Pesticides and You

News from Beyond Pesticides: Protecting Health and the Environment with Science, Policy and Action

Volume 28, Number 1 Spring 2008

Pesticides Trigger Parkinson's Disease

Wood Preservatives Avoid the Axe ■ Pesticides That Disrupt Endocrine System Still Unregulated by EPA ■ Clearing the Air of Toxic Moth Repellents ■ Resources - Healthy Child Healthy World: Creating A Cleaner, Greener, Safer Home; and other books on raising healthy children

Ignoring the (Startling) Facts

A politicized EPA travels a path out-of-step with the big public health issues

This issue of *Pesticides and You* captures the startling science on pesticides and Parkinson's disease at a period when political tactics to downplay pesticide hazard identification and regulation has reached a new high. Beyond Pesticides tracks the science on pesticides on a daily basis in our *Daily News Blog*, specifically shining a light on the range of scientific and political issues that we confront. But, it is not until you step back that things come into focus; and, that is what we did with the highly elevated Parkinson's disease rates associated with pesticide exposure. In the on-line version of the article in this issue we provide citations for the 144 studies we discuss.

Like other disease outcomes, the data connecting Parkinson's to pesticides should give us pause --and then our sense of outrage should kick in, advocacy skills take over, and campaigns to ban toxic pesticides ramp up.

The new information in this issue can be viewed with a sense of optimism --because as the science on pesticide hazards keeps pouring in, and as the politics try to overwhelm the science, there is a strengthened basis for challenging current thinking and regulatory failures, and new justification for just saying *no* to toxics in our communities, and *yes* to non-toxic practices, products, and precautionary policies. We have come to expect recent events like those with bisphenol A (BPA) in plastic bottles, where EPA is on the sidelines watching the BPA-plastic bottle market crash, as consumers react, retailers pull products from their shelves, manufacturers begin recalls, and state legislatures and even Congress discuss bans.

GAO to Congress: Take Politics Out of EPA Risk Assessment

As consumers take measures into their own hands, the Union of Concerned Scientists, reported in this issue, released its findings that 889 of nearly 1,600 EPA staff scientists say that they have experienced political interference in their work over the last five years. Then the U.S. Government Accountability Office (GAO) testified before Congress on April 29, 2008 that EPA's risk review process is plagued by delays, a lack of transparency, and interference from the White House and other agencies. In short, GAO concludes that the agency's science is politicized, outdated, secret, and threatens the protection of people and the environment from harmful chemical exposures. GAO cites a lengthy assessment process, and a lack of transparency practices that are needed to "provide assurance that IRIS [Integrated Risk Information System] assessments are appropriately based on the best available science and that they are not inappropriately biased by policy considerations." GAO cites cases where the White House terminated reviews. The testimony cites the dioxin assessment as an "example of an IRIS assessment that has been, and will likely continue to be, a political as well as a scientific issue."

Wood Preservatives Avoid the Axe

In a politicized science context, EPA published its revised risk assessment in April for the most toxic chemicals and their contaminants known to humankind --persistent organic pollutants. Despite decades of review and reversals of earlier analyses, in finding acceptable the continuing use of toxic utility poles and railroad ties, EPA dismisses the human health hazards with the statement, "Where utility poles are installed on home/school or other residential sites, child contact via the dermal or oral routes is not anticipated since play activities with or around these pole structures would not normally occur. . ." How ludicrous! There is a public comment period, cited in this issue, and we are launching a photo campaign in which we ask you to help introduce reality into risk assessment by sending EPA photos of people and animals coming into contact with utility poles in communities. Clearly, the failure to successfully litigate to force EPA protection of public health in this arena, which Beyond Pesticides has done, illustrates that the underlying law governing pesticides, the *Federal Insecticide, Fungicide and Rodenticide Act* (FIFRA), is severely broken and in need of serious reform. Until that time, the registration and risk assessment of pesticides can offer the public no confidence in product safety.

Endocrine Disruptors

When we went back to check-in with EPA's 11-year old statutory mandate to evaluate pesticides that cause endocrine disruption, we found that despite scientific concern about human and aquatic toxicity, EPA still does not have its endocrine system review protocol in place and its list of 73 pesticides and inert ingredients to be reviewed at some date in the future contains only 29 chemicals that are identified as known or suspected endocrine disruptors by other scientific bodies. Why wouldn't EPA start its review with already suspected chemical endocrine disruptors identified by the European Union and scientists?

