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Getting Sucker-Punched by Pesticides

Are low doses of weed & insect killers hitting our children when they are least able to fight back?

By Brian DeVore

Warren Porter, thankfully, likes to use down-to-earth analogies to describe complicated concepts.

That's good, because the University of Wisconsin professor of zoology and environmental toxicology is often speaking about a subject that is anything but simple: the effects of pesticides on developing biological systems. Or, to put it plainly, what might happen when a baby is exposed to weed and insect killers while still curled up deep in the womb?

Well, try this sample explanation on for size: "During a two day window, key parts of the brain are developed in a baby," says Porter. "If the mom is struck by certain chemicals at that window of opportunity, it may affect development permanently."

Or this: "Imagine if you are a boxer standing in the ring and a professional fighter steps in. He smiles at you and holds out his hands so you relax. Then he punches you in the gut. That's like a sudden short-term exposure to toxic chemicals. We get punched in the gut when our chemical defenses are down."

Scientists like Porter are becoming increasingly alarmed about the possibility that even low levels of pesticide exposure at key points in the development of a child may negatively affect his or her ability to learn, reproduce or just plain get along with others. It's a relatively new, contentious theory that has the scientific community agreeing on only one point: not nearly enough research has been done in this area.

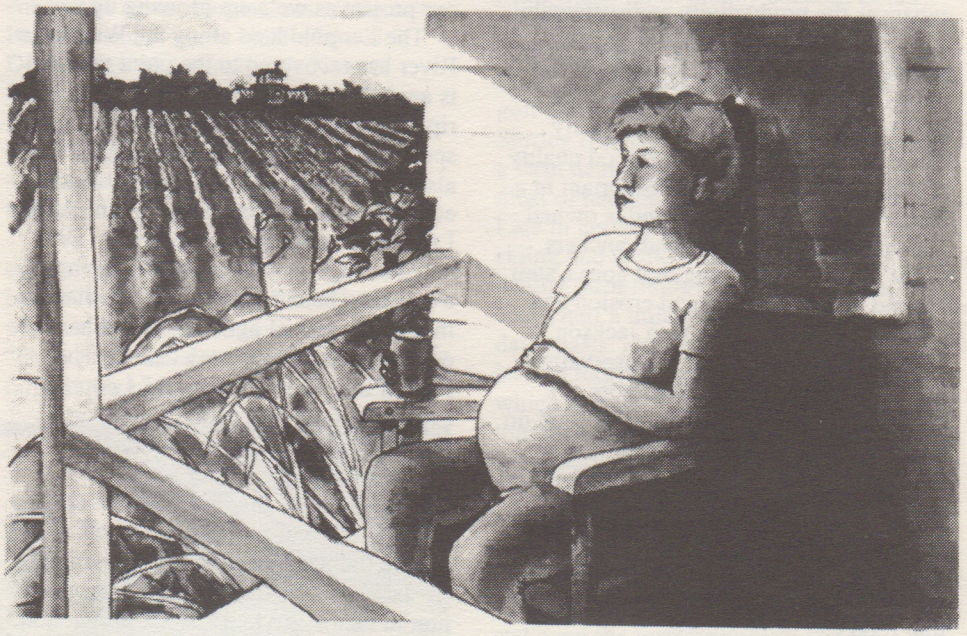

Illustration by Rebecca Schon Kilde

It has huge implications for an agricultural system that has become more dependent than ever on the use of pest-killing chemicals. Despite more precise spraying techniques and chemical industry rhetoric about a kinder, gentler "crop protection" system, we are pouring on more pesticides than ever. In 1995, a record 1.2 billion pounds of pesticides were used on this country's farm fields (three-quarters of all pesticides are used in agriculture), more than twice as much as was used when Rachel Carson's *Silent Spring* sounded the alarm about pesticides and biological systems three decades ago. The Midwest is ground zero for this increased use. More than 90 percent of

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row crops such as corn, soybeans and cotton are treated with pesticides. Almost three-quarters of all herbicides are applied to corn and soybeans alone.

Concern over the health effects of exposure to pesticides — chemicals that kill weeds, insects and funguses through various means — is nothing new. Dozens of studies have made connections between pesticide exposure and various forms of cancer. Farmers who apply these chemicals directly appear to be particularly susceptible.

In general, the jury is still out on what chronic, years-long exposure to chemicals — either through repeated use on the farm or consumption at the dinner table — can do to the human body. But a new, perhaps scarier, chemical smoking gun is emerging in the scientific literature, and in rural communities.

