

Pesticides and Aggression

Rachel's Environment & Health Weekly #648 -- April 29, 1999

For the past 25 years, tens of millions of Americans in hundreds of cities and towns have been drinking tap water that is contaminated with low levels of insecticides, weed killers, and artificial fertilizer. They not only drink it, they also bathe and shower in it, thus inhaling small quantities of farm chemicals and absorbing them through the skin. Naturally, the problem is at its worst in agricultural areas of the country.

The most common contaminants are carbamate insecticides (aldicarb and others), the triazine herbicides (atrazine and others) and nitrate nitrogen.[1] For years government scientists have tested each of these chemicals individually at low levels in laboratory animals -- searching mainly for signs of cancer -- and have declared each of them an "acceptable risk" at the levels typically found in groundwater.

Now a group of biologists and medical researchers at the University of Wisconsin in Madison, led by Warren P. Porter, has completed a 5-year experiment putting mixtures of low levels of these chemicals into the drinking water of male mice and carefully measuring the results. They reported recently that combinations of these chemicals -- at levels similar to those found in the groundwater of agricultural areas of the U.S. -- have measurable detrimental effects on the nervous, immune and endocrine (hormone) systems.[2] Furthermore, they say their research has direct implications for humans.

Dr. Porter and his colleagues point out that the nervous system, the immune system, and the endocrine (hormone) system are all closely related and in constant communication with each other. If any one of the three systems is damaged or degraded the other two may be adversely affected. The Wisconsin researchers therefore designed their experiments to examine the effects of agricultural chemicals on each of the three systems simultaneously. To assess immune system function, they measured the ability of mice to make antibodies in response to foreign proteins. To assess endocrine system function, they measured thyroid hormone levels in the blood. And to assess nervous system function they measured aggressive behavior in the presence of intruder mice introduced into the cages. They also looked for effects on growth by measuring total body weight and the weight of each animal's spleen.

The experiments were replicated many times, to make sure the results were reproducible. They found effects on the endocrine system (thyroid hormone levels) and the immune system, and reduced body weight, from mixtures of low levels of aldicarb & nitrate, atrazine & nitrate, and atrazine, aldicarb & nitrate together. They observed increased aggression from exposure to atrazine & nitrate, and from atrazine, aldicarb & nitrate together.

The Wisconsin research team wrote, "Of particular significance in the collective work of Boyd and others,[3] Porter and others,[4] and our current study[2] is that THYROID HORMONE

CONCENTRATION CHANGE was consistently a response due to mixtures, but NOT usually to individual chemicals." [Emphasis in the original].

In the five-year experiment, thyroid hormone levels rose or fell depending upon the mixture of farm chemicals put into the drinking water. Dr. Porter and his colleagues present evidence from other studies showing that numerous farm chemicals can affect the thyroid hormone levels of wildlife and humans. PCBs and dioxins can have similar effects, they note. Proper levels of thyroid hormone are essential for brain development of humans prior to birth. Some, though not all, studies have shown that attention deficit and/or hyperactivity disorders in children are linked to changes in the levels of thyroid hormone in the blood. Children with multiple chemical sensitivity (MCS) have abnormal thyroid levels. Furthermore, irritability and aggressive behavior are linked to thyroid hormone levels.

Interviewed recently by Keith Hamm of the SANTA BARBARA [CAL.] INDEPENDENT,[5] Dr. Porter explained, "Earlier work had shown that thyroid hormone typically changed when exposure to these pesticides occurred. Thyroid hormone not only affects and controls your metabolic rate, that is, how fast you burn food, it also controls your irritability level. For example, Type A personalities are more assertive, more aggressive, more hyper. These people tend to have higher levels of thyroid hormone. Type B personalities--people that are really laid back, really take things very easily--have lower levels of thyroid hormone. We expected that changes in thyroid [would] change irritability levels. This was a concern because there was information that kids are getting more hyper and [that their] learning abilities are going down," Dr. Porter said.

