12–19 years old) had the highest geometric mean level, 1.50 µg/L, compared with the overall geometric mean for 6- to 79-year-olds of 1.16 µg/L.

The August 2010 report from Statistics Canada is based on the Canadian Health Measures Survey, an ongoing effort to collect biomonitoring data from a nationally representative sample—comparable to the U.S. National Health and Nutrition Examination Survey (NHANES). “A definitive answer as to why we observed higher concentrations among teenagers would be useful,” says Tracey Bushnik of Statistics Canada and lead author of the report. “Beyond making some general hypotheses, however, we can’t really speak to what may be driving these differences.”

BPA is a high-volume industrial chemical with many applications. Food and beverage packaging represents the largest source of human exposure due to the compound leaching into packaged contents from container linings.² Animal studies of low-level BPA exposure suggest negative effects on the reproductive system and neurodevelopment, increased risks of prostate and mammary cancers, and possibly higher risk of obesity and diabetes.^{2–5} Although exposure levels have been established in humans, definitive data for related health effects are not available. Similarly, data establishing a link between BPA intake and biomonitoring results are also lacking.

A recent study based on 2005–2006 NHANES data took a preliminary look at potential sources of BPA exposure.⁶ This analysis supported an association between urinary BPA

concentrations and consumption of soda, school lunches, and meals prepared outside the home, all of which likely involve packaged foods, including canned goods. Eventually other sources and routes of exposure may be identified as well, as suggested by the recently publicized case of BPA found on cash register receipts and thermal papers.⁷

Such findings need to be viewed with caution though. “These results are best considered as hypothesis-generating,” says Judy LaKind, president of LaKind Associates in Catonsville, Maryland, and lead author of the NHANES analysis. She adds, “Further research is needed—preferably research that includes actual measurements of BPA in [sources of exposure]—to substantiate these results.” LaKind stresses that the value of biomonitoring studies lies in providing reference ranges, trend data, and the bases for research hypotheses; they do not establish causal relationships.⁸

With the Canadian study in mind, Bushnik agrees that biomonitoring studies are important for creating a foundation for more in-depth study. “With these data we have baseline information against which we can compare future data,” she says. Once more data are available, it will be possible to examine BPA exposure in greater detail and possibly also consider interrelationships of personal variables and sources of exposure.

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The Beat | by Erin E. Dooley

NIH Launches Gulf Oil Worker Study

This fall the NIH will launch a multiyear study to assess potential health effects from the *Deepwater Horizon* oil spill.¹ So far, \$20 million in funding has been announced, half of that from BP. The research will focus on exposure of cleanup workers to oil and dispersant chemicals, addressing a broad range of potential neurobehavioral,



Near Pass a Loutre, Louisiana, 19 May 2010

carcinogenic, and immunologic end points. Mental health effects also are expected to be evaluated. The NIH is hosting webinars and other activities to obtain input on the study design and implementation from the most affected Gulf Coast communities.

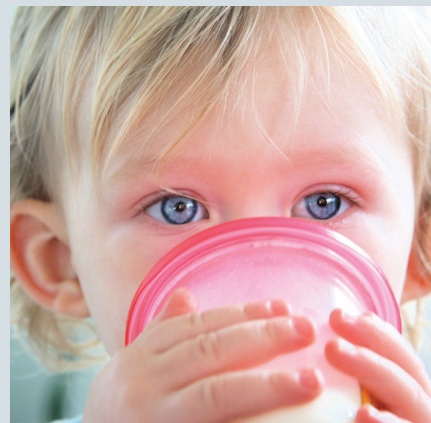
Asthma Drug Efficacy in SHS-Exposed Children

New research suggests that among children with mild to moderate asthma, those who were exposed prenatally to secondhand smoke (SHS) had less of a response to the asthma medication budesonide than those who had no prenatal SHS exposure.² Although all the children’s symptoms improved with treatment, the SHS-exposed group had on average 26% less of an improvement in airway responsiveness than children who were not exposed. Although inhaled corticosteroids remain first-line therapy for children with persistent asthma, these findings offer a potential explanation as to why children exposed prenatally to SHS may not respond to inhaled steroids as

well as hoped. The authors point out the importance of preventing SHS exposure by encouraging pregnant women not to smoke.

