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RACHEL'S HAZARDOUS WASTE NEWS #365

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News and resources for environmental justice.

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A NEW ERA IN ENVIRONMENTAL TOXICOLOGY

The federal National Institute of Environmental Health Sciences (NIEHS), in Bethesda, Maryland, has published a new report describing the "developmental effects" of chemicals on humans and animals. "Developmental effects" are those that occur during the earliest time of life when the young are developing in the womb, or in the egg. [1] With the publication of this report, ideas and data developed by Dr. Theo Colborn and many of her colleagues [2] have entered the mainstream of the nation's scientific and medical thinking. A new era of environmental toxicology has begun. We believe that the work of Dr. Colborn and her colleagues will eventually be seen to be as important as the work of Rachel Carson, who woke the nation to the dangers of pesticides and atomic fallout in her book, SILENT SPRING, in 1962.

The Colborn report is peppered with medical language, and is therefore somewhat difficult for most readers to grasp. However, the ideas in the report are of such profound importance that everyone should own a copy, should read it themselves, and should urge their family doctor to read it. We will mail it free to anyone who sends a stamped, self-addressed envelope bearing 52 cents postage.

The new report describes a class of chemicals (35 common pesticides, and 10 common industrial chemicals) [3] and a kind of health damage from these chemicals that affects the offspring of exposed adults. The damage to the offspring often remains hidden until the young grow to maturity and even to middle age. The damage occurs in three key bodily systems: the reproductive system, the endocrine system, and the immune system. The report describes evidence gathered from three sources: wildlife, laboratory animals, and humans.

The report emphasizes interference with the endocrine system, which then causes damage to the reproductive and immune systems.

The endocrine system is made up of specialized cells, tissues, and organs that create and secrete (usually into the blood) chemicals called hormones, which then regulate other kinds of cells in the body. Particular hormones only affect particular cells that contain "receptors" for those hormones. A small amount of a hormone attaches to a "receptor" (a protein molecule) and the hormone-receptor pair then initiates a cascade of chemical changes, often with major and far-reaching consequences in remote parts of the body. In this way, hormones act as messengers, sending chemical signals that control the way the entire body grows, is organized, and behaves.

What Colborn and her colleagues have discovered, examined, and documented is that many chemicals in common use since World War II enter the bodies of humans, domestic animals, and wildlife, chiefly through contaminated food and water, and that these chemicals mimic hormones. The body mistakes them for natural hormones and reacts to them in ways that cause deep and permanent trouble, especially when exposure occurs during the critical period of development before, and immediately after, birth or hatching.

Endocrine-disrupting chemicals mimic hormones, but with one key difference. Natural hormones do their work as messenger (or as stimulant of a cascade of other effects), and then the body disassembles them and removes them from the blood stream. In contrast, when industrial chemicals and pesticides mimic hormones, they do not disappear quickly. They tend to remain in the body for very long periods, doing the work of hormones at times, and in ways, that are inappropriate and destructive.

The Colborn report begins with this summary:

"Large numbers and large quantities of endocrine-disrupting chemicals have been released into the environment since World War II. Many of these chemicals can disturb development of the endocrine system and of the organs that respond to endocrine signals in organisms indirectly exposed during prenatal and/or early postnatal life; effects of exposure during development are permanent and irreversible. The risk to the developing organism can also stem from direct exposure of the offspring after birth or hatching. In addition, transgenerational exposure [exposure of offspring] can result from the exposure of the mother to a chemical at any time throughout her life before producing offspring due to persistence of endocrine-disrupting chemicals in body fat, which is mobilized during egg laying or pregnancy and lactation [production of milk]."

The report focuses on one group of chemicals, called the **STEROID HORMONES**, which are produced by the mother's ovaries and adrenal glands, the placenta, and by the fetus's gonads and adrenal glands. Steroid hormones have been identified as playing a major role in regulating developmental processes in many bodily systems and tissues.

In humans, the development of the body's organs begins during the second month in the womb. From then on, the course of development is regulated by steroid hormones and other parts of the endocrine system.

Certain organs appear to be particularly vulnerable to developmental abnormalities when the mother is exposed to endocrine-disrupting chemicals. In female fetuses, the most vulnerable organs are: breasts, fallopian tubes, uterus, cervix, and vagina. In male fetuses, the critical organs are prostate, seminal vesicles [where sperm originates], epididymides [a reservoir for sperm], and testicles.

In both sexes, critical organs are the external genitals, the brain, skeleton, thyroid, liver, kidney and immune system because they are all targets for steroid hormone action.

Although the report begins by highlighting the role of "steroid hormones," much of the discussion centers on the particular hormone called estrogen because most industrial endocrine-disruptors mimic estrogen. (See [RHWN #334](#), [#343](#).)

Wildlife Evidence

The Colborn report offers a quick catalog of problems documented in wildlife: Exposure to endocrine-disrupting chemicals in the environment has been associated with abnormal thyroid function in birds and fish; decreased fertility in birds, fish, shellfish, and mammals; decreased hatching success in fish, birds, and turtles; demasculinization and feminization of male fish, birds, and gastropods [the group of animals that includes snails and slugs]; and, finally, altered immune system function in birds and mammals.