A recent study of 4 and 5 year-old children in Mexico specifically noted a decrease in mental ability and an increase in aggressive behavior among children exposed to pesticides.[6] Elizabeth A. Guillette and colleagues studied two groups of Yaqui Indian children living in the Yaqui Valley in northern Sonora, Mexico. One group of children lives in the lowlands dominated by pesticide-intensive agriculture (45 or more sprayings each year) and the other group lives in the nearby upland foothills where their parents make a living by ranching without the use of pesticides. The pesticide-exposed children had far less physical endurance in a test to see how long they could keep jumping up and down; they had inferior hand-eye coordination; and they could not draw a simple stick figure of a human being, which the upland children could readily do.

Notably, in the Guillette study we find this description of the behavior of pesticide-exposed children: "Some valley children were observed hitting their siblings when they passed by, and they became easily upset or angry with a minor corrective comment by a parent. These aggressive behaviors were not noted in the [pesticide-free] foothills [children]."

The human body can defend itself against poisons to some degree, but Dr. Porter and his colleagues describe ways in which low-level mixtures of pesticides and fertilizer might get past the body's defenses:

The body is prepared to protect itself against poisons taken by mouth. The liver begins to produce enzymes that try to break down fat-soluble chemicals. However, if a poison enters through the lungs or the skin, the body does not offer the same kind of defenses. Furthermore, the body's ability to put up defenses may be compromised by taking certain medications (e.g., antibiotics), or by receiving "pulses" of toxins rather than a steady dose.

Receiving "pulses" of poisons would be normal in the case of agricultural poisons which are sprayed onto crops only at certain times of the year. During those periods, people living near sprayed fields might get a sudden dose of poison via their lungs, their skin and their drinking water. Dr. Porter describes such a situation this way:

"Imagine [that] you're standing in a boxing ring and a boxer jumps in with you, and he walks toward you smiling with his hand outstretched. And you reach out to shake his hand and he smacks you in the stomach as hard as he can. And when you bring your arms up to defend yourself, he backs away. Finally you get tired of holding your defenses up and you drop them and he rushes in and smacks you again. That's the physical equivalent to a 'pulse dose,' which is normally what we tend to get exposed to.

"The defenses we have take a while to induce, just like it takes a while to bring your arms up. It takes anywhere from a half a day to five days to induce those [defenses] to appropriate levels. If you're in a particular stage of your hormone cycle or you're taking some antibiotics, it can compromise your ability to defend yourself even if you did have enough time to induce your defenses. If you've got pulse doses coming in under your defenses or coming in faster than you can bring your defenses up then you've got a situation where you're totally vulnerable.

"If you've got a pregnant mom, for example, in day 20 when the fetus's neural tube is closing and she gets an exposure, she hasn't had enough time to induce her defenses. Her thyroid level goes up or goes down, the hormone crosses the placenta and can permanently alter the developmental pattern of the fetus's brain. And then the pulse dose is gone, you have no detection, mom doesn't even know she's pregnant, and you may have an offspring that is neurologically compromised and wonder, 'How did this happen?'"

In the interview with Keith Hamm, Dr. Porter expressed concern for the overall effect of pesticides on the nation's children:

Hamm: "Are pesticides, herbicides, and fertilizer used more or less these days than fifty years

ago and have the toxicities changed?"

Porter: "The usage has continued to climb. There's an enormous amount of these [chemicals being used] right now. There was a recent study that examined the urine of people across the country, [asking] if people are being exposed. On average, anywhere from five to seven compounds were being excreted. There's a great deal of exposure to the general populace.

"And yes, the toxicities have definitely changed. [Some toxicities are now measured] in the parts-per-trillion range. I would point out that fetuses are sensitive to chemicals in the parts per quadrillion range."

Hamm: "I would assume that most people in this country are eating conventionally grown food. If that's the case, wouldn't the problems be more apparent? Why are there not more hyperaggressive dim-witted people with poor immune systems?"