Farm Bill

In light of these mounting and seemingly unending deficiencies, we jumped into high gear to strike from the final Farm Bill a provision (included in the House version) that would prohibit the Secretary of Agriculture, in carrying out USDA's conservation programs, from "discriminating against" pesticides. With this provision, pushed by the pesticide industry, USDA would be prohibited from assisting farmers to avoid poorly regulated pesticides that are contaminating the environment. We helped rally over 60 organizations in opposition and are, at press time, waiting on the final outcome.

Doing without Toxic Pesticides

This all adds up to the increasingly dramatic need to avoid toxic pesticides. So, we again, in this issue, provide some practical solutions for managing insects where we do not want them, namely clothes moths in our closets. Our approach is to assist in identifying the underlying cause of pest problems and then advise corrective measures. The non-toxic solutions are within reach!

Jay Feldman is executive director of Beyond Pesticides.

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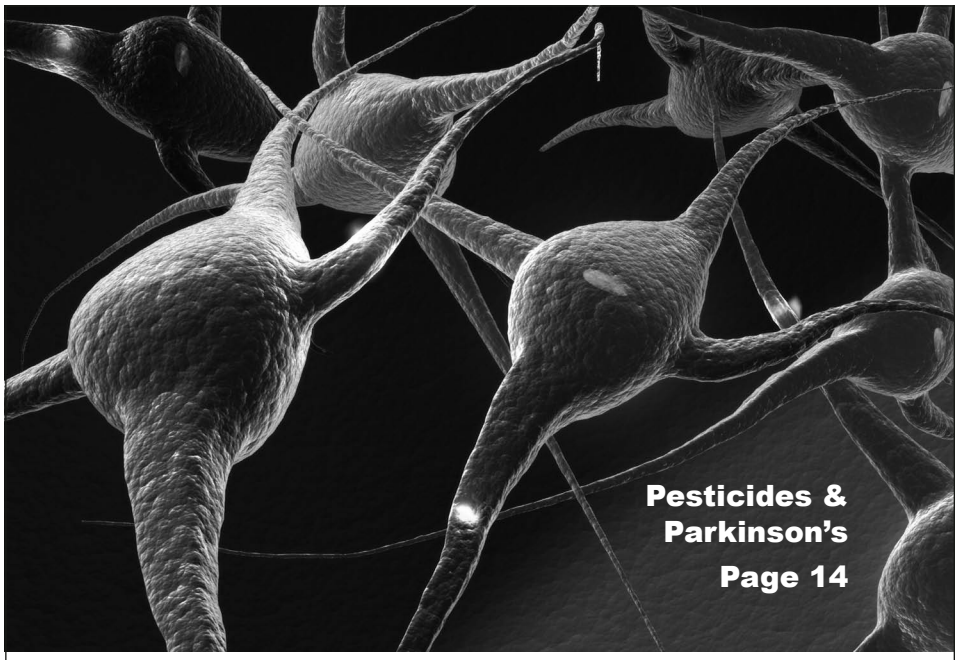

Printed on 100% post consumer waste with soy inks.

Pesticides and You © 2008 (ISSN 0896-7253) is published 4 times a year by Beyond Pesticides. Beyond Pesticides, founded in 1981 as the National Coalition Against the Misuse of Pesticides (NCAMP), is a voice for health and the environment, promoting protection from pesticides and safe alternatives; donations are tax-deductible.

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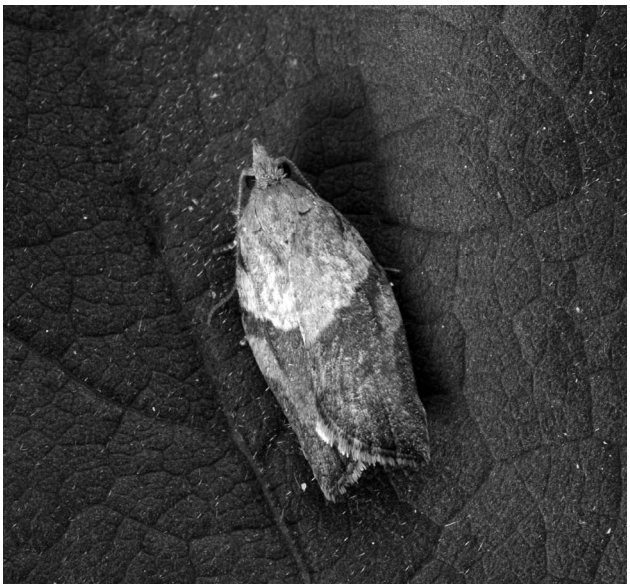
Stop Sprays for Light Brown Apple Moth

Could you please post information on your site concerning the planned aerial spraying of Santa Cruz, Monterey, and the entire San Francisco bay area in California to eradicate the light brown apple moth (LBAM).

