



# Your Health & the Environment

NEWS FROM THE UNIVERSITY OF ROCHESTER ENVIRONMENTAL HEALTH SCIENCES CENTER, WINTER ISSUE 2006

## Phthalates

### What are they?

**Phthalates** are a class of industrial chemicals (dialkyl or alkyl/aryl esters of 1,2 benzenedicarboxylic acid) that are often added to products people use on a daily basis. A majority of the phthalates are used as **plasticizers**.

Plasticizers allow plastic to be soft, strengthened, flexible, and durable. Phthalates are also used as **solvents** in products such as perfume in order to extend the fragrance durability. Human exposure to phthalates is often measured by the related metabolites ('breakdown products') of the phthalates. Phthalates are colorless oily liquids, with high boiling points and low volatility. These characteristics make phthalates a useful additive in a variety of industrial and commercial products.

### How are you exposed to phthalates?



#### *Ingestion:*

-Food can absorb plasticizers from its packaging or during manufacturing

## Rochester Focuses on Environment, Fertility, Family Health

### New Research Explores How Chemicals Effect Reproduction

Growing evidence suggests that ubiquitous chemicals soaked up by pregnant women around the time of conception or later in pregnancy may be harming the fetus, and ultimately impacting the child's future health. To explore this question, the University of Rochester Medical Center has established a Center for Reproductive Epidemiology, which is among the first in the United States to focus on this area of research.

[Shanna H. Swan, Ph.D.](#), professor of Obstetrics and Gynecology, is serving as Director of the Center for Reproductive Epidemiology. Swan is internationally recognized for her work on links between male and female reproduction and environmental toxins. Since 1998 she has served as principal investigator for a federally funded, multi-center Study for Future Families, an investigation into the environmental causes of geographic variations in reproductive health. Her most recently published research showed that phthalates in a mother's body during pregnancy had subtle effects on the development of the genitals of infant boys.

Swan is a first-ever recipient of the [Jenifer Altman Awards](#), created in 2005 to honor scientists whose work promotes the protection of human and

-Toys that are made out of soft plastic and chewed on by children can leach out plasticizers

-Water can be contaminated by a many sources

#### *Inhalation:*

-Household products can off-gas phthalates

#### *Skin Absorption:*

*(research suggests that this is the least common exposure route)*

-Clothing made of plastic or vinyl

-Nail polish which uses plasticizers to keep it from cracking

-Medical tubing (infants in neonatal intensive care nurseries, dialysis patients, blood bags)

#### **Where can you find phthalates?**



- Vinyl flooring adhesive
- Cosmetics
- Perfume
- Nail polish
- Hairspray
- Polyvinyl Chloride(PVC)
- Toys
- Shower Curtains
- Solvents
- Air fresheners
- Medical bags and tubing
- Plastic Raincoats
- Automotive plastics
- Food packaging

ecological health, through a commitment to science in the public interest. These scientists demonstrate a deep commitment to scientific integrity and the public's right to know, even in the face of controversy.

"At the Center for Reproductive Epidemiology we will continue to focus on understanding how chemicals in our bodies affect our fertility and the outcome of pregnancy," said Swan, who joined the University of Rochester faculty in January 2005 from the University of Missouri-Columbia. "Science is recognizing that adult diseases often originate in the womb. Animal studies have shown that exposures at the earliest stages of life may predict future health. So it is important to conduct epidemiological studies to determine whether these common exposures also impact human development and adult health."

Swan and colleagues are planning a long-term study of families living in the Rochester area to better understand how phthalates and other environmental exposures can impact infant development.