Porter: "If we really looked carefully at what's been happening in this county, you might find exactly that happening."

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Because of recent violence in small cities and towns (such as Littleton, Colorado, Laramie, Wyoming, and Jasper, Texas), this is a time when Americans are searching for the causes of violence in their society. Some are blaming a decline in religious upbringing. Others are blaming households with the parents working and no one minding the kids. Some say the cause is violent movies, violent TV and extremist internet sites, combined with the ready availability of cheap guns. Still others point to a government that has often sanctioned the violence of "gunboat diplomacy" to open foreign markets for U.S. corporations.

No one seems to be asking whether pesticides, fertilizers and toxic metals [see REHW #529, #551] are affecting our young people's mental capacity, emotional balance, and social adjustment. From the work of Warren Porter, Elizabeth Guillette and others, it is apparent that these are valid questions.

--Peter Montague (National Writers Union, UAW Local 1981/AFL-CIO)

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[1] Jack E. Barbash and Elizabeth A. Resek, PESTICIDES IN GROUND WATER (Chelsea, Michigan: Ann Arbor Press, 1996); Richard Wiles and others, TAP WATER BLUES (Washington, D.C.: Environmental Working Group, 1994); Brian A. Cohen and Richard Wiles,

TOUGH TO SWALLOW (Washington, D.C.: Environmental Working Group, 1997); Environmental Working Group, POURING IT ON; NITRATE CONTAMINATION OF DRINKING WATER (Washington, D.C.: Environmental Working Group, 1996). See www.ewg.org. And: Gina M. Solomon and Lawrie Mott, TROUBLE ON THE FARM; GROWING UP WITH PESTICIDES IN AGRICULTURAL COMMUNITIES (New York: Natural Resources Defense Council, October, 1998).

[2] Warren P. Porter, James W. Jaeger and Ian H. Carlson, "Endocrine, immune and behavioral effects of aldicarb (carbamate), atrazine (triazine) and nitrate (fertilizer) mixtures at groundwater concentrations," TOXICOLOGY AND INDUSTRIAL HEALTH Vol. 15, Nos. 1 and 2 (1999), pgs. 133-150.

[3] C.A. Boyd, M.H. Weiler and W.P. Porter, "Behavioral and neurochemical changes associated with chronic exposure to low-level concentration of pesticide mixtures," JOURNAL OF TOXICOLOGY AND ENVIRONMENTAL HEALTH Vol. 30, No. 3 (July 1990), pgs. 209-221.

[4] W.P. Porter and others, "Groundwater pesticides: interactive effects of low concentrations of carbamates aldicarb and methamyl and the triazine metribuzin on thyroxine and somatotropin levels in white rats," JOURNAL OF TOXICOLOGY AND ENVIRONMENTAL HEALTH Vol. 40, No. 1 (September 1993), pgs. 15-34. And see: W.P. Porter and others, "Toxicant-disease-environment interactions associated with suppression of immune system, growth, and reproduction," SCIENCE Vol. 224, No. 4652 (June 1, 1984), pgs. 1014-1017.

[5] Keith Hamm, "What's In the Mix?" SANTA BARBARA [CALIFORNIA] INDEPENDENT April 15, 1999, pg. 21 and following pages. See www.independent.com/007/001/002.html. Thanks to George Rauh for alerting us to this interview.

[6] Elizabeth A. Guillette and others, "An Anthropological Approach to the Evaluation of Preschool Children Exposed to Pesticides in Mexico," ENVIRONMENTAL HEALTH PERSPECTIVES Vol. 106, No. 6 (June 1998), pgs. 347- 353.

Descriptor terms: violence; hormones; thyroid hormone; development; aggression; chemicals and behavior; behavior and chemicals; delinquency; studies; mexico; warren p. porter; elizabeth guillette; adhd; attention disorders; hyperactivity; learning disabilities; brain development; emotional stability;

Rachel's Environment & Health Weekly is a publication of the Environmental Research

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