To illustrate wildlife problems caused by endocrine-disrupting chemicals, the Colborn report describes the plight of the bald eagle, also known as the American eagle because it is pictured on the coat of arms of the U.S. Bald eagles around the Great Lakes and in the Columbia River basin in Washington state are unable to reproduce successfully after they have fed on local fish for two years or longer. Their bodies contain up to 10 times as much DDT, PCBs and chlordane [all of which have been banned for about 20 years in the U.S.] as would allow them to reproduce successfully. Most of these chemicals are being transported into the U.S. via the atmosphere from other countries where their use has not been banned (and where some U.S.-connected firms continue to produce them). They are also extremely persistent. "PCBs will be around over geologic time," the Colborn report says, meaning thousands of years.

Human Evidence

The Colborn report spends considerable time discussing DES (diethylstilbestrol), the synthetic hormone that was given to a million American women by their physicians between 1960 and 1970 to prevent spontaneous abortions. DES is an endocrine-disrupter. Daughters of women who took DES suffer reproductive organ dysfunction, abnormal pregnancies, reduced fertility, immune system disorders, and periods of depression. As young adults, these women also suffer elevated rates of a rare vaginal cancer.

The report offers a very long list of problems caused in both female and male children of DES-exposed mothers. "DES-exposed humans thus serve as a model for exposure during early life to any estrogenic chemical, including pollutants in the environment that are estrogen agonists [mimickers or enhancers]." "It is now suspected that increases in the incidence of numerous pathologies [disease conditions] in men

and women may be related to exposure to pesticides and other endocrine-disrupting chemicals that can mimic DES and are thus estrogen agonists [mimickers or enhancers]. The clinical and experimental findings with DES show that consideration must be given to the following facts:

1. an increase in breast and prostatic cancer in the United States occurred between 1969 and 1986;
2. a 400% increase in ectopic [tubal] pregnancies occurred in the United States between 1970 and 1987;
3. a doubling of the incidence of cryptorchidism [undescended testicles] occurred in the United Kingdom between 1970 and 1987; and
4. an approximate 50% decrease in sperm count worldwide over the last 50 years. These trends may be a reflection of the increase [of] estrogenic pollutants in the environment. For example, an association between reduced sperm motility [power of spontaneous movement] and PCBs in men with fertility problems has been reported...."

"Evidence already exists that a number of organochlorine chemicals (such as dioxin, PCB, and DDT) has reached concentrations in aquatic food sources that can lead to substantial functional deficits in animals that consume this food," the report says.

Furthermore, "Based on current breast milk concentrations nationwide, it is estimated that at least 5% and possibly more of the babies born in the United States are exposed to quantities of PCBs sufficient to cause neurological effects."

--Peter Montague, Ph.D.

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[1] Theo Colborn, Frederick S. vom Saal, and Ana M. Soto, "Developmental Effects of Endocrine-Disrupting Chemicals in Wildlife and Humans," ENVIRONMENTAL HEALTH PERSPECTIVES Vol. 101 No. 5 (October, 1993), pgs. 378-384.

[2] Theo Colborn and Coralie Clement, editors. CHEMICALLY-INDUCED ALTERATIONS IN SEXUAL AND FUNCTIONAL DEVELOPMENT: THE WILDLIFE/HUMAN CONNECTION. Princeton, N.J.: Princeton Scientific Publishing Co., 1992.

[3] The Colborn report lists the following endocrine-disrupting chemicals: 2,4,-D; 2,4,5-T; alachlor; amitrole; atrazine; metribuzin; nitrofen; trifluralin; benomyl; hexachlorobenzene; mancozeb; maneb; metiram-complex; tributyl tin; zinab; ziram; beta-HCH; carbaryl; chlordane; dicofol; dieldrin; DDT and metabolites; endosulfan; heptachlor and heptachlor epoxide; lindane (gamma-HCH); methomyl; methoxychlor; mirex; oxychlordane; parathion; synthetic pyrethroids; toxaphene; transnonachlor; aldicarb; DBCP; cadmium; dioxin (2,3,7,8-TCDD); lead; mercury; PBBs; PCBs; pentachlorophenol (PCP); penta-to nonylphenols; phthalates; styrenes.

Descriptor terms: niehs; national institute of environmental health sciences; developmental effects; theo colborn; theodora colborn; rachel carson; radiation; nuclear weapons; fallout; pesticides; endocrine system; immune system; reproductive system; hormones; wildlife; reports; studies; steroid hormones;

estrogen; bald eagle; great lakes; columbia river; des; diethylstilbestrol; breast cancer; prostate cancer; cryptorchidism; undescended testicles; ectopic pregnancy; reduced sperm count; pcbs; polychlorinated biphenyls; breast milk; nervous system disorders; dioxin;

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