

from the Learning and Developmental Disabilities Initiative, September 2009

Many chemicals often used by industry and in consumer products, are considered endocrine-disrupting chemicals, or EDCs. This column presents a summary of what is known about EDCs and human health.

Some known EDCs:

- bisphenol A (BPA)
- dioxins
- fuels, including perchlorate*
- many industrial chemicals
- organochlorinated pesticides*
- PCBs*
- phthalates and other plasticizers
- plastics*
- preservatives, including parabens, in cosmetics and pharmaceuticals

A more detailed list of EDCs can be found at www.ourstolenfuture.org/basics/chemlist.htm

* See previously published columns and fact sheets from LDDI for more information on these topics.

Much of the information in this column comes from a report and policy statement, both published in 2009, by the Endocrine Society, a professional organization for basic and clinical endocrine research and the treatment of endocrine disorders.

Your endocrine system: A brief review

Your endocrine system creates and releases hormones that regulate the growth and development of your organs and body's systems, your metabolism, puberty, and many of your body's functions. Hormones are produced in glands including the thyroid, the pituitary, sex glands (ovaries and testes), and others. If your hormones do not work properly, many other aspects of your body can be affected or harmed, including the development and functioning of the brain and neurological system.

Hormones travel through your body and attach – or bind – to hormone receptors on or in cells. The hormones regulate many processes inside cells, including regulating gene activity, growth and tissue formation, immune function, cell death, and so on. In this manner, hormones can affect mood, reproduction and other activities. Changes in our external environment, such as a change in temperature or light, can trigger a change in hormone releases.

What are EDCs?

Endocrine-disrupting chemicals (EDCs) are either man-made or naturally occurring chemicals that interfere with the body's ability to regulate its growth, development, metabolism and other functions. EDCs are sometimes referred to as hormone mimics or, for those that behave like estrogen, estrogen mimics.

There are hundreds of EDCs in the environment, in food, and in consumer products. They include components of plastics* and plasticizers (including BPA and phthalates), dioxins, PCBs*, PBBs, pesticides*, heavy metals*, industrial chemicals and fuels, preservatives and fragrances in

cosmetics, and many more.

Hormones work in your body in very tiny amounts, so even small exposures to EDCs can affect development and function. Unlike most other toxic substances, low doses of EDCs may be more harmful than higher doses. Higher exposures may overwhelm the endocrine system and cause less response to the chemical. This is a concern because safety testing of chemicals assumes that low doses are not harmful if higher doses do not show effects. Most EDCs have not been thoroughly tested for health effects at very low exposures.

What are the health effects of EDCs?

EDCs mimic your body's natural hormones, binding to cells and causing changes that your natural hormones would otherwise initiate. As a result, your body responds as though your own hormones are sending signals for cells to grow, die, turn genes on or off, reproduce and so on. This can cause particularly devastating and lifelong health problems if the wrong signals are received by cells, starting at conception and going through adolescence when organs and tissues are developing. As a result, fetuses and children are at high risk of harm from exposures to EDCs, though adults can also be affected either from exposures early in life or from cumulative exposures over a lifetime

EDCs can contribute to a wide range of diseases and disabilities including obesity, diabetes, cancer, heart disease, reproductive health problems and neurodevelopmental and neurodegenerative disorders (see the Endocrine Society statement – #2 in the Sources section on page 5 – for more information).

The outcome of EDC exposure may not be seen for many years. If a fetus is exposed to a chemical that alters the way the reproductive system develops and functions, for example, the changes may not be apparent until puberty or later.

This LDDI Practice Prevention column focuses on

the impact that EDCs may have on the developing neurological system and brain. Normal prenatal brain development is highly dependant on thyroid hormones* from both the mother and the developing fetus. An insufficient supply of thyroid hormone can cause lower intelligence, higher rates of attention deficit disorders and problems with motor coordination, balance and other psychomotor skills.