In Fall 2007, the California Department of Food and Agriculture (CDFA) aerial sprayed our Santa Cruz and Monterey neighborhoods with an unregistered pheromone pesticide. With an emergency exemption, they were able to bypass health and environmental impact studies.

There has been virtually no national media coverage on this issue. In the meantime, people here are fighting it and CDFA threatens us that if we don't cool out that they will spray us with *Bacillus Thurengensis* (Bt) too. The current plan is to start spraying Santa Cruz and Monterey June 1, every 30 days for up to 10 years. They will begin spraying the rest of the bay area in August. It is a very complex and political situation. To learn more, please see www.stopthespray.org and check out the forum section and please sign and distribute the petition. Thank you for your time.

Jenny,
Santa Cruz, CA



Light Brown Apple Moth, *photo: www.moths-of-holme.info*

Thank you for your email regarding LBAM. We have been following developments in California since spraying began last fall, including regularly updating our Daily News blog with announcements as they happen. (You can reach our LBAM archive here: www.beyondpesticides.org/dailynewsblog/?cat=101. We also held an organizing session at our 26th Annual National Pesticide Forum in Berkeley, California on March 15. Beyond Pesticides advocates for full disclosure of all pesticide product ingredients, including so-called inert ingredients, questions the efficacy of aerial applications of any pesticide that, by their nature, cause unnecessary exposure, and is urging targeted ground efforts only as a last resort.

CDFA has established a range of options that can be used in lieu of aerial spray, including natural predators. Little research has been done on the pheromone product, CheckMate, and we do not agree with widespread use before determining health and environmental impacts (such as on threatened butterflies). We appreciate the potential effect LBAM may have on California's agriculture, but until that threat and the comparative costs of aerial spraying are fully assessed, we urge CDFA to choose a less experimental approach.

Beyond Pesticides Daily News Blog

Below are blog comments we've recently received on LBAM

JSutton Says:

I was in Sacramento at the Agricultural Committee meeting. The two bills they approved will not stop the plan to spray the Bay Area from being implemented. I was discouraged to see the impassive faces of many of the committee members (even in the face of pleading mothers with babies, seniors, disabled people, etc.) and I realize that they represent big agricultural interests, not the people. The only way that we can influence legislators is to make them believe that a decision to spray will affect their political status. Jerry Brown is planning to run for governor. How about appealing to him? Perhaps he can do something to help, and this would get him many hundreds of thousands of votes from grateful Californians. You can leave him a message on his 800 line.

Gilbert Says:

My daughter has been diagnosed with a genetic condition that limits her body's ability to eliminate environmental toxins from her system. Repeated exposure to the inert ingredients in CheckMate would likely lead to my daughter developing some form of cancer. Our options are to (a) keep my daughter indoors for the entire summer, (b) temporarily move outside the area during the spraying, (c) move out of the area altogether. If the folks in Sacramento are worried about economic impacts, perhaps they should consider declining real estate, loss of tax revenue, and loss of the tourist trade?

Keeping Poisons Away from Pets

I am a pet owner whose dog had an adverse reaction to the flea control product, Frontline Plus. Frontline (made by Merial Limited), is the best-selling flea and tick product in the world. Frontline contains the insecticide fipronil and I believe that it is responsible for causing hundreds or thousands of severe adverse reactions in pets each year. It also has the potential to cause harm in humans, especially young children who play or sleep with treated pets. Merial promotes Frontline as being "gentle" and "non systemic" to animals, but there are many scientific studies which show that fipronil has adverse effects on the nervous systems of people and animals.

Here is the address for a website that features pets' adverse reactions to flea control products: www.elversonpuzzle.com/biospot.html. The webmaster's contact information is James Terbush, james@elversonpuzzle.com. He is very involved in the collection of scientific data revealing the harmful effects of these products. He has assisted me a great deal with research for this case.

