Report to the Boards of Health

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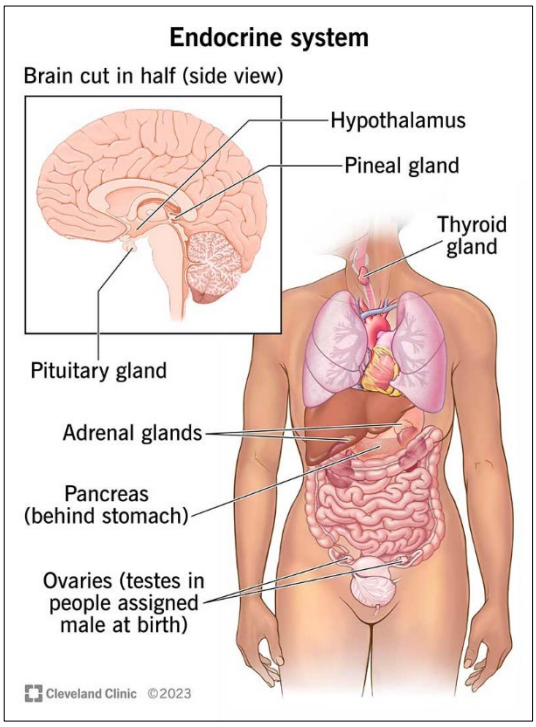
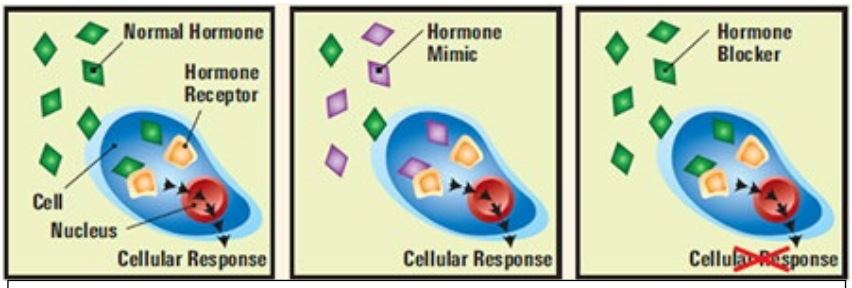
Endocrine Disrupting Chemicals

Our endocrine system is made up of many different glands and tissues in our body. It oversees the making and releasing of hormones. Hormones are chemicals that work as signalers, carrying messages to other parts of our body to tell it what to do and when to do it. Hormones are needed for us to live and be healthy. There are many parts to the endocrine system and there are more than 50 different hormones. These hormones affect nearly all parts of our health, such as metabolism, blood pressure, blood sugar, fluid and electrolyte balance, growth and development, sexual development, reproduction, sleep, and mood.



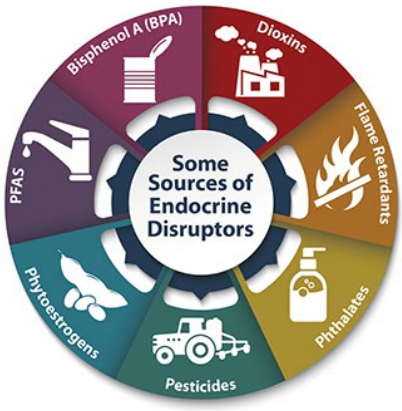
Endocrine-disrupting chemicals (EDCs) are things that are found in our environment (air, soil, or water), food, or man-made products that can affect or interfere with the normal function of our endocrine system. EDCs can affect the endocrine system in many different ways. They can interfere with the production, release, transport, binding, action, or elimination of our hormones.



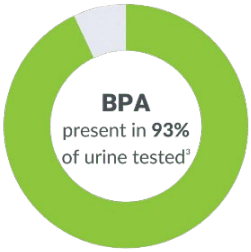
When absorbed in the body, an endocrine disruptor can decrease or increase normal hormone levels (left), mimic the body's natural hormones (middle), or alter the natural production of hormones (right).

The most concerning aspect of EDCs is that they can act like uncontrolled medicines or drugs in the body. EDCs have been linked to many different problems, including changes in sperm quality and fertility, abnormalities in sex organs, endometriosis, early puberty, problems with nervous system function, immune function, certain cancers, respiratory problems, metabolic issues, diabetes, obesity, cardiovascular problems, growth, neurological and learning disabilities, and more.

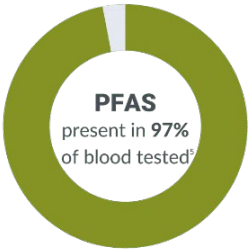
There are nearly 85,000 man-made chemicals in the world and 1,000 or more could be EDCs. The most common and well-studied are listed below.



