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#263 - The Wingspread Statement -- Part 1: Chemicals In Environment Affect Sexual Development In Wildlife December 10, 1991

Gradually during recent years a new body of knowledge has developed showing that some chemicals in food and water can mimic hormones and disrupt the development of living things like fish, birds, and mammals, including their sexual development.

In some cases, the effects on wildlife have been dramatic. For example, male herring gulls on Lake Ontario, exposed to DDT and other organochlorine compounds, developed female sex organs. Female-female pairing has been observed in herring gulls on Lake Michigan and on Santa Barbara Island, California. Because humans share the same basic mechanisms of growth and development as wildlife, an increasing number of scientists has become concerned that humans may already be affected without recognizing it.

In July of this year an international group of 21 scientists met at Wingspread in Racine, Wisconsin to assess what is known about these matters. They have now released a "consensus statement" containing information and opinions about the nature and possible causes of these problems. The five-page statement is called "Chemically Induced Alterations in Sexual Development: The Wildlife/Human Connection."

Background

Hormones are produced by the endocrine system--a bodily system consisting of specialized cells, tissues, and organs that create and secrete (usually into the blood) organic 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 site" and the hormone-receptor pair then initiates a cascade of chemical changes, often with major and far-reaching consequences.

The endocrine system shares with the nervous system the job of adjusting the body's response to a changing external environment. The nervous system copes with environmental changes on an immediate basis, whereas the endocrine system copes with environmental changes on a sustaining basis. For example, when the body gets cold, the nervous system causes shivering, which raises the body's temperature. But each month it is the endocrine system that starts the human female menstrual cycle. In a developing fetus, it is the endocrine system that regulates cell division and organ differentiation. The endocrine system regulates pattern and timing of bird migration and of hibernation in mammals. Examples of endocrine glands in humans include the adrenal gland, pancreas, thyroid, pituitary, ovaries and testes.

The scientists gathered at Wingspread last July focused on the sex hormones--the androgens that make males look and act like males and the estrogens that make females look and act like females. The Wingspread Statement begins, "Many compounds introduced into the environment by human activity are capable of disrupting the endocrine system of animals, including fish, wildlife, and humans. The consequences of such disruption can be profound because of the crucial role hormones play in controlling development...."

"The following consensus was reached by participants at the workshop.

"[1]. 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.[1]

"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.

"The patterns of effects vary among species and among compounds. Four general points can nonetheless be made: (1) the chemicals of concern may have entirely different effects on the embryo, fetus, or perinatal [meaning "near the time of birth," from the 28th week of pregnancy through the first week of life, in humans] organism than on the adult; (2) the effects are most often manifested in offspring, not in the exposed parent; (3) the timing of exposure in the developing organism is crucial in determining its character and future potential; and (4) although critical exposure occurs during embryonic development [from conception through the end of the second month of pregnancy], obvious manifestations [effects] may not occur until maturity.

"Laboratory studies corroborate the abnormal sexual development observed in the field and provide biological mechanisms to explain the observations in wildlife.

"Humans have been affected by compounds of this nature, too. The effects of DES (diethylstilbesterol), a synthetic therapeutic agent, like many of the compounds mentioned [in footnote 1] are estrogenic [meaning they act like estrogen, a family of female sex hormones]. Daughters born to mothers who took DES now suffer increased rates of clear cell adenocarcinoma [cancer], various genital tract abnormalities, abnormal pregnancies, and some changes in immune responses. Both sons and daughters exposed in utero [while in the uterus] experience congenital anomalies of their reproductive system and reduced fertility. The effects seen in in utero DES-exposed humans parallel those found in contaminated wildlife and laboratory animals, suggesting that humans may be at risk to those same environmental hazards as wildlife."

The Wingspread Statement goes on:

"[2]. We estimate with confidence that:

"Some of the developmental impairments reported in humans today are seen in adult offspring of parents exposed to synthetic hormone disruptors (agonists and antagonists) released in the environment. The concentrations of a number of synthetic hormone agonists and antagonists measured in the U.S. human population today are well within the range and dosages at which effects are seen in wildlife populations. [An agonist is a chemical that is not a hormone but mimics a natural hormone; an antagonist interferes with a natural hormone.] In fact, experimental results [in animals] are being seen at the low end of current environmental concentrations [in humans].

"Unless the environmental load of synthetic hormone disruptors is abated and controlled, large scale dysfunction at the population level is possible. The scope and potential hazard to wildlife and humans are great because of the probability of repeated and/or constant exposure to numerous synthetic chemicals that are known to be endocrine disruptors...."

"[3]. Current models predict that:

"... Both exogenous (external source) and endo-genous (internal source) androgens (male hormones) and estrogens (female hormones) can alter the development of brain function.

"Any perturbation [disturbance] of the endocrine system of a developing organism may alter the development of that organism: typically these effects are irreversible. For example, many sex-

related characteristics are determined hormonally during a window of time in the early stages of development, and can be influenced by small changes in hormone balance. Evidence suggests that sex-related characteristics, once imprinted, may be irreversible."

The Wingspread statement then gives three reasons why these predictions are subject to "many uncertainties:" (1) effects of exposure of humans are not well understood, especially exposure of embryos; (2) data on reproductive problems in wildlife exist but data on behavior changes are not so readily available; (3) the potency of many synthetic [human-created] estrogenic chemicals is not well known.

The British publisher, Elsevier Applied Science, will publish a book on this subject by next fall. Until then, the best source of information is Theodora E. Colborn and others, GREAT LAKES GREAT LEGACY? available for \$20.00 (plus \$2.00 shipping) from: World Wildlife Fund, P.O. Box 4866, Hampden Post Office, Baltimore, MD 21211; phone (301) 516-6951.

For \$3.00 plus stamped, self-addressed envelope, we can send you the Wingspread statement itself.

[More on this subject coming soon.]

--Peter Montague

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[1] A footnote on page 1 of the Wingspread Statement says, "Chemicals known to disrupt the endocrine system include: DDT and its degradation products, DEHP (di(2-ethylhexyl)phthalate), dicofol, HCB (hexachlorobenzene), kelthane, kepone, lindane and other hexachlorocyclohexane congeners, methoxychlor, octachlorostyrene, synthetic pyrethroids, triazine herbicides, EBDC fungicides, certain PCB congeners, 2,3,7,8-TCDD and other dioxins, 2,3,7,8-TCDF and other furans, cadmium, lead, mercury, tributyltin and other organo-tin compounds, alkyl phenols (non-biodegradable detergents and anti-oxidants present in modified polystyrene and PVCs), styrene dimers and trimers, soy products, and laboratory animal and pet food products."

Descriptor terms: endocrine disrupters; racine, wi; wi; wildlife; sexual development; endocrine system; fish; birds; herring gulls; mammals; humans; reproductive hazards; reproductive disorders; ddt; des; pesticides; herbicides; insecticides; fungicides; theo colborn; wingspread statement;