Low dose danger

Porter has been studying the effects of pesticides on the development of mammals since the early 1980s. He has become increasingly alarmed over the negative impact seemingly "safe" levels of these chemicals have on development, growth and reproduction. He is among a growing group of toxicologists who believe short-term "pulse" doses of these chemical mixtures — some at levels never before considered toxic — can in some cases have a more negative impact than long-term, high dose exposure.

A biological system may never get that "pulse," or "burst" of chemical exposure again, but the damage has been done, says Porter. Toxicologists are particularly concerned about the effect of pulse doses of chemicals on the thyroid system. This system regulates metabolism, determining a person's very disposition.

One experiment Porter conducted involved exposing rats to doses of common insecticides and herbicides. Some of those doses were at levels that are present in Midwestern drinking water. He found that exposing the animals for as short a time as six weeks made their thyroids overly active, in effect making them hyper.

In a 1994 article for *Environmental Health Perspectives*, endocrinologist Susan Porterfield concluded that exposure to chemicals such as PCBs and dioxins during key times of a human fetus' development can have disastrous effects.

A mother may show no health problems as a result of a certain levels of exposure, but she's in a different state of susceptibility than her baby. Thus, the baby could be negatively affected by doses that are harmless to adults, Porterfield wrote.

The effects of low doses of chemicals on human development has come front and center since the publication of *Our Stolen Future* in 1996. This book laid out evidence that low levels of pesticides and other toxic chemicals may be disrupting the endocrine system in animals, and pose a real threat to human beings. To grasp the importance of such a disruption, consider that the endocrine system controls the key development engines in our body, including systems that manage growth, development and reproduction.

The book summarized growing evidence that "endocrine-disrupting" chemicals cause reproductive abnormalities, reduced fertility, behavioral abnormalities and population declines — particularly in top predators.

Chemical companies became particularly nervous early last year when Frederick vom Saal, a researcher at the University of Missouri, found that extremely low doses of a plastics component altered the reproductive development of lab mice. How low were the doses? Near those that humans are exposed to each day from sources like food packaging and dental sealants.

In short, the old saw "the dose makes the poison" is in need of some modification, say toxicology experts.

"Yeah, the dose does make the poison, but that dose is different for different people," says Vincent Garry, director of environmental medicine and pathology at the University of Minnesota's medical school.

Birth of a problem

But no matter how scientifically relevant experiments on lab animals may be, the real question in the minds of policy makers and the general public is what these chemicals are doing to humans.

That's why Vincent Garry's research is so intriguing. His study medium isn't the lab animal. It's the river of records produced by our society's desire to document everything from a baby's birth weight to the kind of weed killer his or her father used on his corn acres the month it was conceived.

Garry has been researching pesticides in one form or another for almost 40 years. For the past decade, he's been studying the health records of people within Minnesota who are licensed to apply these chemicals. That includes any farmer who uses pesticides, as well as commercial applicators who work for coops and other agriculture supply services. In 1996, he and his colleagues published research results that would send chills down the spine of anyone who has raised children in a rural area.

The results were based on records of babies born to licensed private pesticide applicators between 1989 and 1992. The almost 35,000 private pesticide users present in the state during that period produced 4,935 live births. The study compared the health of those babies to the health of all 210,723 babies born in the state during the same three-year period.

In western Minnesota, where intensive production of wheat, sugar beets and potatoes leads to heavy use of chemicals, on average 30 out of every 1,000 children born to pesticide applicators had some sort of defect at birth during the study period. The birth defect rate for the general population in that part of the state was 26.9 per 1,000 births. In areas of the state where agricultural chemicals are not used extensively, the general population's birth defect rate was 18 per 1,000 children during the study period.

In areas of heavy pesticide use, 19.8 of 1,000 babies conceived during the spring of 1991 had defects. The birth defect ratio for autumn-conceived babies in those same areas was almost half that. In the Midwest, spring planting season is when the majority of pesticides are applied.

These results have frightening implications for connections between pesticide use and birth defects, especially because they echo results of similar analyses done in Iowa and Nebraska. But Garry says nothing definitive has been nailed down yet.

"I think pesticides are a contributor to these birth defects, but I don't know how much of a contributor," he says, adding that the fact that birth defect rates seem to go up in babies conceived in the spring is of particular concern. "There are so many different avenues for birth defects to occur. You can have too much of this. Too little of that."

Birth defects recorded during the study period included circulation, respiration and urogenital problems, as well as malformed muscles, bones and skin. It

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should be noted that these kinds of defects can be caused by several factors, including diet, genetics and stress.

That's why Garry and his team have spent the past two years following up with a more intense study of a 1,500-member subgroup of the licensed applicators. Using personal interviews, questionnaires, medical records and family histories, the pathologists are trying to determine what other factors may contribute to the defects.

Question & answer time

For now, toxicologists working in this emerging field are coming up with more questions than answers.

