

Endocrine Disrupting Chemicals (EDCs) and Shale Gas Development

A growing body of scientific research suggests that many chemicals, both natural and man-made, may interfere with hormones and the endocrine system and produce unfavorable effects in laboratory animals, wildlife, livestock, pets, and humans. These chemicals are referred to as endocrine disrupting chemicals (EDCs). **Recent laboratory studies indicate shale gas development uses and produces EDCs, and therefore is a potential for negative impacts on health from exposure to these chemicals.**

TERMS TO REMEMBER:

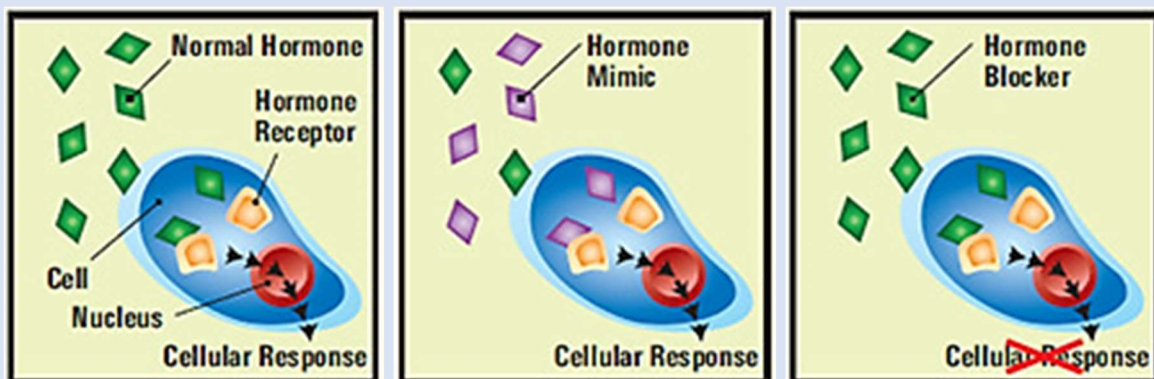
Endocrine System: the collection of glands and hormones that regulate growth and development, reproduction, response to stress, sexual development, and brain function, such as emotions, memory and learning.

Hormones: chemicals such as insulin, thyroid hormone, estrogen, and testosterone, that are chemical messages used by the body to regulate every aspect of life. There are hundreds of different hormones in the body that send messages through the body by interacting with specific receptors in and on different target cells.

Endocrine Disrupting Chemical (EDC): a chemical or mixture of chemicals in the environment, that can interfere with any aspect of hormone action. EDCs characteristically produce hormone alterations at low levels of exposure. In addition, unlike many other harmful chemicals, EDCs may have a very different effect at high levels of exposure than that resulting from lower levels of exposure. But both high and low levels of exposure disrupt normal hormone function in a harmful way.

How Do EDCs Act? EDCs disrupt normal hormone signals in two main ways:

- Change the amount of hormone available by altering production, metabolism and/or secretion
- Mimic or block the action of hormones and their receptors at target tissues



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).

Although research in recent years has resulted in a greater understanding of the actions of EDCs, it is not always known how EDCs work, even when EDC exposure has been linked to an unfavorable effect.

What Are Sources of Human Exposure to EDCs? EDCs are present in our everyday life. They are components of plastics, pesticides, flame retardants, cosmetics, personal care products, lawn care products, and cleaning products. In addition, many chemicals associated with oil and gas operations are recognized or suspected endocrine disruptors. **EDCs have been identified in fracturing fluid and in the wastewater and air emissions generated during the process of shale gas development. The resulting EDCs may contaminate air, water, soil and food sources, and expose residents through inhalation, ingestion and skin absorption.**

How Do EDCs Affect Our Health? The effects of EDCs can vary depending on when in the lifetime exposure occurs. Fetal development, early childhood, and puberty are critical periods for exposure because hormones normally act to set the stage for how the body grows, develops and responds to environmental factors throughout life. Since fetuses, infants, children, and adolescents undergo rapid growth and development that is controlled by hormones, they are particularly vulnerable to the adverse effects of EDCs.

Although much of the focus of EDCs is on developmental exposure, they also interact with hormone receptors during adulthood. Hormones work in your body in very tiny amounts, so even small exposures to EDCs can affect function.

For some EDCs the scientific literature identifies potential health effects resulting from the exposure. Examples of recognized health effects include:

- abnormal development of sex organs
- reduced ability to have children
- changes to secondary sex characteristics such as those that develop in puberty (i.e., underarm hair)
- cancers such as breast, ovarian, prostate, and testicular
- impaired intellectual development
- altered behavior
- altered response to stress
- increased buildup of fat and changes in ability to respond to insulin and regulate blood sugar

Why is endocrine disruption important to human health and disease?

- Hormones and EDCs work at very low levels
- EDCs are associated with disease in adults and permanent damage in babies and children

Susan Nagel, PhD

Recommendations for Protecting Against EDCs' Impacts:

- speak with your health care provider if you are concerned about exposure to EDCs
- participate in health registries to monitor exposure to shale gas contaminants, including EDCs
- support efforts for government regulation of and increased research on EDCs
- support efforts for government and nonprofit researchers to collect air and water monitoring data for pollutants at shale gas development sites
- encourage health assessments of people living, working or going to school/daycare within 5 miles of shale gas development
- campaign for non-toxic alternatives to pesticides in your child's school or day care
- avoid using pesticides in your home or yard, or on your pet
- limit use of plastics, particularly do not cook/microwave with plastics

Resources: <https://academic.oup.com/edrv/article-lookup/doi/10.1210/er.2015-1010#59031666>
<https://endocrinedisruption.org>
<https://doi.org/10.1016/j.scitotenv.2015.04.013>
<https://doi.org/10.1210/en.2015-1375>
<https://doi.org/10.1210/en.2013-1697>

Endocrine Disrupting Activity Associated with Unconventional Oil and Natural Gas Operations, Susan Nagel, PhD, University of Missouri, 2016
http://toxtown.nlm.nih.gov/text_version/chemicals.php?id=31

February 2018