A broad range of chemicals common in our environment can interfere with how the thyroid hormone binds and harm the development of the brain and nervous system. For example, exposure to PCBs* is associated with lower full-scale IQ, reduced visual recognition memory, attention deficits and motor deficits. BPA has also been shown to interfere with thyroid hormone binding, and BPA-exposed rats exhibit symptoms similar to attention deficit-hyperactivity disorder. Several studies show that some EDCs disrupt prenatal brain sexual differentiation – the changes before birth that distinguish male and female brains.

Some laboratory studies indicate that some effects of EDC exposure during fetal development can be passed from one generation to the next without additional exposures. How this might happen, and whether it happens in humans, is not well understood.

How am I exposed to EDCs?

Humans can be exposed to EDCs through water, air, food, consumer products or contaminated soil. This is a partial list of chemicals that are known or suspected to be EDCs:

- synthetic chemicals used as industrial solvents/lubricants and their byproducts: polychlorinated biphenyls (PCBs*), polybrominated biphenyls (PBBs), dioxins
- plastics*: bisphenol A (BPA)
- plasticizers: phthalates*
- pesticides*: methoxychlor, chlorpyrifos,

dichlorodiphenyltrichloroethane (DDT)

- fungicides: vinclozolin
- pharmaceutical agents: diethylstilbestrol (DES) and the synthetic estrogen ethinylestradiol in birth-control pills

Endocrine disrupting chemicals – both natural and man-made – can be found in thousands of places and products throughout the world. Because they are so widespread, and because manufacturers are not required to tell people what is in their products, most of us are exposed from many sources every

day without our knowledge. Even if our exposure from one product is considered a “safe” level, we need to consider all the EDCs in products and items that we encounter to get a picture of our total exposure level.

Even though new production of some man-made chemicals, such as PCBs, has been banned for decades, these chemicals still lurk in water and soil and continue to expose animals and humans today.

Water

In many places, both surface water (rivers and lakes) and ground water have been contaminated with EDCs from septic systems and treated waste water, storm water runoff, industrial waste, oil spills, agriculture, household products or fallout from the air. Most waste treatments facilities do not filter all EDCs from sewage, and so these chemicals are discharged into surface water.

Food

Fish and seafood from contaminated water can have EDCs in their flesh and fat. EDCs “bioaccumulate” in animals – they are found in higher concentrations in animals that eat other animals. Predatory fish, such as walleye, pike, tuna and swordfish, are more likely to have higher concentrations of EDCs and other toxic chemicals. Similarly, larger fish are more likely to have high concentrations than smaller fish of the same species.

Food can also be contaminated through the use of pesticides that have endocrine-disrupting properties. Further, some livestock that provide meat and dairy products are treated with hormones and/or steroids (a form of hormone) to enhance growth or milk production. There is ongoing controversy about whether these hormones and steroids affect the endocrine functioning of people who eat the meat and milk from treated animals.

Food that is stored in BPA-lined metal cans or plastic storage containers absorbs some of the BPA from the container. This is especially true when the containers are heated.

Children are exposed before birth to EDCs in

amniotic fluid arising from their mothers’ exposures. After birth, exposure can continue through both breast milk and formula. Soy formula or milk-based formula stored in cans lined with BPA plastic is especially likely to contain EDCs, as are beverages served in BPA-laden bottles and sippy cups.

Natural chemicals called phytoestrogens (chemicals from plants that behave like estrogen hormones) are found in many food plants such as soy and other legumes, nuts, grains and flaxseed. Some essential oils, including lavender and tea tree oil, are also phytoestrogens. Research on health effects of phytoestrogens is inconclusive about possible harmful effects, and some beneficial effects have been seen from them, including anticancer effects. Much more research on the benefits and risks of phytoestrogens is needed, especially for pregnant and nursing women and small children.

Personal care products

EDCs can be found in many personal care products, including lotions, creams, gels, powders, deodorants and other cosmetics. EDCs are also present in baby wipes, creams and countless baby-care products*. Known or suspected EDCs in these products include parabens, phthalates and essential oils such as lavender and tea tree oil. Several studies have shown that EDCs can be absorbed through skin from these products, and intact paraben esters (which are EDCs) have been found in human body tissues.