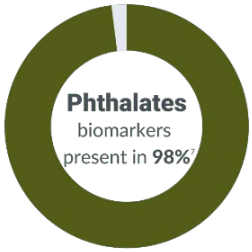
Endocrine-Disrupting Chemicals	Description
Atrazine	One of the most commonly applied herbicides in the world, often used to control weeds in corn, sorghum, and sugarcane crops.
Bisphenol A (BPA)	Used to make polycarbonate plastics and epoxy resins. It is used in manufacturing, food packaging, toys, thermal printed receipts, and other applications. BPA resins may be found in the lining of some canned foods and beverages.
Dioxins	A byproduct of certain manufacturing processes, such as herbicide production and paper bleaching. They can be released into the air from waste burning and wildfires.
Parabens	Ingredients that may be found in sunscreen, hair lotion, hair relaxer, root stimulator, leave-in conditioner, hot oil.
Perchlorate	Colorless salt manufactured and used as an industrial chemical to make rockets, explosives, and fireworks, which can be found in some groundwater.
Per- and polyfluoroalkyl substances (PFAS)	A large group of chemicals used widely in industrial applications, such as firefighting foam, nonstick pans, paper, and textile coatings.
Phthalates	A large group of compounds used as liquid plasticizers to make plastics more flexible. They are found in hundreds of products including some food packaging, cosmetics, fragrances, children's toys, and medical device tubing. Cosmetics that may contain phthalates include nail polish, hair spray, aftershave lotion, cleanser, and shampoo.
Phytoestrogens	**Naturally occurring** substances with hormone-like activity found in some plants; they may have a similar effect to estrogen produced by the body. Soy foods, for example, contain phytoestrogens.
Polybrominated diphenyl ethers (PBDE)	Used to make flame retardants for products such as furniture foam and carpet. The most persistent PBDE have been phased out, but newer, less persistent brominated flame retardants are still being used for this purpose.
Polychlorinated biphenyls (PCBs)	Were used to make electrical equipment, such as transformers, and are in hydraulic fluids, heat transfer fluids, lubricants, and plasticizers. PCBs were mass-produced globally until they were banned in 1979 **but** 100% of the U.S. population has detectable levels of this chemical because they are so persistent.
Polybrominated biphenyls (PBB)	Formerly used as additive flame retardants in synthetic fibers and molded plastics products, PBB were also used to make products such as computer monitors, televisions, textiles, and plastic foams difficult to burn. **In 1973, the Michigan Chemical Corporation in St. Louis, Michigan, caused the largest food contamination event in U.S. history** when it shipped polybrominated biphenyl (PBB), a chemical flame retardant, instead of a nutritional supplement to be mixed into livestock feed. The event remains the worst case of accidental contamination in agricultural history. PBB was able to pass from mother to child in the womb and through breastmilk so many in Michigan still have elevated PBB levels today.
Triclosan	An ingredient that was previously added to some antimicrobial and personal care products, like liquid body wash and soaps.



The EPA reports that biomonitoring shows that BPA exposure is prevalent in the US.[4]



The CDC's National Health and Nutrition Examination Survey (NHANES) found PFAS in the blood of 97% of Americans.[5]



Biomarkers of phthalates exposures are detected in greater than 98% of US women and children.[7]

Many EDCs can remain intact in the environment for long periods of time, for example PFAS. Some, like BPA, break down in the environment. Others can build up or accumulate in a person or may build up along the food chain (called biomagnification). For example, DDT was banned in 1972 but 100% of blood samples taken mothers in 2003 had detectable levels of DDE, the most common break-down product (or metabolites) of DDT.

Once in our body, EDCs are usually broken down by our liver. Many EDCs are stored in our fat tissue and can stay in our body for years. Others are stored in the liquid parts of our bodies and are flushed out more quickly. People are most likely to be harmed by EDCs during sensitive life stages when there are critical periods of development, such as pregnancy when there is fetal development, and early life.

The amount of exposure we have to EDCs is also important. Different types of jobs and lifestyles can cause more risks of exposure.