California Senate Defeats BPA Ban

Amid heavy lobbying from the chemical and pharmaceutical industries California’s Senate in late August defeated a bill introduced by Sen. Fran Pavley (D) that would have banned more than trace amounts of bisphenol A



Left to right: Photo courtesy of the Office of the Governor, Louisiana; © Adam Loeuwen

CHILDREN'S HEALTH

AAP Publishes Oil Protection Guidelines for Children

Sparked by requests from anxious parents throughout the U.S. Gulf Coast region after the *Deepwater Horizon* oil rig exploded on 20 April 2010, the American Academy of Pediatrics (AAP) worked with the Pediatric Environmental Health Specialty Units (PEHSU)¹ to develop fact sheets for clinicians and parents that pulled together the best available information on protecting children against oil exposures.² The recommendations, which have been endorsed by the American College of Medical Toxicology and the American Academy of Clinical Toxicology, cover a wide range of measures addressing air, water, beach, and food issues, and they can be applied in any oil-exposure situation.³

The recommendations are only professional best estimates based on the limited information about health effects of oil spills on adults, acknowledges Katherine Kirkland, executive director of the Association of Occupational and Environmental Clinics, which runs PEHSU. "There really isn't any research done on children," she says. The fact sheets will be updated as more information becomes available, says Scott Needle, a Florida pediatrician and member of the AAP Disaster Preparedness Advisory Council.

Along with physical health concerns, the fact sheets address psychological problems that may develop in children because of worries about their own health or that of their parents. Needle says it's essential for parents to try to head off problems by talking with their children and to reassure them that people are working to clean up the oil and keep this from happening again.

"We are also concerned about the potential long-term community effects, particularly economic and psychological, and especially affecting areas that have already been battered by severe hurricanes and other stressors in recent years," Needle says. "The majority of our experience in long-term effects comes from studying the *Exxon Valdez* spill in Alaska, and affected communities there are still dealing

with the mental health effects." Even if children do not exhibit health symptoms directly, he says, their overall health and sense of well-being may continue to be impacted on a long-term basis.

John Lanza, director of the Escambia County Health Department in Pensacola, Florida, had not heard of the PEHSU guidelines,⁴ but he says his county adopted similar recommendations based on research conducted by a consortium of Florida panhandle counties after the spill began. The county also conducted an extensive community education effort that parents and children seem to have heeded.

The number of acute health problems reported so far has been minimal.⁵ Data on longer-term effects on children may be hard to come by, however—of the four Gulf states tracking self-reported spill-related health complaints, only Louisiana is breaking out exposure and health effect data by age,⁵ and no definitive plans for researching health effects on children have surfaced. Moreover, as recently as mid-September new sightings of oil were being reported for several Louisiana beaches, marshes, and offshore areas,⁶ and there are widespread concerns that oil will continue to resurface in still other areas when storms pass through. It's extremely difficult to predict how soon after any given storm that it will be safe to visit shoreline areas, says Stephen West, a Coast Guard spokesman working with the Unified Area Command.

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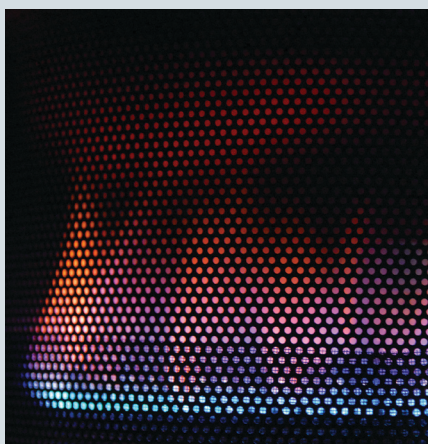
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3. For instance, on 26 July 2010 Enbridge Energy Partners informed officials that a 30-inch oil pipeline it owns near Marshall, Michigan, had burst, spewing roughly 1 million gallons into nearby watersheds (see <http://tinyurl.com/28wvxy8b> [accessed 15 Sep 2010]).
4. The AAP is assessing the effectiveness of its fact sheets and outreach efforts, but has few data so far, other than its Aug 9–Sep 16 tally of 439 hits on the health providers' fact sheet and 261 hits on the community fact sheet, according to Kirkland.
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(BPA) in children's products such as baby bottles, drinking cups, and infant formula containers.³ The vote on the decision was two votes short of passage; it must now be reintroduced in the next legislative session. Sen. Dianne Feinstein (CA–D) has announced plans to include an amendment to the upcoming FDA Food Safety Bill that would ban BPA in a range of children's products.⁴

Atrazine and Rat Puberty

In one of the first studies to show low-dose effects of atrazine metabolite mixtures, levels of the herbicide similar to those found in drinking water sources have been associated with a higher incidence of prostate inflammation and delayed puberty in prenatally exposed male rats.⁵ The EPA has begun a comprehensive evaluation of atrazine to help assess its effects on human health, a process that could lead to a revision of the current risk assessment and new regulations.⁶ Atrazine is mainly used for weed control and on crops such as corn and sugarcane.



Classroom Stoves Up in the Air

Research in this month's issue of *EHP* links classroom exposure to "low NO_x" unflued gas heater emissions with increased respiratory symptoms.⁷ In July 2010, in response to the initial publication of this paper, the education minister of New South Wales announced that all low NO_x unflued gas heaters in the state's public schools would be replaced with

cleaner heating sources at an estimated cost of AUD\$400 million. Afterward, the state government retracted the offer, saying the promise had not gone through the proper governmental channels. The government is now trying to come up with support for the funding to go forward with the replacement, which will involve 50,000 heaters.⁸

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