Adapted from: Leslie Orr, September 13, 2005

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## **Researchers Investigate Prenatal Phthalate Exposure**

*Anogenital distance and prenatal phthalate exposure*

Swan et al. 2005

Questions and Answers

### **Study background**

#### ***What did you study?***

We examined several androgen dependent developmental endpoints in baby boys in relation to

- Soil/air/water

### **Common Types of Phthalates:**

- DMP, dimethyl phthalate
- DBP, dibutyl phthalate
- BzBP, benzylbutyl phthalate
- DEHP, di-(20ethylhexyl) phthalate
- DINP, di-isononyl phthalate
- DEP, di-ethyl phthalate

### **What is the potential harm from exposure to phthalates?**

In the past, there has been little research on phthalate exposure in humans, although there have been animal studies. This is partially due to the complications presented by human studies because of the ever-present nature of phthalates in the environment. Humans are constantly exposed to phthalates. It can be difficult to identify how much, what kind, and from which products phthalates present potential harm to humans. What research exists does not give a decisive verdict on the health effects of phthalates.

The debate about the safety of phthalates is of international concern. One side of the dispute claims that there has been sufficient research on phthalates which has found no significant evidence that phthalates cause harm to humans. According to the United States Food and Drug Administration- "It's not clear what effect, if any, phthalates have on health." The Phthalates Information Center claims that "research suggests that health effects seen in rodents may be specific to that species, and

the concentration of phthalates in their mothers' urine. The primary outcome for our study was the anogenital distance (AGD).

### ***Who did you study?***

The mothers in our study participated, while pregnant, in the *Study for Future Families (SFFI)*, which we conducted in Minneapolis MN, Los Angeles CA and Columbia MO. If a woman agreed, and the baby was 3-24 months old when we recontacted her, mother and baby were enrolled in the current study (SFFII). This study is still ongoing, and this analysis is based on data available at the end of 2004, which includes 134 mother-son pairs, of which 85 had phthalate measurements.

### ***What is anogenital distance and why did you study it?***

Anogenital distance (AGD) is a measurement of the length of the perineum that toxicologist routinely use to determine the sex of newborn pups. It is easily measured and in rodents and humans it is about twice as long in males as females. Experiments have demonstrated that in rodent studies this distance is shortened when the mother is exposed to chemicals that are anti-androgenic, such as dibutyl phthalate (DBP) or benzylbutyl phthalate (BBzP). We hypothesized that the same was true in human boys.

### ***Methods***

#### ***How did you conduct this study?***

We invited mothers to bring their babies, if they were 3- 24 months old, to one of our clinical centers for a physical examination administered by study staff, using a protocol developed for our study. For boys this examination included measurement of AGD and development of the testicles, the penis and the scrotum. Boys with an AGD that was quite short (<25% of expected) for their age and weight were classified as having short AGD.)

not relevant to humans.”

On the other hand, new studies are beginning to shed light on potential human health effects of phthalate exposure. This research has persuaded Europe to regulate phthalates based on the Precautionary Principle . (see Precautionary Actions below)

“Research suggests that exposure to phthalates can cause reproductive and respiratory health effects.”  
*Phthalate Analysis in Household Air Freshener* (A. Turner, 2004)

In fall 2005, Europe permanently banned the use of six types of phthalates (DEHP, DBP, BBP, DINP, DIDP, DNOP) that are often used items such as toys for children. The European Commission has begun looking at limiting the use of phthalates in medical devices. The EU aims to use precaution while keeping in mind the major implications, such as displeasing major industries or creating alternatives that are more costly and less is known of them, when creating new policies.

A professor at the University of Rochester, Shanna H. Swan, Ph.D., will continue her previous work with phthalates in the new Center for Reproductive Epidemiology in order to broaden the knowledge of phthalate exposure in humans.

[For More News and Information on Phthalates:](#)

[USAToday, August 2005](#)

[Journal of the American Medical Association, July](#)

[2005](#)

[WallStreet Journal, October 2005](#)

[SanJose Mercury News, October 2005](#)

Urine samples provided by some mothers while pregnant were analyzed at the Centers for Disease Control and Prevention for nine phthalate metabolites. Then AGD and other outcomes were analyzed in several ways in relation to metabolite concentrations. For categorical analyses (lowest concentrations were divided into: high (upper quartile), low quartile) and intermediate (all others).