Health Concerns for EDC Exposure in High-Risk Occupations

Occupation	Potential EDC Exposures	Health Concerns
Farm Worker	Pesticides	• Cancers • Respiratory system diseases • Congenital malformation • Thyroid dysfunction • Immunotoxicity • Neurological & developmental toxicity • Endocrine system disruption
Firefighter	Flame retardants & toxic by-product from burning	• Cancers - PCBs considered probable carcinogens by DHHS and EPA. Classified as carcinogens by IARC. • Chloracne disrupted reproductive function • Neurobehavioral & developmental deficits in newborns • Thyroid hormone toxicity • Increased risk of diabetes mellitus • Increased liver enzymes • Cytochrome P450 induction
Mortuary Services & Laboratory Staff	Solvents & Formaldehyde	• Asthma-like respiratory problems • Dermatitis • Cancers
Healthcare Worker	Antineoplastic drugs, Disinfectants, Epoxies, Resins	• Pneumonitis • Hypersensitivity • Allergic dermatitis • Asthma • Cancers
Veterinary Staff	Antineoplastic drugs, Disinfectants, Pesticides	• Pneumonitis • Hypersensitivity • Allergic dermatitis • Asthma • Cancers
Veteran or Active Service Member	Pesticides, Industrial Solvents, Burn Pits, Flame retardants, Herbicides	• Cancers • Respiratory diseases • Thyroid dysfunction • Reproductive system problems
Artisan, Industrial Worker/ Material Handler, Salon Worker, Transportation Industry and Maintenance	Epoxies, Resins, Solvents, Heavy Metals	• Allergic dermatitis • Birth defects in laboratory animals • Reduced sperm counts in men • Cancers • Neurologic effects

Sources:

- https://www.osha.gov/sites/default/files/publications/osha3162.pdf
- https://www.cdc.gov/niosh/topics/repro/jobhazardexamples.html
- https://www.publichealth.va.gov/exposures/categories/chemicals.asp
- https://www.apa.org/wsh/past/2011/high-risk-jobs

Resources:

- Endocrine-Disrupting Chemicals (EDCs): What You Need To Know (from Endocrine Society, PDF) https://www.endocrine.org/-/media/endocrine/files/patient-engagement/hormones-and-series/hormones_and_edcs_what_you_need_to_know.pdf
- Endocrine Disrupting Chemicals (EDCs) Video explanation from Endocrine Society and Hormone Health Network https://www.youtube.com/watch?v=ibfAF66JzFE
- What are endocrine disruptors (from U of M Lifestage Environmental Exposures and Disease Center, PDF) https://mleead.umich.edu/files/What_Are_Endocrine_Disruptors_2024.pdf
    - Additional Environment health resources here https://mleead.umich.edu/Community_Engagement_Core_Resources.php
- EPA Safer Choice product lists https://www.epa.gov/saferchoice
- Detox Me app https://silentspring.org/detox-me-app-tips-healthier-living
- PFAS Exchange https://pfas-exchange.org/
    - What's my exposure? https://www-pfas.pfas-exchange.org/report/graphtool/
    - Resources https://pfas-exchange.org/resources/
- Michigan PFAS Action Response Team (MPART) https://www.michigan.gov/pfasresponse
    - FAQ https://www.michigan.gov/pfasresponse/faq
- PBB
    - Emory University PBB Registy https://sph.emory.edu/pbbregistry/index.html
    - Michigan PBB Oral History Project https://sph.emory.edu/pbbregistry/studies-resources/oral-history-project/index.html
    - Other resources https://sph.emory.edu/pbbregistry/studies-resources/other-resources/index.html
        - Includes information and links to Bitter Harvest, a personal story of the PBB contamination event written by Frederic and Sandra Halbert later turned into a movie starring Ron Howard, the book The Poisoning of Michigan by Joyce Egginton, investigative journalist, and others.
- Video of the symposium: "From PBB to PFAS: Research and Action to Address Michigan's Large-Scale Chemical Contaminations", at the University of Michigan, February 20, 2020. https://www.youtube.com/playlist?list=PLt4u9Gmt5XuI18jrOQBfcg3MZClie2zUJ
- NIH National Institute of Environmental Health Sciences. How can you reduce health effects of endocrine-disrupting chemicals? https://factor.niehs.nih.gov/2024/7/science-highlights/endocrine-disruptors

Recommendations:

1. Try to avoid unnecessary, preventable exposure to EDC-containing products. Experts suggest avoiding microwaving food in plastics to avoid leaching of EDCs into food, choosing personal care products and cleaners that are unscented, and replacing older non-stick pans with newer, ceramic-coated ones. These precautions are especially important if you are pregnant or planning a family.
2. Support continued regulation and environmental cleanup of known endocrine disruptors.
3. Keep in mind it is the combined effect, or cumulative impact, of all the environmental exposures, social and economic conditions, as well as personal risk factors that may increase someone's likelihood of experiencing harm. See https://mleead.umich.edu/files/Cumulative_Impact_2023.pdf and https://www.michigan.gov/egle/maps-data/miejscreen for more information.

Sources

- Cleveland Clinic. Endocrine System. https://my.clevelandclinic.org/health/body/21201-endocrine-system
- National Institute of Environmental Health Sciences. Endocrine Disruptors. https://www.niehs.nih.gov/health/topics/agents/endocrine
- Emory University Provider CME Course. Endocrine Disrupting Chemicals: Uncontrolled Medicine in Your Patient for Providers.
- As listed above.