

Rachel's Environment & Health News

#487 - Our Stolen Future -- Part 2

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Humans and other animals (fish, birds, reptiles, amphibians, and mammals) all have three great internal networks that coordinate growth, development, and behavior:

** the nervous system (brain, spinal cord, and peripheral nerves);

** the immune system (a myriad of specialized cells and tissues that protect us against bacteria, viruses, and cancers); and

** the endocrine system, which controls and coordinates the body by sending chemical messages (hormones) through the blood stream, turning on and off various functions throughout the body.

The human body is more than a mere collection of 50 trillion individual cells because our cells work together. Working together requires coordination, which requires communication.

Nerves are just one avenue of communication--the one employed for rapid, discrete messages, such as a quick instruction to a hand, to move away from a hot stove. A large part of the body's internal communication and control is carried out via the bloodstream, where hormones and other chemical messengers move about, carrying signals that not only govern sex and reproduction but also coordinate organs and tissues that work together to keep the body functioning properly.

Hormones --chemical messengers --began to be understood early in this century. Nobel prizes were awarded for the discovery of insulin in 1923, and for work on sex hormones in 1939. The best-known hormones are estrogen (the main female sex hormone) and testosterone (the main male sex hormone) but by 1987 more than 100 hormones had been identified in humans and higher mammals.[1]

The endocrine (hormone) system plays an important role starting early in life's beginnings. It is the endocrine system that controls development of the embryo. The embryo begins as a single fertilized egg cell, which divides again and again, creating new cells; these cells in turn "differentiate" into different kinds of cells, thus creating a brain, eyes, fingers, genitalia, and so forth. All of these processes are controlled by hormones.

In 1950, researchers at Syracuse University exposed young roosters to DDT and showed that their testicles only grew to 18 percent of normal size.[2] The researchers concluded, "These findings suggest that DDT may exert an estrogen-like action..."

A 1963 study in the JOURNAL OF THE NATIONAL CANCER INSTITUTE showed that cysts and cancers developed in mice treated with estrogen as newborns. In that 1963 study, author Thelma Dunn warned that her work showed "the vulnerability of the immature animal to the harmful effects of exposure to a naturally occurring hormone." [3]

The following year, in 1964, two authors writing in the JOURNAL OF THE NATIONAL CANCER INSTITUTE reported changes in vaginal tissues in mice after exposure to estrogen shortly after birth. They warned, "We feel that abnormal hormonal environments during early postnatal (and antenatal) life should not be underestimated as to their possible contribution to abnormal changes of neoplastic [cancer] significance later in life." [4]

These early warnings were ignored. From about 1940 onward, roughly 1000 new chemicals were introduced into commercial channels each year (a practice that continues today). No one asked whether any of these chemicals might exert an estrogen-like effect or might in some other way disrupt the chemical-messaging system on which we all depend for health and well-being. Still today, no one in any official capacity is asking.

Starting in the 1950s, papers began to appear in scientific journals showing declines in wildlife populations, resulting from exposures

to certain pesticides. Reports of odd behavior began to appear as well -- pairs of female gulls (so-called "gay gulls") sharing nests; pairs of terns (birds on the Great Lakes) failing to sit on their eggs, neglecting to defend their nests against predators. Alligators with penises so small they couldn't reproduce. As time passed, hundreds of such studies accumulated from many parts of the world.

However, it wasn't until 1991 that some scientists began to see a pattern in these studies. In July of that year, Theo Colborn, a biologist with the World Wildlife Fund, invited a group of 20 scientists to discuss their research. To their surprise, the scientists all agreed that, in their individual research, they were seeing evidence that industrial chemicals in the environment were harming the endocrine systems of fish, birds and mammals. They issued a consensus document, now known as the Wingspread statement (see REHW #263, #264), which began,[5] "We are certain of the following:

"A large number of man-made chemicals that have been released into the environment, as well as a few natural ones, have the potential to disrupt the endocrine system of animals, including humans. Among these are the persistent, bioaccumulative, organohalogen compounds that include some pesticides (fungicides, herbicides, and insecticides) and industrial chemicals, other synthetic products, and some metals." [An organohalogen is a chemical that contains carbon attached to a halogen such as chlorine; there are now 15,000 chlorine-containing organic compounds in commercial use.]