As an organization that promotes safe environmental living standards I wonder if you are interested in learning more abut this toxic animal treatment product. I have completed significant research in the area of fipronil's toxic effects on mammals and can supply you with such in addition to contact information with other pet owners whose animals have suffered as well. This case was under the guidance of a suburban Philadelphia law firm, which had it for almost one year and then decided not to file. They felt that individual cases would be difficult to 'prove,' despite a wealth of knowledge. The statue of limitations only allows me until August 2008 to file. I am having difficulty locating a firm that is interested in taking this case, perhaps hesitant to go up against Big-Pharma. I was wondering if you could assist in recommending a potential litigator. Thank you in advance for your consideration.

-- Jan, Philadelphia, PA.

Dear Jan,

Thank you for sharing your experience with toxic pet products. Fipronil is, indeed, both common to pet products and reports of pet reactions, but is also used in products designed for use against insects like cockroaches and ants. You can find more information on its health and environmental effects in our fact sheet, which you can find online at www.beyondpesticides.org/pesticides/factsheets/Fipronil.pdf.

Safe treatment for your pets is important, and products like fipronil are not necessary to keep away ticks, fleas, and other pests they may pick up. Our Fall 2007 issue of Pesticides and You featured an article called "Pesticides and Pets: What you should know to keep your pets safe." If you did not receive that issue, the article is available online at www.beyondpesticides.org/infoservices/pesticidesandyou/Fall%2007/pets.pdf.

Poisoning cases can be difficult to litigate, given the cost and the burden to prove causation. An impediment to litigation in these cases was lifted in April 2007 when the Supreme Court in Bates v. Dow ruled that registration of pesticide products like Frontline does not preempt the right to sue (see Pesticides and You Vol. 25 no. 1). Even so, the cases require expert testimony and medical assessments, with ample science and regulatory background. It is our hope that more attorneys will see the opportunity to litigate in cases like yours and others, especially in light of an inadequate EPA regulatory system that allows dangerous products on the market. We have found that attorneys with a sense of outrage about the widespread availability of poisonous pesticide products on the market will collaborate with those who find themselves to be victims. With the research that you have assembled, you can assist any attorney with assembling the scientific and regulatory background necessary to move a case like this forward. For additional advice, we suggest that you contact Bishop Dansby, Esq., 540- 269-2541, bishdansby@earthlink.net. For additional information, please don't hesitate to get back in touch with us.

Speak Your Mind!

Whether you love us, disagree with us or just want to speak your mind, we want to hear from you. All mail must have a daytime phone and verifiable address. Space is limited so some mail may not be printed. Mail that is printed will be edited for length and clarity. Please address your mail to:

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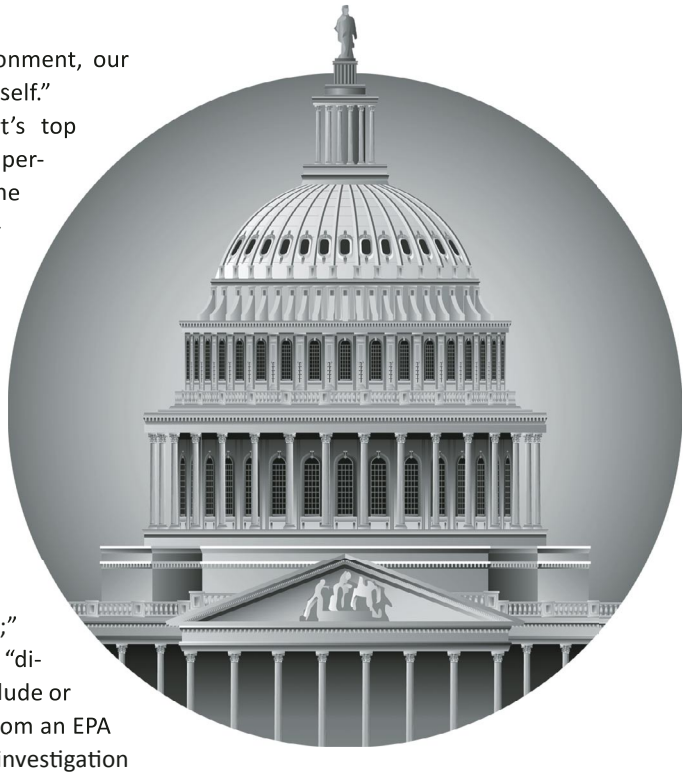
info@beyondpesticides.org, fax: 202-543-4791

