

## *Biomonitoring is useful tool*

### Technique sorts through complexities of exposure to environmental chemicals

Environmental chemicals can be present in water, food and other materials common in industrialized society. They may also be in the air or the soil. Pairing a particular chemical with an effect on human health is fraught with complications, but a technique called biomonitoring can help cut to the chase, according to two speakers at the 2005 conference on Emerging Topics in Breast Cancer and the Environment Research.

"Predicting health outcomes from exposure is a tricky consideration," said Antonia Calafat, Ph.D., of the Centers for Disease Control and Prevention (CDC). "For instance, we don't know why some people respond differently to similar exposures." Genetics, demographic factors, age, sex, geographical location, timing of exposure, diet, and other environmental and behavioral stressors can all affect a certain chemical's impact, she said. Biomonitoring promises to begin cutting through the complexities, and Dr. Calafat is now involved in the early stages of a major study of environmental-chemical exposure in U.S. girls.

#### **What is biomonitoring?**

Biomonitoring is an especially useful tool for exposure investigations, because it assesses the dose of a chemical in a person's body through such means as a blood or urine sample, said Janice Barlow, R.N., of the Marin Breast Cancer Watch in San Rafael, Calif. Her organization helped lead a Bay area community forum to discuss community biomonitoring projects.

The technique allows researchers to detect exposure to environmental chemicals that enter the body via ingestion, inhalation or dermal contact, and whether they are long-lasting or flushed through the body quickly. Those that remain in the body for days, months or even years are called persistent chemicals, she said. "Examples are the persistent organic pollutants, such as dioxin, PCB and DDT, that are stored in adipose (fat) tissue. These are of most concern to lactating women because a portion of the internal dose of those chemicals can end up in breast milk, and can be passed on to the infant during breast feeding."

Many researchers and others have become increasingly concerned about the second main group of environmental chemicals, which are called non-persistent chemicals. Some of these have been tied to a heightened breast cancer risk. These chemicals move quickly through the body and to the kidney, where they are passed in the urine, she said. Non-persistent chemicals are found in such sources as pesticides and phthalates.

By detecting exposure in the body, Barlow said, biomonitoring can capture "unique individual exposures through food, such as mercury in fish; from products, such as those containing phthalates; and from workplace and home exposures, such as lead." It can also yield detailed comparisons of exposures between populations in different areas or of different ages or ethnic groups. Sometimes, data from these studies can lead to changes at the local, state and national levels, she noted. "An example is a study showing that women living in the Bay area (of California) had very high levels of flame retardants, and as a result of that, the California legislature passed a ban on flame retardants that will go into effect in 2008."

In addition, she said, biomonitoring data can help validate models of exposure or evaluate intervention strategies, such as the impact of phasing out lead from gasoline, paints and industrial processes.

### **The study**

The large-scale, multi-site study of environmental-chemical exposure in girls will include biomonitoring of blood and urine samples from girls who are 6 years old and older, said Dr. Calafat. "Before undertaking this large study, we thought it was important to check the coordination and the logistics of collecting samples at different sites, sending them to CDC, and then, once at the CDC, to distribute the samples to the different labs that will do the analyses," she said. For this purpose, a pilot study was devised at CDC in collaboration with the Breast Cancer and the Environment Research Centers in New York City, Cincinnati and San Francisco.

Earlier this year, each center received exacting instructions on the methods for taking the biological samples, and for labeling, handling and shipping the samples to the CDC. All three centers are taking urine samples, and two are also taking blood samples. She commented, "For some chemicals ubiquitous in the environment, care must be taken to avoid potential contamination of the sample during collection and handling." Once at the CDC, the samples go to CDC laboratory personnel who use biomonitoring techniques to screen the samples for various environmental chemicals, such as phenols, phthalates, phytoestrogens, and persistent pollutants.

Although Dr. Calafat had begun receiving the first samples three weeks before the conference, she already had some preliminary results on exposures to bisphenol A and phthalates, both of which are found in plasticizers commonly used in packaging and other products, and have been implicated in a possible rise in breast-cancer risk. The initial findings show a considerable variation in concentrations between the centers and also among the samples at each center for both bisphenol A and phthalate metabolites. Metabolites are compounds that form when a chemical breaks down.

She will continue to keep a watchful eye on the pilot study procedures, and with good results, will then proceed to the large-scale biomonitoring project.

### **An emerging science**

Despite the wide-ranging benefits that the biomonitoring technique already demonstrates, it is still an emerging science, Barlow acknowledged. For example, reliable biomonitoring tests are not available for all chemicals; researchers frequently find it difficult to obtain data on non-persistent chemicals because of their short time in the body following exposure; and large-scale sampling can be both expensive and time-consuming. Even after data are finally collected, she said, their interpretation can be difficult.

Social and ethical questions can also arise, she said. The Bay area community forum, which comprised researchers, members from breast cancer and environmental advocacy groups, health officials and community members, addressed some of these issues. They ranged from the level of community involvement in deciding what chemicals are biomonitored to the type of information that should be released to the public.