The Wingspread statement went on,

"Many wildlife populations are already affected by these compounds. The impacts include thyroid dysfunction [impaired or abnormal functioning] in birds and fish; decreased fertility in birds, fish, shellfish, and mammals; decreased hatching success in birds, fish and turtles; gross birth deformities in birds, fish and turtles; metabolic abnormalities [impaired or abnormal use of energy, manufacture of tissue, or handling of resulting wastes] in birds, fish, and mammals; behavioral abnormalities in birds; demasculinization and feminization in male fish, birds, and mammals; defeminization and masculinization of female fish and birds; and compromised [impaired] immune systems in birds and mammals." This was the first time anyone had ever put two and two together and had concluded that industrial chemicals are interfering with hormones in wildlife and, by analogy, probably in humans.

Since 1991, the journals have continued to swell with new studies showing how industrial chemicals, in low concentrations, can disrupt hormone messages.

In some instances, industrial chemicals behave like (mimic) hormones, fooling the body into responding as if natural hormones are present when in fact they are not, thus sending fake messages. In other instances, industrial chemicals block (partially or fully) the action of natural hormones, thus interfering in the receipt of messages. In other instances, industrial chemicals block the production of hormones, thus preventing the sending of messages. In still other instances, industrial chemicals interfere with the body's normal ability to break down and eliminate hormones, thus resulting in too many messages being present simultaneously and for too long.

No matter where you live today --whether in New York City, or on a remote island in the Arctic Ocean, anyone willing to put up the \$2000 for testing will find more than 250 synthetic industrial chemicals in their body.[6] DDT was first reported in human milk in 1951 and by the early 1980s, 192 different industrial chemicals (pesticides, solvents, etc.) were measurable in mothers' milk.[7]

These industrial chemicals are routinely present in our tissues at levels measured in parts per billion (or, in extreme instances, parts per million). On the other hand, naturally-occurring hormones often

do their work at levels that are measured in parts per trillion, one thousand times lower than parts per billion and a million times lower than parts per million.[8]

Furthermore, there is evidence that industrial chemicals at exceedingly low levels can combine together to produce additive effects. Dr. Ana Soto at Tufts University combined 10 hormone disrupters, each at one-tenth of the dose required to produce a minimal response; she found that the combination produced a response.[9] Thus combinations of chemicals must be taken into account when we try to learn how much "effective exposure" we are getting to hormone-disrupting chemicals.

Is there any evidence that humans have been harmed? Yes, there is. The medical profession exposed millions of women to drugs called thalidomide and DES (diethylstilbestrol) before it was learned that birth defects might result from such exposures. The DES exposures, particularly, provided compelling evidence that humans respond to hormone-disrupting chemicals the way other mammals do. Studies of humans exposed to PCBs (a class of hormone-disrupting industrial chemicals) shown mental and physical stunting. (See REHW #295, #372.) (We will review additional human evidence in future issues.)

OUR STOLEN FUTURE, Theo Colborn's new book,[5] presents evidence and hypotheses pointing toward a variety of effects in humans: reduced sperm count; increases in cancer of the prostate, testicles, and female breast; diminished intelligence; reduced capacity to pay attention; increased aggression and violence. Are these things all proven? They are not. Are they plausible enough and important enough to warrant thoughtful preventive action by prudent people? They definitely are.

What lessons can we learn from all this? Many. But they will have to wait. For the next two weeks, we will focus on the institution that allowed our future to be stolen --indeed, made it all but certain that our future would be stolen. Stay tuned.

--Peter Montague

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[1] Anthony W. Norman and Gerald Litwack, HORMONES (San Diego, Ca.: Academic Press, 1987), pg. xi. And see Appendix A.