Hundreds of EPA Scientists Report Political Interference

An investigation of the Environmental Protection Agency (EPA) released April 23, 2008 finds that 889 of nearly 1,600 staff scientists report that they have experienced political interference in their work over the last five years. The report, *Interference at EPA: Science and Policies at the U.S. Environmental Protection Agency*, by the Union of Concerned Scientists (UCS), sparked the setting up of a May congressional oversight hearing on the issue. The study follows previous UCS investigations of the Food and Drug Administration, Fish and Wildlife Service, National Oceanic and Atmospheric Administration, and climate scientists at seven federal agencies, which also found significant administration manipulation of federal science. "Our investigation found an agency in crisis," said Francesca Grifo, director of UCS's Scientific Integrity Program. "Nearly 900 EPA scientists reported political interference in their scientific work. That's 900 too many. Distorting science to accommodate a narrow political agenda threatens our environment, our health, and our democracy itself."



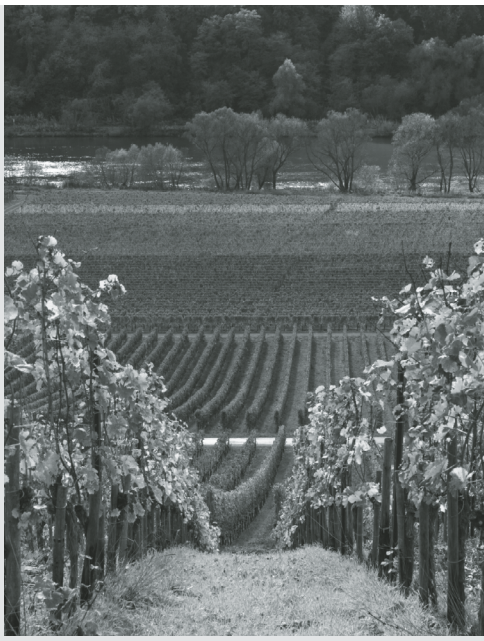
Among the UCS report's top findings: 60% say they have personally experience at least one instance of political interference in their work over the last five years; 31% personally experienced frequent or occasional "statements by EPA officials that misrepresent scientists' findings;" 22% say they frequently or occasionally personally experience "selective or incomplete use of data to justify a specific regulatory outcome;" and, 17% say they have been "directed to inappropriately exclude or alter technical information from an EPA scientific document." UCS's investigation reveals political interference is most pronounced in offices where scientists write regulations and at the National Center for Environmental Assessment, where scientists conduct risk assessments that could lead to strengthened regulations. "Scientific integrity is the bedrock on which the federal science establishment must rest," said Bill Hirzy, Ph.D., an EPA senior scientist and senior vice president of the National Treasury Employees Union, Chapter 280, the union that represents EPA scientists. *For more information on the report and suggested action, go the UCS website. http://www.ucsusa.org/scientificfreedom.*

Lawsuit Challenges EPA on Four Deadly Pesticides

On April 4, 2008, a coalition of farmworker advocates and environmental groups filed a lawsuit against the Environmental Protection Agency (EPA) to stop the continued use of four deadly organophosphate pesticides: methidathion, oxydemeton-methyl, methamidophos, and ethoprop. They are used on a wide variety of fruit, vegetable, and nut crops. "These four pesticides put thousands of farmworkers and their families at risk of serious illness every year," said Patti Goldman, Earthjustice attorney on the suit. "It is inexcusable for EPA to allow use of pesticides that they know are harming people, especially children."

EPA has documented that children are especially susceptible to poisoning from organophosphates. They are acutely toxic and cause systemic illnesses to humans and wildlife by inhibiting the ability to produce cholinesterase, an enzyme necessary for the proper transmission of nerve impulses. Symptoms of cholinesterase inhibition include dizziness, vomiting, convulsions, numbness in the limbs, loss of intellectual functioning, and death. Some organophosphates also cause hormone disruption, birth defects, and cancer. EPA has long recognized that the four organophosphates can poison farmworkers. However, in 2002 and 2006, EPA decided that growers could continue using these poisons without considering the risks posed to rural children and families when these pesticides drift into schoolyards, outdoor play areas, and homes. The lawsuit was brought by Earthjustice and Farmworker Justice on behalf of labor, environmental and public health groups, including Beyond Pesticides.