## **Study results**

### ***What are your main findings?***

We found that:

- Boys' AGD was significantly (and inversely) associated with the concentration of metabolites of four commonly used phthalates in their mothers' prenatal urine.
- The pattern of genital changes seen in these baby boys is consistent with the "phthalate syndrome" previously identified in rodents prenatally exposed to phthalates.
- These changes are seen at phthalate levels below those found in one-quarter of the female population of the United States, based on a nation-wide sample.

### ***Have other studies linked these phthalates to markers of masculinization in human infants?***

No. Prior to our study, the only studies on effects of prenatal phthalate exposure were conducted in rodents. However, two recent studies found adverse effects of some phthalates on semen quality in adult males and one study found increased rates of prematurity among infants whose mothers had high levels of one phthalate (di-2-ethylhexyl phthalate or DEHP)

### ***What are you doing next?***

We hope to study a new cohort to validate our findings. We will also be analyzing our data to learn more about sources of mothers and babies phthalate exposure. We will be working with colleagues to examine phthalate levels in relation to prematurity and low birth weight. And we will be looking at phthalate levels in the fathers in relation to their semen quality.

## **TOXICOLOGY TRAINING NEWS**

Congratulations to alumnus, [George M. Gray Ph.D.](#), for his recent appointment as the Assistant Administrator for the U.S. Environmental Protection Agency's Office of Research and Development.

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Welcome to the students who entered the Toxicology Training Program in Fall 2005: David Adenuga, Nancy Ordenana, Sophia Fang, and Sam Caito.



In October 2005, the Department of Environmental Medicine opened the Neurobehavioral Facility Laboratory. Dr. Troy Zarcone is the Director of the laboratory, and Dr. Bernard Weiss is the Senior Advisor. This facility provides state-of-the-art equipment and expertise in the neurobehavioral field to researchers at the University of Rochester Medical Center. This facility provides consultations in interpreting data on behavioral changes and helps support research that builds collaborations between scientists.

## OTHER NEWS

### **Center for Science Education and Outreach Faculty Member Attends World Environmental Education Congress in Torino, Italy, October 2- 6 2005**

This Congress addressed diverse participants including: university professors and researchers, educators, politicians, scientists, technicians, teachers, students, environmentalists, and the mass media. The objectives of the Congress were to exchange observations and best practices at a worldwide level, to develop the main themes for the agenda on environmental education and to jointly discuss the theses and proposals presented in the speeches and posters from around the world. University of Rochester professors David Hursh, Ph. D (Warner Graduate School of Education and Human Development) and Camille Anne Martina, Ph.D. (Department of Environmental Medicine) presented their paper "We all live downstream: Transforming knowledge and thinking through teaching and learning about the relationship between the environment and human health."

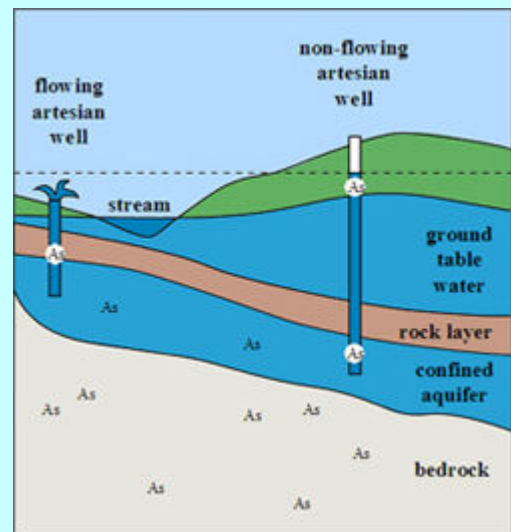


### **Team Completes AOEC Development of Health Education and Promotion Materials for Health Care Professionals and Lay Community Audiences to Support Department of Energy Site Work**

Dr. William Beckett, Dr. Dina Markowitz, Dr. Katrina Korfmacher, Dr. Camille Martina, and Kate Kuholski collaborated on a grant from the Agency for Toxic Substances and Disease Registry (ATSDR) during Spring and Summer of 2005. The team developed educational materials on Mercury, Arsenic, and Lead. These materials will be used by ATSDR to educate communities that are near Department of Energy sites about potentially toxic substances and other environmental health topics.

