

## Thyroid Alert

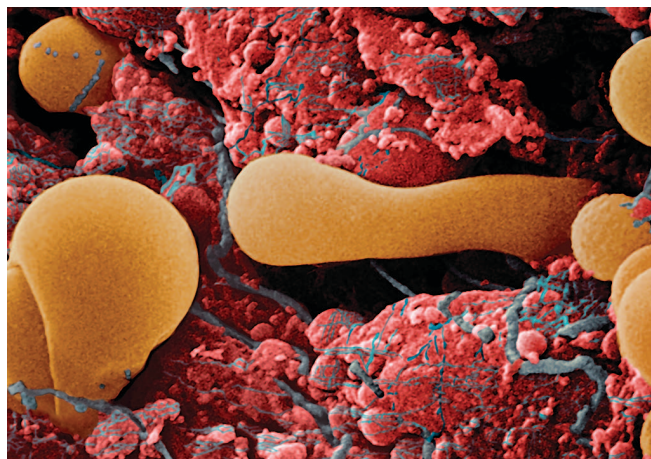
### Low Iodine and Perchlorate Effects in Women

Perchlorate, an oxidizer in solid rocket fuel, is widely found in groundwater, drinking water, milk, vegetables, fruit, grain, and forage crops. Large doses of perchlorate have been shown to inhibit iodide uptake and reduce thyroid hormone production, which can contribute to metabolic problems in adults and abnormal neurodevelopment during gestation and infancy. Now, researchers at the CDC show that U.S. women with low iodine intake may be at risk for reduced thyroid function due to perchlorate exposure [*EHP* 114:1865–1871; Blount et al.].

The researchers examined 2,299 men and women, aged 12 and older, who participated in the National Health and Nutrition Examination Survey. Examining the relationship between urine perchlorate concentrations and blood levels of the thyroid hormones thyroxine ( $T_4$ ) and thyroid-stimulating hormone (TSH), which stimulates  $T_4$ , they observed that perchlorate was a significant predictor of thyroid hormone levels in women, but not in men.

Upon seeing this sex-based difference, the authors then categorized 1,111 women into “sufficient” and “low” iodine groups using a threshold of 100  $\mu\text{g/L}$  urinary iodine, based on WHO recommendations. They found a slight relationship between perchlorate concentrations and TSH for the sufficient-iodine group, but a much stronger one for perchlorate and both  $T_4$  and TSH in the low-iodine group.

For the low-iodine group, higher perchlorate was associated with lower serum  $T_4$  and higher TSH. This relationship was consistent with what would be expected if perchlorate were inhibiting iodine uptake to such an extent that it interfered with thyroid hormone production. At the 50th percentile of urinary perchlorate (2.9  $\mu\text{g/L}$ ), the predicted decrease in  $T_4$  was 1.06  $\mu\text{g/dL}$ ; at the 95th percentile (13  $\mu\text{g/L}$ ), the



**One thing leads to another.** Thyroid tissue, with thyroglobulin, a protein used to produce  $T_4$ , shown in orange. Perchlorate may interfere with iodide uptake by the thyroid, leading to altered thyroid hormone synthesis.

predicted decrease in  $T_4$  was 1.64  $\mu\text{g/dL}$ . Given that the normal range of  $T_4$  for women is 5–12  $\mu\text{g/dL}$ , these predicted reductions were significant and indicate that even small increases in perchlorate exposure may inhibit the thyroid’s ability to absorb iodine.

In the United States, 36% of women have urinary iodine levels under 100  $\mu\text{g/L}$ . In addition, the perchlorate doses seen to cause effects in this study are well below the 24.5 ppb reference dose recommended in 2005 by a National Academy of Sciences panel. The authors say that another large study is needed to confirm these findings; they are planning that study. —Richard Dahl

## Picking Up on Preservatives

### New Biomarkers for Gauging Paraben Exposure

As scientists seek to characterize human exposures to chemicals, they need more valid, accurate biomarkers—telltale molecular signatures that indicate a particular exposure has occurred. A team from the CDC has now provided the field with a new biomarker that could help researchers document exposures to a class of antimicrobial preservatives called parabens [*EHP* 114:1843–1846; Ye et al.].

Parabens are used in shampoos, cosmetics, moisturizers, medications, foods, and beverages. Concerns have arisen about the potential human health risks associated with the widespread use of these weakly estrogenic compounds, including widely publicized speculation that parabens in antiperspirants were linked to breast cancer. Although that theory was later refuted, frequent and common human exposure to parabens means that research attention will continue to focus on these chemicals.

Until now, the only biomarker used for human paraben exposure was *p*-hydroxybenzoic acid in urine. But that metabolite is produced by the hydrolysis of all of the various paraben compounds, so it is nonspecific to individual parabens, which vary widely in estrogenic bioactivity.



**Biomarkers roll on.** Scientists may have discovered a new way to measure exposure to parabens, an ingredient in many toiletries and cosmetics.

The CDC team measured the presence of free and conjugated parent parabens in urine to determine their suitability to be biomarkers of human exposures. They analyzed the urinary concentrations of methyl, ethyl, *n*-propyl, butyl (*n*- and *iso*-), and benzyl parabens in 100 human adults with no known industrial exposure to the compounds. The results appear to support the viability of those measures as biomarkers of exposure.