Activists Fight Pro-Pesticide Provision Passed in House Version of the Farm Bill

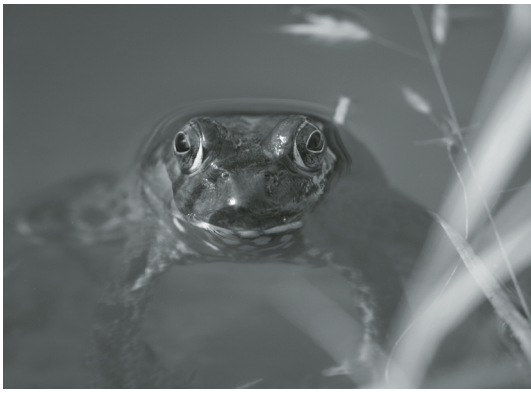


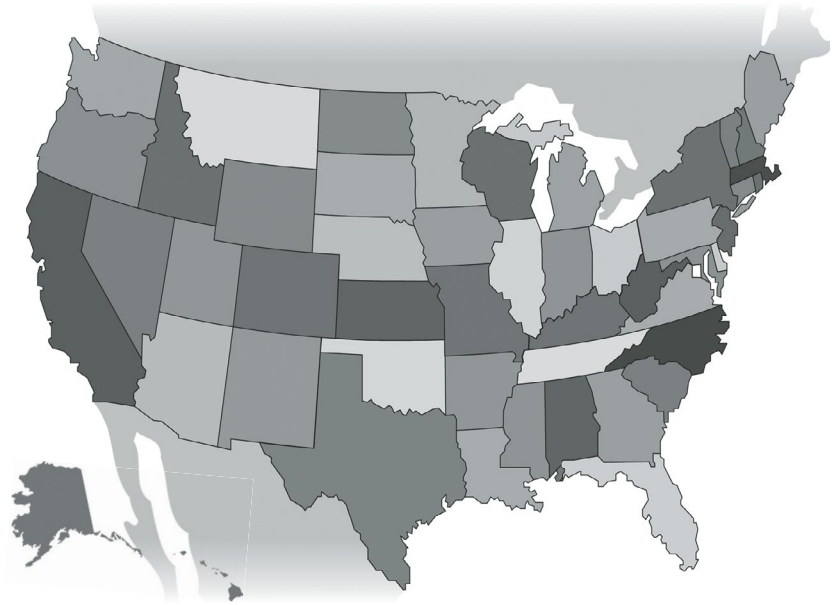
Beyond Pesticides, along with dozens of environmental, farm and public health groups and grassroots activists, has led a campaign to strike a chemical industry inspired provision in the Farm Bill that would restrict future U.S. Department of Agriculture (USDA) efforts to control pesticides. The provision, and other substitute amendments, would stop USDA from curtailing hazardous pesticide use through its conservation programs, either by targeting specific contaminants that are poisoning water or hurting wildlife, or facilitating a transition to organic practices. The provision as passed in the House version of the Farm Bill read, "The Secretary shall not discriminate against [or "prohibit" in substitute language] the use of specific registered pesticides or classes of pesticides as a pre-condition for participation in programs under that [conservation] subtitle." Over 70 farm and food, public health and environmental groups signed a public interest letter to conferees asking that the provision be removed from the final Farm Bill. Members of Congress also sent Senate and House Dear Colleague letters to conferees asking that the provision and similar language be removed.

According to the groups, the authority of USDA to restrict usage of specific pesticides when necessary under its conservation title is critical to long-term sustainability in agriculture, forestry, wildlife and wetlands management, essential in assisting agricultural producers to meet the standards of numerous federal statutes (*Clean Air Act, Safe Drinking Water Act, Clean Water Act, Federal Insecticide, Fungicide and Rodenticide Act, Federal Food Drug and Cosmetic Act* and others), and imperative as the department carries out its responsibility to assist in the transition to organic management systems. There are many instances when USDA may need to utilize its authority to support management practices that implicitly or explicitly seek to reduce contaminants that are adversely affecting the environment and, in the process, ensure continued agricultural viability. For example, to assist agricultural producers to comply with the *Clean Air Act* and Montreal Protocol, USDA has the authority to limit the use of methyl bromide in its conservation programs. Additionally, if the department is to play a role in addressing U.S. Geological Survey (USGS) findings of contaminants in watersheds across the country, the department may need to consider some restrictions on specific pesticide contaminants in the disbursement of its conservation program dollars, according to the groups. At press time, the Farm Bill was still in negotiations.