How Does Arsenic Get into the Environment?:

*Graphic by Jenny Smith of the University of Rochester  
Medical Center*





## **CENTER FOR SCIENCE EDUCATION AND OUTREACH NEWS**

### **Community Outreach and Education Programs**

[Get the Lead Out \(GLO\) Project:](#)

#### **Outreach Project Finds Extensive Lead Hazards in Rochester Neighborhoods**

An intensive outreach project in two inner-city Rochester neighborhoods has revealed that up to 88% of homes may have some form of exterior lead paint hazards.

The event, jointly conducted by Action for a Better Community and the University of Rochester Medical Center, represents the most ambitious outreach project undertaken by the "Get the Lead Out" (GLO) project. 16 community interns and staff from the University of Rochester's Environmental Health Sciences Center conducted education, visual assessments, and resident surveys over a two-week period in July. Homeowners, landlords, and tenants were notified in advance of the inspection visits and were provided with information about lead hazards.

The outreach teams documented deteriorated paint in 385 homes. Because all of these houses were built before 1978, any deteriorated paint may pose a lead hazard.



**The Life Sciences Learning Center's Science Out of School** programs offer informal hands-on science programs for students in grades 6-8. Students from throughout the greater Rochester area are invited to participate in these fun and informative classes. Please contact the Life Sciences Learning Center for more information and to register (585-275-0268).

#### LSLC Crime Scene

Investigators II (NEW Crime!).....Monday, January 16th, 2006

Come be a detective for a day! You will learn how to use scientific methods to analyze clues from a mock crime scene. If you liked last year's Crime Scene Investigators, join us again this year for a brand new crime. If you missed last year, here's your chance to join in!



Chocolate Covered Science.....Saturday, February 11th, 2006

Millions of boxes of Valentine's Day chocolate are sold each year. Why do we love chocolate so much? Come explore the science behind how chocolate is produced and what makes it so appealing.



Over 800 Monroe County children are lead poisoned each year. Lead poisoning is most serious for children six years and younger, potentially damaging the child's central nervous system, kidneys and other organs. Even low levels of lead are harmful and are associated with decreased intelligence, impaired neurobehavioral development, decreased growth and impaired hearing. The major source of lead exposure among U.S. children is lead-based paint and lead-contaminated dust found in housing built before 1978. Eighty-seven percent of Rochester's housing was constructed prior to 1950.



Interns/Volunteers: Veronica Siaca, Trey McCullough, Kazuko Sharp, Ann Walter, Obidi Ikpeze

## Community Advisory Board

Composed of members of local Rochester-area community organizations, our Community Advisory Board provides a unique forum for discussion of human environmental health issues. At the June meeting, Dr. Mark W. Frampton of URMC presented research and findings regarding the relationship between air pollution and the cardiovascular and pulmonary systems.

Also at the June meeting, Dr. Hoffman Moka Lantum of Kodak informed the group that a presentation from the previous Community Advisory Meeting was inspiration for a Day of Caring Event that his company hosted in conjunction with community members and health care professional from the City of Rochester, "Give A Kid A Healthy Smile". Presentations at the previous CAB meeting by Dr. Gene Watson and Dr. T. Kopycka-Kedzierawski of the University of Rochester's Eastman Dental Center inspired this project.

The December meeting featured a presentation by Dr. Shanna Swan on her research on phthalates (see other articles, this issue).

## Precautionary Actions Regarding Phthalates and Other Plasticizers

Shanna H. Swan, Ph.D.