Methyl and *n*-propyl parabens, the parabens most commonly used in cosmetics and foods, were found at the highest median concentrations in almost all the samples—99% contained the former and 96% the latter. The authors say this could result from the widespread use of these compounds; from differences in the absorption, distribution, metabolism, and excretion of the various parabens; or from a combination of both factors. Other parent compounds, such as ethyl and butyl paraben, appeared in more than half of the samples.

Regardless of the reason for such high frequencies of detection, the researchers say their results suggest that urinary parabens and their conjugates could be valid biomarkers of exposure to these chemicals. The detection and measurement methodologies used by the CDC scientists could help investigators as they seek to characterize the potential health risks associated with exposure to the individual paraben compounds. —Ernie Hood

Top: © iStockphoto.com; Bottom: © iStockphoto.com

## Adding Up to ADHD

### Effects of Early Exposures

Many studies have documented health risks of childhood exposures to lead and tobacco smoke. Both exposures have been implicated in the development of attention deficit/hyperactivity disorder (ADHD) in children. A team of researchers now confirms links between both neurotoxicants and ADHD development [EHP 114:1904–1909; Braun et al.].

ADHD, one of the most common childhood disorders, may affect up to 8% of children, costing society an estimated \$9.2 billion per year. However, the mechanisms for the development of the disorder are unclear. Previous research has implicated prenatal tobacco smoke exposure in its development, but the relative contribution of this exposure remains uncertain, and to date there have been no convincing studies linking lead exposure with diagnosis of ADHD.

The researchers analyzed data collected from 3,879 children participating in the National Health and Nutrition Examination Survey. They assessed ADHD in children aged 4–15 years based on parental reports of diagnosis by a health professional and the use of medication for ADHD. They also used parental reports to estimate children's pre- and postnatal exposure



**Exciting data.** New findings shed light on links between ADHD and early exposure to lead or tobacco smoke.

to tobacco smoke, and analyzed blood samples to determine lead concentration. The research team then used logistic regression analysis to identify predictors of ADHD.

Children exposed prenatally to tobacco smoke were 2.5 times more likely to develop ADHD than unexposed children, and those with a blood lead concentration greater than 2 µg/dL had were 4 times more likely than children with the lowest blood lead concentrations. Girls exposed prenatally to tobacco smoke were 4.6 times more likely than unexposed girls to develop ADHD, and exposed boys were twice as likely as unexposed boys. Based on these results, the researchers estimated that about 1 in 3 cases of ADHD could be attributed to either prenatal tobacco smoke exposure or childhood lead exposure.

The team acknowledges several limitations to this study, including recall bias and the inability to adjust for certain potential confounders. However, they note that their findings confirm the previously observed association of prenatal tobacco smoke exposure and ADHD as well as

concern about whether low-level childhood lead exposure also is linked. This evidence reinforces the need for strengthened public health efforts aimed at reducing the occurrence of these exposures.

—Tanya Tillett

## Unwelcome Guest

### Airborne Staph in Homes

*Staphylococcus aureus*, one of the most prevalent causes of infections of the blood, skin, soft tissue, and lower respiratory tract, spreads through close contact with contaminated people and surfaces. Although a few studies hint that airborne transmission of the microbe may be involved in hospital infections, no studies have examined indoor levels of *S. aureus* outside of a hospital setting. The first study to monitor *S. aureus* bioaerosols in residences shows that strains of the bacterium are common inhabitants of indoor and outdoor air [EHP 114:1859–1864; Gandara et al.]. Moreover, indoor strains are particularly resistant to commonly prescribed antibiotics.

During March, April, and May 2006, researchers cultured *S. aureus* from bioaerosol samples collected at 24 one-story homes in El Paso, Texas. They treated the bacterial colonies with three common antibiotics—ampicillin, penicillin, and cefaclor—to assess drug resistance.

All the indoor samples contained airborne *S. aureus*, as did nearly half of the outdoor samples. *S. aureus* levels inside the homes averaged 15.39 colony-forming units (CFU) per m<sup>3</sup> air, and outdoor samples averaged 12.63 CFU per m<sup>3</sup>. About half the indoor samples were resistant to ampicillin, 60% were resistant to penicillin, and 13% were resistant to cefaclor. Samples of *S. aureus* collected outside the homes proved more susceptible to antibiotic killing, with 34% resisting ampicillin, 42% resisting penicillin, and 14% resisting cefaclor. In addition, about 14% of all *S. aureus* samples showed multidrug resistance, meaning the sample withstood both cefaclor and either penicillin or ampicillin. No other investigators have measured household levels of aerosolized *S. aureus* resistant to antibiotics, so the results have no basis for comparison.



**Down in the west Texas town.** A study in El Paso, Texas, shows evidence of antibiotic-resistant *Staphylococcus aureus* within residences.

The health consequences of living with *S. aureus* bioaerosols were not assessed in this study. The researchers plan to evaluate health risks associated with bacterial bioaerosols, such as whether elevated levels of drug-resistant *S. aureus* in indoor air parallel increases in community-acquired infections—that is, infections acquired outside a hospital setting.

The prevalence of drug-resistant *S. aureus* infections continues to rise, and rather than being confined largely to hospitals, such infections are increasing in the community, particularly in children. These new findings suggest that residential exposure to aerosolized *S. aureus* and a possible link to community-acquired *S. aureus* infections deserve further study. —Carol Potera