Intersex Frogs More Common in Suburban Areas

Frogs that live in suburban areas are more likely than their rural counterparts to develop reproductive abnormalities, according to David Skelly, Ph.D., professor of ecology at Yale University. This phenomenon becomes a serious concern as the frog's mating season begins, leaving researchers to wonder if frogs will be clear on their role in the annual ritual? Research by Dr. Skelly, soon to be published, focuses on the common green frog, *Rana clamitans*, within the Connecticut River Valley. A total of 233 frogs were collected from various ponds and landscapes in the river valley and among them 13 percent have abnormalities in their reproductive organs. In urban areas, 18 percent of the collected frogs are intersex, and in suburban areas 21 percent. Frogs collected from agricultural areas have the lowest rate of reproductive problems with just seven percent classified as intersex. According to Dr. Skelly, the more suburban the land cover, the more likely the abnormalities. In an attempt to explain the higher prevalence of intersex frogs in urban and suburban areas, the study notes that many suburban areas use septic systems that may be leaching pharmaceuticals, antibacterial agents and other chemicals into streams or ponds. These areas also have higher rates of using herbicides and insecticides for lawn care and garden treatments. Intersex frogs, also called hermaphroditic frogs, refer to mostly male frogs observed to be producing eggs in their testes. This study, the first of its kind in non-agricultural settings, follows research by Tyrone Hayes, Ph.D. at UC Berkeley, linking the effects to the agricultural herbicide atrazine.





Ag-Mart Settles Pesticide Birth Defect Case

In December 2004, Carlos Candelario was born without arms or legs and with spinal and lung deformities, birth defects almost certainly caused by his mother's exposure to multiple pesticides while working in Ag-Mart Produce fields during her pregnancy. His parents, Francisca Herrera and Abraham Candelario, sued the company in 2006, and the March 2008 settlement will provide for Carlos for the rest of his life. "I am as gratified about this case as any I've ever handled," said attorney Andrew Yaffa. "This child has tremendous needs and needed somebody willing to speak on his behalf. Every medical need will be taken care of as a result of this settlement." According to the lawsuit, Ag-Mart's violations included: spraying fields with workers present; ordering workers to reenter sprayed fields too soon after applications; failing to provide protective equipment; burning used pesticide containers next to fields and workers; applying pesticides up to three times as often as allowed by law; negligently using up to eighteen different chemicals on their crops; and, intentionally ignoring state regulations pertaining to pesticides because "it felt that paying fines to the State was economically less expensive."

Carlos' mother was directed to work in tomato fields without gloves, and chemicals would dye her clothes and stick to her body. Beyond Pesticides board member Routt Reigart, M.D., professor at the Medical University of South Carolina and former chair of the Committee on Environmental Health of the American Academy of Pediatrics, stated in a deposition that he believed Ms. Herrera was "heavily exposed" to a "witch's brew" of pesticides early in her pregnancy. Along with Ms. Herrara, two other pregnant women also had children born with birth defects while working in Ag-Mart's fields during the same season.

Carlos Candelario lays on Ms. Herrera's lap.

Maine Passes GE Crop Bill to Protect Farmers

After much debate on genetically engineered (GE) crops, the Maine legislature passed a bill in April 2008 to protect farmers from genetic trespass. According to the group Protect Maine Farmers, the law prevents lawsuits for patent infringement against farmers who unintentionally end up with GE material in their crops, ensures lawsuits that do occur will be held in the state of Maine, and directs the state Department of Agriculture to develop and implement "Best Management Practices" for growing GE crops. "Maine's farmers now have some substantial assurance that if they save seed that has been contaminated by [GE] varieties, they are not at risk for a lawsuit," said Logan Perkins, the lead organizer for Protect Maine Farmers. "Hopefully, the development of these Best Management Practices will give farmers the information they need to make good decisions about how to protect themselves, their livelihoods and their neighbors when using [GE] crops."