Consumers and journalists often ask me about precautionary measures I would recommend (or use myself) to limit exposure to phthalates and other plasticizers of concern. Some recommendations are summarized here.

As stated on the National Library of Medicine (NIH) website ([http://toxtown.nlm.nih.gov/text\\_version/chemical.php?name=phthalates](http://toxtown.nlm.nih.gov/text_version/chemical.php?name=phthalates)), "You can be exposed to low



levels of phthalates through air, water, or food. You can be exposed to phthalates if you use cosmetics, personal care products, cleaning products, or other plastic and vinyl products that contain them. Exposure to low levels of phthalates may come from eating food packaged in plastic that contains phthalates, or breathing dust in rooms with vinyl miniblinds, wallpaper, or recently installed flooring that contain phthalates. You could be exposed by drinking water that contains phthalates, though it is not known how common that is. Children can be exposed to phthalates by chewing on soft vinyl toys or other products made with them. Children can be exposed by breathing household dust that contains phthalates, or using IV tubing or other medical devices made with phthalates”.

In other words, the sad truth is that *virtually all of us are regularly exposed to low levels of phthalates and other plasticizers*. But there are some measures we can take to avoid at least some of these exposures, until the time when the use of these chemicals in everyday materials and products is more aggressively restricted.

Unfortunately, since these chemicals are so pervasive in our environment it is unclear what precautionary measures are most effective in reducing risk. Food is probably a large source, but it is not possible to know when phthalates are present. As a precautionary action, choose microwave-safe plastic wrap, and never let it directly contact food. In fact, you can avoid using plastic wrap—try waxed or parchment paper instead. If possible, choose containers made of polyethylene, which is plasticizer-free. Otherwise, you can use microwaveable glass and ceramic cookware. Don't microwave plastic containers used for cold food storage—they often melt and warp, because they are not designed to withstand the high heat of microwaving. Also, it is probably safer to avoid microwaving food in freezer cartons or on Styrofoam trays. If in doubt, choose food containers with recycling codes #1, #2, #4 or #5. Avoid those with #7 (PC or polycarbonate) and #3 (PVC or polyvinyl chloride).

Only one phthalate (diethylhexyl phthalate) is regulated in drinking water, and even that chemical may be present at higher than permissible levels if levels fluctuate, since water is tested only intermittently. That may be of concern for couples trying to get pregnant, or during pregnancy, when the time around and the weeks after conception are most critical. And other phthalates are not regulated at all. So consumers may decide to use a home water treatment method. The recommended method to remove phthalates from drinking water is with a granular activated carbon (GAC) filter. There are no regulatory requirements for phthalates. The National Resources Defense Council tested a number of brands of bottled water and some, but not all, contained phthalates (<http://www.nrdc.org/water/drinking/bw/exesum.asp>).

Children can be exposed to phthalates by chewing on soft vinyl toys or other products made with them. Parents may want to dispose of all teethingers, pacifiers, nipples and heavily mouthed toys made of soft plastic, unless they know them not to contain phthalates. Parents may also want to dispose of all clear, shiny plastic baby bottles, unless the manufacturer states they are not made of polycarbonate, primarily because of concerns about the plasticizer bisphenol-A.

*The European Union has imposed a ban on three types of phthalates in all children's products, and has banned three other types from use in mouthing products marketed for children under three. California is currently considering a similar ban. Several phthalates are contained in personal care products, and some companies have removed some or all phthalates from their products. More information about specific products can be found at <http://www.nottoopretty.org>. Consumers, particularly pregnant women or couples attempting to conceive, may want to limit their use of phthalate-containing personal care products. Additional precautionary actions include asking for phthalate-free medical care, checking pharmaceutical labels for presence of phthalates and, when building or remodeling, avoiding PVC (vinyl) materials that will add phthalates to indoor environments.*

While the risks from these products have not been established, these precautionary actions cannot be harmful, and it is likely they will reduce exposure to plasticizers, a class of chemicals now under intense scrutiny because of increasing evidence of their toxicity.