Plastic*

Household items made of plastic may contain phthalates or BPA, both of which are endocrine disruptors. Phthalates are used in polyvinyl chloride (PVC, or vinyl, marked #3 on packaging), which is used in making thousands of products including toys, appliances, shower curtains, furniture, window blinds, plumbing pipes, flooring, lunch boxes and packaging. BPA is a component of polycarbonate plastic used to make drinking bottles, baby bottles and other items. Recent research shows that BPA levels in urine increase when people drink from polycarbonate plastic. BPA is also an ingredient used in plastics and resins that line metal food and

drink cans, and some research shows it leaches into food packaged in these cans.

Other Sources of Exposure

- pesticides and preservatives used in homes, in yards and gardens, on playgrounds and sports

fields, and on wooden structures such as decks, fences and outdoor furniture

- dental sealants
- industrial lubricants
- birth-control pills

How can I reduce/prevent exposures?

Food

Look for and follow warnings from federal, state, tribal and local governments about fish consumption. Sport fishermen can usually find warnings at fishing-supply stores, or check the US Environmental Protection Agency's online advisory site: www.epa.gov/waterscience/fish/states.htm.

When selecting and preparing foods with animal fat, reduce the amount of fat you eat. Buy low-fat products, trim visible fat from meat and fish, and broil or grill meats instead of frying them to let the fat drip away.

To the extent that you can, purchase organically grown food. Wash fresh foods thoroughly to remove pesticide residues.

Reduce your use of plastic food containers, especially those made from polycarbonate plastic (#7). Do not heat foods in plastic containers, and avoid using plastic dishes with heated foods, including baby formula. Avoid food packaged in lined metal cans if not labeled BPA-free.

Personal care products

Check ingredients on products before you buy, avoiding phthalates, DEHP, fragrances and other chemicals that include the word "paraben." Unfortunately, manufacturers don't have to list inert chemicals, so EDCs may still be present even though not listed in the ingredients. Sometimes ingredients that contain parabens and/or phthalates are marked simply as "fragrance" on a label. Look for items marked "paraben-free" for greater assurance that there are no hidden parabens. You can also check an online database called Skin Deep: Cosmetic Safety Reviews at www.cosmeticsdatabase.com. This database lists thousands of personal care products and details

health and safety concerns.

Plastic*

Reduce your use of plastic items in your home and at work, especially PVC (#3) and polycarbonate plastic (#7). Avoid plastics that contain phthalates, especially infant toys and teething rings. There are many alternatives to plastic toys, dishes, and other common items.

Pesticides*

Reduce the use of pesticides in your home and yard, your schools, playgrounds, churches, businesses and work places. The US Environmental Protection Agency and many other organizations provide information on alternatives. See www.epa.gov/opp00001/factsheets/ipm.htm, for example.

Pregnant women and children especially should avoid places where pesticides have been sprayed, including downwind areas. Remove your shoes when you enter your home to prevent bringing residues inside, and keep floors, carpets and other surfaces clean. Always wash your hands, and children's hands, before handling food or eating.

National and global policy

With EDCs in our water and soil, and sometimes even the air, we cannot individually avoid exposures. Instead, we must act to reduce the contamination by industry, by agriculture and by consumers. Ask your elected representatives to work to regulate EDCs in the environment based on unbiased research covering both low-level and high-level exposures. You can also encourage lawmakers to fund more research and screening programs. Ask your health professionals to advocate for more research and oversight of EDCs.

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* See previously published columns and fact sheets from LDDI for more information on these topics: www.healthandenvironment.org/working_groups/learning



The Learning and Developmental Disabilities Initiative is a working group of the Collaborative on Health and the Environment (CHE). For more information or for other Practice Prevention columns, visit CHE online at www.healthandenvironment.org or call 360-331-7904.