

# toxicliniq

The official newsletter of Toxicology & National Poisons Information Centre, National Hospital of Sri Lanka

Toxicology Newsletter is an updated information collection for the healthcare practitioner that intended to enhance knowledge, stimulate research and promote

better management of patients with poisoning. The newsletter also publishes clinically relevant review articles, letters to the editor and commentaries.

Themes covers are of interest to clinicians, researchers, epidemiologists and other health care professionals.

## Effects of endocrine disruptors in human health

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### Introduction

Endocrine disruptors are chemicals that may interfere with our

endocrine system and produce adverse developmental, reproductive, neurological, and immune effects in humans. A wide range of substances, both natural and man-made, are thought to cause endocrine disruption.

Endocrine disruptors may be found in many everyday products— including plastic bottles, metal food cans, detergents, flame retardants, food, toys, cosmetics, and pesticides. In the intervening decade, a great deal of research has provided new information about the mechanisms by which

endocrine disruptive chemicals can interfere with hormone actions, the degree to which our environment is contaminated with such chemicals, and the relationship between chemical exposures and health outcomes in humans (1).

### How do endocrine disruptors work?

Some chemicals can act on the endocrine system to disturb the homeostatic mechanisms of the body or to initiate processes at abnormal times in the life cycle.

Our toxic lover: 

Plastics are everywhere, convenient and affordable. We use them for storing and delivering food, drink, medicines, and anything else that can be directly and consciously ingested (including plastic toys, because babies and infants like to suck on them). However, the benefits are outweighing the harm that they cause.

Manufacturers often add different chemicals to plastics to give them the exact characteristics they're looking for, like flexibility, strength, and reduced production cost. These components can include phthalates, bisphenol A (BPA), polybrominated diphenyl ethers (PBDE) and tetrabromobisphenol A (TBBPA) — all of which are endocrine-disruptors (EDs), and each affects different elements of hormone disruption (e.g. inducing estrogen-like activity, thyroid hormone homeostasis disruption, anti-androgens, and so on). Also, some chemicals are made of monomers, which have known mutation-inducing and cancer-causing qualities. And yet other compounds contain toxic metals.

These chemicals which are odorless and tasteless can enter the human body in any number of ways and at dramatically different levels. Children are at the greatest risk since they consume more for their size. Many of them seep into the environment during the production process or as waste. They enter our waterways and other areas where they eventually make contact with humans (2).

The chemicals can exert their effects through a number of different mechanisms:

- They may mimic the biological activity of a hormone by binding to a cellular receptor, leading to an unwarranted response by initiating the cell's normal response to a naturally occurring hormone at the wrong time or to an excessive extent (agonistic effect).
- They may bind to the receptor but not activate it. Instead the presence of the chemical on the receptor will prevent binding of the natural hormone (antagonistic effect)
- They may bind to transport proteins in the blood, thus altering the amounts of natural hormones that are present in the circulation.
- They may interfere with the metabolic processes in the body, affecting the synthesis or breakdown rates of the natural hormones.

**Potential endocrine disrupters include :**

- **Natural hormones** released into the environment from any animal, and chemicals produced by one species that exert hormonal actions on other animals, e.g. human hormones unintentionally reactivated during the processing of human waste in sewage effluent may result in



**Poisonous Beauty**

Many sunscreens lotions contain oxybenzone, which blocks UV radiation, but also appears to have estrogenic effects in humans (3).

Even painting your nails can expose you to endocrine system effects. Thousands of nail polish products contain triphenyl phosphate (TPHP), a plasticizer linked to hormone irregularities and obesity. It has been shown that TPHP can directly enter the body when nail polish is applied, both by breathing and skin absorption. Furthermore, it has been reported that the name TPHP was not disclosed on their labels among several nail polishes tested (4).

changes to fish.

be detected in sewage effluent.

- **Natural chemicals** including toxins produced by components of plants (the so-called phytoestrogens, such as genistein or coumestrol) and certain fungi.
- **Synthetically produced pharmaceuticals** that are intended to be highly hormonally active, e.g. the contraceptive pill and treatments for hormone-responsive cancers may also
- **Man-made chemicals** and by-products released into the environment. Laboratory experiments have suggested that some man-made chemicals might be able to cause endocrine changes. These include some pesticides (e.g. DDT and other chlorinated compounds), chemicals in some consumer and medical products (e.g. some plastic additives), and a number of industrial chemicals (e.g.



