

Rachel's Environment & Health News

#751 - The Latest Hormone Science -- Part 2

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In this series we are exploring whether mainstream scientists take seriously the idea that some industrial chemicals can interfere with hormones (the "endocrine system") in living things and thus cause health problems. The NEW YORK TIMES says they don't. See RACHEL'S #750.

Hormones are naturally-occurring chemicals that circulate at very low levels in the blood stream of all vertebrate animals including reptiles, amphibians, fish, birds and mammals.[1] (Vertebrates are animals with a backbone.) In all vertebrate species, hormones act as chemical messengers and as switches, turning on and off bodily systems that control growth, development, learning and behavior. Hormones start affecting every animal shortly after it begins life as a fertilized egg. Hormones control growth and development prior to birth or hatching, and they continue to influence behavior throughout life. Hormones determine when bears will hibernate, when salmon will return to their spawning grounds, and when women will menstruate. Hormones profoundly affect the nervous system, the reproductive system, and the immune system. Naturally-occurring hormones are also implicated in some forms of cancer, such as female breast cancer which is widely believed to be linked to a woman's lifetime exposure to estradiol (estrogen), the main female sex hormone.

The question is, do some hormonally-active industrial chemicals interfere with naturally-occurring hormones and give rise to disease (certain cancers or autoimmune disorders such as diabetes, for example), or hinder growth, development, behavior, intelligence, learning, or immunity? Three years ago, in 1999, the National Academy of Sciences studied this question and concluded that the answer is a qualified Yes:

Here are some quotations from the Academy's 1999 report:

"Adverse reproductive and developmental effects have been observed in human populations, wildlife, and laboratory animals as a consequence of exposure to HAAs [hormonally active agents]."[2,pg.3]

"Studies with laboratory animals have shown that prenatal exposure to some HAAs, such as methoxychlor [a pesticide], TCDD [dioxin], and octylphenol and bisphenol A can reduce sperm production."[2,pg.131]

"Taken together, the results of animal and human studies indicate that prenatal exposure to PCBs can affect neurologic development."[2,pg.175] [PCBs are highly-toxic, persistent industrial chemicals released into the environment for 40 years by Monsanto and now found in food, water and soil world-wide.]

"In the Michigan/Maternal Infant Cohort Study, Fein et al. (1984) evaluated the birth size and gestational age of 242 infants and found that maternal consumption of fish and concentrations of PCBs in cord serum [in blood in the umbilical cord] were correlated with lowered birth weight, shortened gestation [time in the womb], and smaller head circumference. Lower weight was also observed in children from this cohort at 4 yr [years] in a dose-dependent fashion (Jacobson et al. 1990). Children with cord serum PCB levels of 5.0 ng/mL [nanograms per milliliter] or more weighed 1.8 kg [4 pounds] less on average than the lowest exposed children. Prenatal exposure was also associated with deficits in neurologic development in followup studies of these children at up to 11 yr [years]."[2,pg.125]

"It has been well documented that HAAs [halogenated aromatic hydrocarbons] such as TCDD [dioxin], polychlorinated dibenzofurans (PCDFs), and PCBs, affect immune response, and they appear to affect all functional arms of the immune system (innate immunity and host resistance, cell-mediated immunity, and humoral immunity)."[2,pg.178]

"There have only been a few studies of the effects of HAAs [hormonally active agents] in humans, but the results of laboratory

and wildlife studies suggest that HAAs have the potential to affect human immune functions."[2,pg.194]

With this background, let's review the last two years' worth of studies appearing in ENVIRONMENTAL HEALTH PERSPECTIVES (EHP), a peer-reviewed journal published by the federal National Institutes of Health. This will tell us whether scientists have recently rejected or abandoned the idea that industrial chemicals can interfere with hormones.

The first thing that struck me as I read through the past 24 monthly issues of EHP is that there is much more human data now than there was 5 years ago. Most studies still involve laboratory animals or wildlife, but humans figure prominently in many recent findings. Here is a sampling:

** Women exposed to dioxin by living near the scene of an industrial accident in Seveso, Italy in 1976 are now showing an excess of breast cancer, even though they are still relatively young (average age 40.8 years). Scientists within U.S. Environmental protection Agency (EPA) have been referring to dioxin as an "environmental hormone" since 1992. (See RACHEL'S #269.) [EHP Vol. 110, No. 7 (July 2002), pgs. 625-628.]

** Forest pesticide applicators who spray the popular herbicide known as 2,4-D have altered levels of male sex hormone in their blood. [EHP Vol. 109, No. 5 [May 2001], pgs. 495-500.] Thus 2,4-D joins the growing list of common chemicals known to disrupt hormones. 2,4-D is the herbicide used more than any other on lawns to kill dandelions and crab grass. It is sold under many names, including my personal favorite, Hormotox. It is also known as Demise, Weed-B-Gone, Weedone, Lawn-Keep, Raid Weed Killer, Plantgard, and Ded-Weed, among other trademarked names. Earlier studies showed that pet dogs die of cancer at twice the normal rate if they live in a family that uses 2,4-D on its lawn. (See RACHEL'S #250.)

A recent study shows that children's exposure to 2,4-D inside homes increases 10-fold after lawns are treated with 2,4-D. The family dog and humans' shoes are the main vehicles transporting 2,4-D into homes, exposing children living there. [EHP Vol. 109, No. 11 (November 2001), pgs. 1185-1191.]

** A study of 100 adolescents who grew up near waste incinerators or a metal smelter shows developmental delays in sexual maturity, compared to a control group living in an uncontaminated rural area. Adolescents in Flanders (Belgium) living in moderately polluted urban neighborhoods have "relatively low" levels of PCBs and dioxin-like polychlorinated aromatic hydrocarbons (CAHs) in their blood. Even these low levels correlated with delayed sexual maturation in both girls and boys, the study concludes. In 1997 the Flemish government had reported a higher percentage of conceptions requiring medical assistance near incinerators, compared to the rest of Flanders.