[2] H. Burlington and V.F. Lindeman, "Effects of DDT on Testes and Secondary Sex Characters of White Leghorn Cockerels," Proceedings of the Society for Experimental Biology and Medicine Vol. 74 (1950), pgs. 48-51. Even earlier, the sexual development of mice had been disrupted by exposure to estrogen: R. Greene and others, "Experimental Intersexuality: The Paradoxical Effects of Estrogens on the Sexual Development of the Female Rat," ANATOMICAL RECORD Vol. 74 No. 4 (1939), pgs. 429-438. And: R. Greene and others, "Experimental Intersexuality: Modification of Sexual Development of the White Rat With a Synthetic Estrogen," PROCEEDINGS OF THE SOCIETY FOR EXPERIMENTAL BIOLOGY AND MEDICINE Vol. 41 (1939), pgs. 169-170.

[3] T. Dunn and A. Green, "Cysts of the Epididymis, Cancer of the Cervix, Granular Cell Myoblastoma, and Other Lesions After Estrogen Injection in Newborn Mice," JOURNAL OF THE NATIONAL CANCER INSTITUTE Vol. 31 (1963), pgs. 425-438.

[4] N. Takasugi and H. Bern, "Tissue Changes in Mice with Persistent Vaginal Cornification Induced by Early Postnatal Treatment With Estrogen," JOURNAL OF THE NATIONAL CANCER INSTITUTE Vol. 33 (1964), pgs. 855-864.

[5] Theo Colborn, Dianne Dumanoski and John Peterson Myers,

OUR STOLEN FUTURE (N.Y.: Dutton, 1996), pgs. 251-260 reprints the Wingspread statement.

[6] J.S. Stanley, [Midwest Research Institute, Kansas City, Mo.], BROAD SCAN ANALYSIS OF HUMAN ADIPOSE TISSUE. EXECUTIVE SUMMARY. VOLUME 1. FINAL REPORT. [EPA/560/5-86/035] (Springfield, Va: National Technical Information Service [NTIS No. PB 87-177218/REB]. See also VOLUME II, NTIS No. PB 87-177226. And see: Kristin Bryan and Theo Colborn, "Organochlorine Endocrine Disruptors in Human Tissue," in Theo Colborn and Coralie Clement, editors, CHEMICALLY-INDUCED ALTERATIONS IN SEXUAL AND FUNCTIONAL DEVELOPMENT: THE WILDLIFE/HUMAN CONNECTION [Advances in Modern Environmental Toxicology Vol. XXI] (Princeton, N.J.: Princeton Scientific Publishing Co., 1992), pgs. 365-394.

[7] E.P. Laug and others, "Occurrence of DDT in Human Milk," ARCHIVES OF INDUSTRIAL HYGIENE Vol. 3 (1951), pgs. 245-246. And see: Edo D. Pellizzari and others, "Purgeable Organic Compounds in Mother's Milk," BULLETIN OF ENVIRONMENTAL CONTAMINATION AND TOXICOLOGY Vol. 28 (1982), pgs. 322-328, reporting 192 different industrial chemicals in samples of human milk from New Jersey, Pennsylvania and Louisiana.

[8] In their Appendix A, Norman and Litwack, cited above in note 1, list the levels at which naturally-occurring hormones are present in human blood. Many occur in the low parts per trillion range.

[9] Soto's work is reported in Paul Cotton, "Environmental Estrogenic Agents Area of Concern [sic]," JOURNAL OF THE AMERICAN MEDICAL ASSOCIATION Vol. 271, No. 6 (February 9, 1994), pgs. 414-415.

Descriptor terms: our stolen future; theo colborn; john peterson myers; dianne dumanoski; nervous system; immune system; endocrine system; hormones; development; embryo; estrogen; endocrine disrupters; wingspread statement; pesticides; thyroid disease; infertility; wildlife; fish; birds; mammals; synergism; additive effects; ana soto; book reviews;