## Examples of some potential endocrine disruptors

Potential endocrine disruptors	Commonly found / Common uses
Bisphenol-A (BPA)	As a strengthener in polycarbonate plastics; baby bottles and nursing products, dental sealants and orthodontic products, water bottles and other food and beverage containers, the liners of food cans, CDs and DVDs, eyeglasses, water pipes, sports safety equipment, medical equipment and tubing, consumer electronics, PVC, plasticizers.
Diethylstilbestrol(DES)	As DES tablets (synthetic estrogen)
DDT	As an organochloride insecticide
Dieldrin	As an organochlorine insecticide
Dioxin	A family of toxic chemicals, includes eight of the chlorinated dibenzo dioxins (CDDs), ten of the polychlorinated dibenzo furans (PCDFs) and twelve of the polychlorinated biphenyls (PCBs). These are all organochlorine compounds. Dioxins are unintentionally produced by industrial, municipal, and domestic incineration and combustion processes
Endosulfan	An organochlorine insecticide
Hexachlorobenzene	Hexachlorobenzene (HCB) is a fully chlorinated industrial hydrocarbon chemical.
Hormonal Contraception	Oral contraceptive pills
Polychlorinated biphenyls (PCBs)	Transformers and capacitors, Other electrical equipment including voltage regulators, switches, reclosers, bushings, and electromagnets, Oil used in motors and hydraulic systems, Old electrical devices or appliances containing PCB capacitors, Fluorescent light ballasts, Cable insulation, Thermal insulation material including fiberglass, felt, foam, and cork, Adhesives and tapes, Oil-based paint, Caulking, Plastics, Carbonless copy paper, Floor finish
Phthalates	Ingredients in many sprays including pesticides, cosmetics, and wood finishes. Phthalates are found in: PVC products, vinyl flooring, vinyl shower curtains, adhesives, detergents, lubricating oils, solvents, automotive plastics, soap, shampoo, deodorants, hair spray, plastic bags, garden hoses, inflatable recreational toys, blood storage bags, children's toys, perfumes, nail polish, lotions, IV bags
Polybrominated Diphenyl Ethers(PBDEs)	Flame retardants in electronics, textiles, and polyurethane foam
Toxaphene	Organic insecticide.
Estrogens	Natural steroid hormones as well as synthetic sex steroids
Tributyltin	A highly toxic biocide that has been used extensively to prevent the growth of marine organisms on the hulls of large ships.

polychlorinated biphenols (PCBs), dioxins).

### How are people exposed to endocrine disruptors?

People may be exposed to endocrine disruptors through the food and beverages they consume, medicine they take, pesticides they apply, and cosmetics they use. So, exposures may be through the diet, air, skin, and water.

Some environmental endocrine disrupting chemicals, such as the pesticide DDT, dioxins, and polychlorinated biphenyls (PCBs) used in electrical equipment, are highly persistent and slow to degrade in the environment making them potentially hazardous over an extended period of time.

### Adverse Health Effects

Possible adverse effects in humans from exposure to endocrine-

disrupting chemicals that can interfere with the endocrine system include:

- Reductions in male fertility and declines in the numbers of males born.
- Abnormalities in male reproductive organs.
- Female reproductive health issues, including fertility problems, early puberty, and early reproductive senescence.



- Increases in mammary, ovarian, and prostate cancers.
- Increases in immune and autoimmune diseases, and some neurodegenerative diseases.

Clear evidence exists that some chemicals cause these effects in wildlife, but limited evidence exists for the potential of chemicals to cause these effects in humans. Very few chemicals have been tested for their potential to interfere with the endocrine system. BPA is one of those and research shows significant data about the harmful effects of BPA on many developing fetuses. Furthermore, researchers observed changes in the onset of puberty and in reproductive function

through an alteration in endocrine homeostasis (5). Also, it was found that DES tablets cause adenocarcinoma of the vagina in female offspring(5). However, the relationship of human diseases of the endocrine system and exposure to endocrine disruptive chemicals, is poorly understood and more studies on humans are necessary.


### References

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**We welcome your comments and suggestions regarding the newsletter.**



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 **0112-686-143**



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April 2016

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