The authors conclude, "Through endocrine disruption, environmental exposure to CAHs may interfere with sexual maturation and in the long-run adversely affect human reproduction." [EHP Vol. 110, No. 8 (August 2002), pgs. 771-776.]

** Premature breast development (known as thelarche, pronounced thee-larkey) is the growth of breasts in girls younger than 8 with no other signs of puberty. Puerto Rico has the highest incidence of thelarche ever reported. The problem there has been studied for years, to no avail. Now a study of 41 girls in Puerto Rico with thelarche and 35 girls without thelarche has found that 68% of the thelarche girls had high levels of several phthalates (pronounced tha-lates) in their blood. Only one of the non-thelarche girls had measureable levels of one phthalate in her blood. The phthalates found in the thelarche group are known to have estrogenic and anti-androgenic effects. (Anti-androgenic means "interferes with male hormone." Humans of both genders always have a mix of male

and female hormones in their blood stream, the balance between them being important.) [EHP Vol. 108, No. 9 (September 2000), pgs. 895-900.]

Phthalates are common industrial chemicals used in building materials, food packaging and food wrap, toys and other children's products, medical devices, garden hose, shoes, shoe soles, automobile undercoating, wires and cables, carpet backing, carpet tile, vinyl tile, pool liners, artificial leather, canvas tarps, notebook covers, tool handles, dishwasher baskets, flea collars, insect repellents, skin emollients, hair sprays, nail polish, and perfumes, among other uses.

In October, 2000, a study reported in EHP measured the metabolic byproducts of 7 phthalates in the urine of adults and concluded that exposure to phthalates "is both higher and more common than previously suspected." The highest levels (1 to 16 parts per million in urine) were phthalates known as MEP, MBP, and MBzP and they occurred at the highest levels in women of child-bearing age. MBP and MBzP have previously been shown to cause reproductive and developmental toxicity in animals. [EHP Vol, 108, No. 10 (October 2000), pgs. 979-982.]

** A study of 63 female Air Force personnel with exposure to jet fuel (JP-8) and solvents showed that the most exposed women had the lowest levels of four reproductive hormones in their urine. The hormones were studied because they indicate likelihood of success or failure in conception. Thus the components of jet fuel, and/or solvents, are likely hormone disruptors in human females. [EHP Vol. 110, No. 8 (August, 2002), pgs. 805-811.]

** Two new studies indicate that Monsanto's herbicide, Roundup, is a hormone-disruptor and is associated with birth defects in humans.

Farm families that applied pesticides to their crops in Minnesota were studied to see if their elevated exposure to pesticides caused birth defects in their children. The study found that two kinds of pesticides -- fungicides and the herbicide Roundup -- were linked to statistically significant increases in birth defects. Roundup was linked to a 3-fold increase in neurodevelopmental (attention deficit) disorders. [EHP Supplement 3, Vol. 110 (June 2002), pgs. 441-449.]

A recent test tube study reveals that Roundup can severely reduce the ability of mouse cells to produce hormones. Roundup interferes with a fundamental protein called StAR (steroidogenic acute regulatory protein). The StAR protein is key to the production of testosterone in men (thus controlling male characteristics, including sperm production) but also the production of adrenal hormone (essential for brain development), carbohydrate metabolism (leading to loss or gain of weight), and immune system function. The authors point out that "a disruption of the StAR protein may underlie many of the toxic effects of environmental pollutants." [EHP Vol. 108, No. 8 (August 2000), pgs. 769-776.]

Monsanto, the St. Louis chemical giant and creator of Roundup as well as PCBs, is now a leader in genetically engineered crops. Monsanto sells "Roundup ready" seeds for corn, soybeans, and cotton; wheat and lawn grasses will be next. These are seeds engineered to withstand a thorough dousing with Roundup, which kills weeds without killing the Roundup-ready crops. To make Monsanto's "Roundup ready" seeds legal, U.S. Environmental Protection Agency (EPA) had to triple the amount of Roundup residues that it allows on crops. For years, Roundup has been Monsanto's most profitable product, and genetic engineering has now allowed the firm to sell much more of it. See RACHEL'S #637, #639, #660, #686, #726.

For example, a 1999 study of soybean farming in the U.S. midwest found that farmers planting Roundup Ready soybeans used 2 to 5 times as many pounds of herbicide per acre as farmers using

conventional systems, and ten times as much herbicide as farmers using Integrated Weed Management systems, which are intended to reduce the need for chemical herbicides.[3,pg.2]

More chemical dangers probably lie ahead as new products of genetic engineering come to market. According to the NEW YORK TIMES, Scotts Company is collaborating with Monsanto to develop Roundup Ready grass for lawns.[4] Children and pregnant women, beware.

[To be continued.] --Peter Montague

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[1] H. Maurice Goodman, BASIC MEDICAL ENDOCRINOLOGY [Second Edition] (New York: Raven Press, 1994).

[2] Ernst Knobil and others, HORMONALLY ACTIVE AGENTS IN THE ENVIRONMENT (Washington, D.C.: National Academy Press, July 1999). ISBN 0-309-06419-8.

[3] Charles Benbrook, "Evidence of the Magnitude and Consequences of the Roundup Ready Soybean Yield Drag from University-Based Varietal Trials in 1998," AgBioTech InfoNet Technical Paper #1, July 13, 1999. Available at http://www.biotech-info.net/RR_yield_drag_98.pdf.

[4] David Barboza, "Suburban Genetics: Scientists Searching for a Perfect Lawn," NEW YORK TIMES July 9, 2000, pg. A1.