For one, how do toxins enter our bodies? Most people associate pesticide exposure to the amount of herbicide spray left on vegetables once they reach the supper table. As a result, laboratory studies focus on ingestion through the mouth, or even direct injection into the bloodstream. But what about intake via drinking water, breathing contaminated air or absorbing it through the skin?

And in an attempt to make pesticides less of a threat to our ground water, chemical companies are making their products more volatile. That means they dissipate in the atmosphere quicker after being sprayed on a field, instead of hanging around long enough to be washed into a river during the next rain storm. But such volatility could make it easier for these chemicals to enter our bodies through the skin or the respiratory system.

Are pregnant women, with their higher water retention and respiration rates, more likely to take in toxic levels? Garry has been wondering that since 1987, when he investigated the tragic death of a 24-year-old woman who was seven months pregnant. Within a few hours of being exposed to a pile of grain saturated with an aluminum-phosphide-based bug killing fumigate, the woman went into cardiac arrest and died. Garry's investigation raised questions about whether a pregnant woman's altered metabolism increases her intake of toxins. But 11 years later, the question remains relatively unstudied.

Toxicologists are also concerned about the hidden contents of poorly labeled pesticide containers. These are the preservatives, anti-volatility agents, emulsifiers, solvents and other ingredients that help the pesticide more effectively do its job. Chemical companies clump all these components together and simply call them "inert ingredients," implying they have no pesticidal qualities. However, tests conducted by government laboratories have shown that many of these secret ingredients are carcinogenic or otherwise toxic. Some have even been banned as "active" pesticide ingredients.

Finally, what about the effects of combinations of chemicals? After all, a spring planting season in corn country can send half a dozen or more pesticides into the environment. One Tulane University study produced some alarming results in relation to the "multiplier effect" of being exposed to several chemicals at once. That study was retracted last year when the results couldn't be replicated. However, toxicologists point out that we've long known that we can't take certain pharmaceutical drugs in combination, so why should pesticides be any different?

These are important questions to ask as agricultural pesticides make their presence known virtually everywhere. DDT, banned in this country for more than a quarter century, keeps showing up in the Great Lakes region. Traces of other pesticides are found on the polar ice caps.

"This is a worldwide problem," says Porter, the University of Wisconsin toxicologist. "You don't have to live next to where herbicides are being applied to be affected."

Despite their global reach, attempts to regulate pesticides here and abroad have met with mixed results.

Bugging out on pesticides

But it's not just scientists and lawmakers that have a responsibility to get at the bottom of what these pesticides are doing to future generations.

Garry says consumers should diversify their diet as much as possible — both to improve general health and to make sure the body isn't exposed to the same toxins repeatedly. He also suggests that pregnant women be aware of their surroundings. Are pesticides being sprayed on your lawn or garden? What is the source of the produce in your grocery store? And finally, what incentives are farmers being given to raise pesticide-free food?

"There is a very simple solution to this problem," says Porter. "It's called market share. All people have to do is change how they spend their money." ❐

A researcher's dream

One common complaint of researchers, policy makers, farmers and consumers who are trying to decipher the impact pesticides have on human beings laments the lack of studies that take into account real world situations. University of Wisconsin toxicology expert Warren Porter has developed a list of six common problems with typical toxic dose tests. He's tagged these problems with the acronym **DREAMS**:

✔ **D=Dosing deficiency**. The dosing in most experiments is chronic, rather than in a "pulse" or "punch" situation such as what a fetus might be exposed to. Chronic exposure may even give the body an opportunity to build up a resistance, argues Porter.

✔ **R=Routes restricted**. Often in experiments on laboratory animals the chemicals are injected or put in the food and water. What about testing inhalation or absorption through skin?

✔ **E=Endpoints excessive.** Scientists spend a lot of time and energy looking at what impact (cancer, mutations) chemicals have at the end of a life cycle. We should direct more resources toward examining the early developmental stages when toxic exposure can affect immune, neurological and hormonal systems.

✔ **A=Additions absent**. Dosage tests often only take into account the chemical ingredients listed on the pesticide container by name. Chemical companies also use other toxins which are grouped under the general term "inert ingredients."

✔ **M=Mixtures missing.** More studies are needed that take a look at the effects of pesticide mixtures. In the real world, there are lots of opportunities for chemicals to mix in the field — and in turn in the human body. It would be impossible to test all of the tens of thousands of possible mixes that can occur, but some common ones should be targeted.

✔ **S=Stresses are squelched.** Lab studies normally involve animals living under very healthy, sterile conditions. But in the real world, animals and people are often exposed to toxins when they are at their most vulnerable — when they are malnourished, cold, sick or very young.