North Dakota, South Dakota and Indiana have already passed similar legislation. In the past 10 years, there have been more than 90 GE-based lawsuits filed against 147 farmers in 25 states, although none in Maine, according to the Center for Food Safety. The passage of the bill comes just weeks after the town of Montville, ME passed an ordinance that makes it unlawful to produce genetically modified organisms for a period of ten years." *For more information on GM crops, visit Beyond Pesticides Genetic Engineering webpage, www.beyondpesticides.org/gmos.*

Report Shows Organic Foods Higher in Nutrients

A comprehensive review of 97 published studies comparing the nutritional quality of organic and conventional foods shows that organic fruits, vegetables and grains contain higher levels of eight of 11 nutrients studied, including significantly greater concentrations of the health-promoting polyphenols and antioxidants. A team of scientists from the University of Florida and Washington State University concludes that organically grown plant-based foods are approximately 25% more nutrient dense, on average, and hence deliver more essential nutrients per serving or calorie consumed. The findings are published in the Organic Centers' report, *New Evidence Confirms the Nutritional Superiority of Plant-based Organic Foods*. This study follows a February 2008 study published in *Environmental Health Perspectives*, which finds children who eat organic diets have less pesticide residues in their bodies.

Nutrient levels were studied in matched pairs of foods for ten nutrients, plus nitrates. Each matched pair contains a crop grown organically and another crop from a nearby chemical-intensive farm with similar soils, climate, plant genetics, irrigation systems, and nitrogen levels. There were 191 matched pairs in which the antioxidant, vitamin and mineral levels are compared. The organic crops are more nutrient dense in 119 of these pairs, or 62%, compared to 36% of the chemical-intensive matched pairs with more nutrients. There are no differences in 2% of the pairs. The chemical-intensive samples contain modestly higher levels of protein in 85% of 27 matched pairs (an advantage), but also much higher levels of nitrates in 83% of 18 matched pairs (a nutritional and food safety disadvantage). Of the 87 matched pairs in which the chemical-intensive food is more nutrient dense, 75% have higher concentrations of potassium, phosphorous, and total protein. In general, compared to vitamins and antioxidants, these nutrients are of less importance because they are present in the average American diet at adequate to excessive levels, according to the report authors. Organic food is more nutrient dense in 75% of the matched pairs comparing total antioxidant capacity, total polyphenols, and two key flavonoids, quercetin and kaempferol.

For more information on the benefits of organic agriculture, see Beyond Pesticides Organic Food webpage, www.beyondpesticides.org/organicfood.

Ontario To Ban Lawn Pesticide Use, Home Depot Stops Sales

Ontario, Canada is moving to reduce exposure to toxic chemicals by banning the sale and cosmetic use of pesticides. Legislation introduced on April 23, 2008 would make Ontario's pesticide rules among the toughest in North America. It also replaces a variety of municipal by-laws in place across the province. Studies by public health experts are showing growing evidence of the potential health risk of pesticides, particularly for children. The ban, which would not affect pesticides used for farming or forestry, would likely take effect next spring. Golf courses would still be able to use pesticides, under certain conditions. "Our generation is becoming more and more aware of the potential risks in our environment, not only to our health, but to our children's health. That's why we're taking action on behalf of the next generation of Ontarians, and reducing their exposure to chemicals," said Premier Dalton McGuinty.

Groups such as the Ontario College of Family Physicians and the Canadian Cancer Society have been calling for a ban on the cosmetic use of pesticides. This new legislation comes after years of petitions from local grassroots movements and health groups to ban all cosmetic use of pesticides across the province because of growing concern about the potential harmful effects of these products on human health. The law would prohibit 80 chemicals and 300 products that experts say pose a potential health risk, including the widely used herbicide, 2,4-D. Similar bans have gone into effect in Toronto and Quebec, and 55 municipalities have also banned cosmetic pesticide use. In the wake of these bans, the Canadian division of Home Depot announced in April that it will stop selling lawn pesticides in its stores by the end of 2008.

Experts Discuss the Greening of Golf Courses

In what it calls the most important article it has ever published, *Golf Digest* in its May 2008 article, "How Green is Golf?" asks the hard questions about the environmental impact of golf in a series of in-depth interviews, including a builder, golf course superintendent, regulator and environmentalist. The article spans a range of opinions on water usage, pesticide contamination, and management practices, with general agreement that golfer expectations and management practices must move and are moving in an environmental direction, citing important ways in which attitudes and understanding must change. Despite the documented problems with pesticides, the head of EPA's pesticide program, in what is described as a "rebuttal" to criticism of pesticides and the pesticide registration process that are highlighted, responds without addressing key specifics identified in the article and preferring to extol the virtues of the EPA's pesticide program.

According to a *Golf Digest* survey of golfers...

91% believe golf is environmentally friendly

85% willing to sacrifice some landscape "perfection" to save water/prevent groundwater pollution

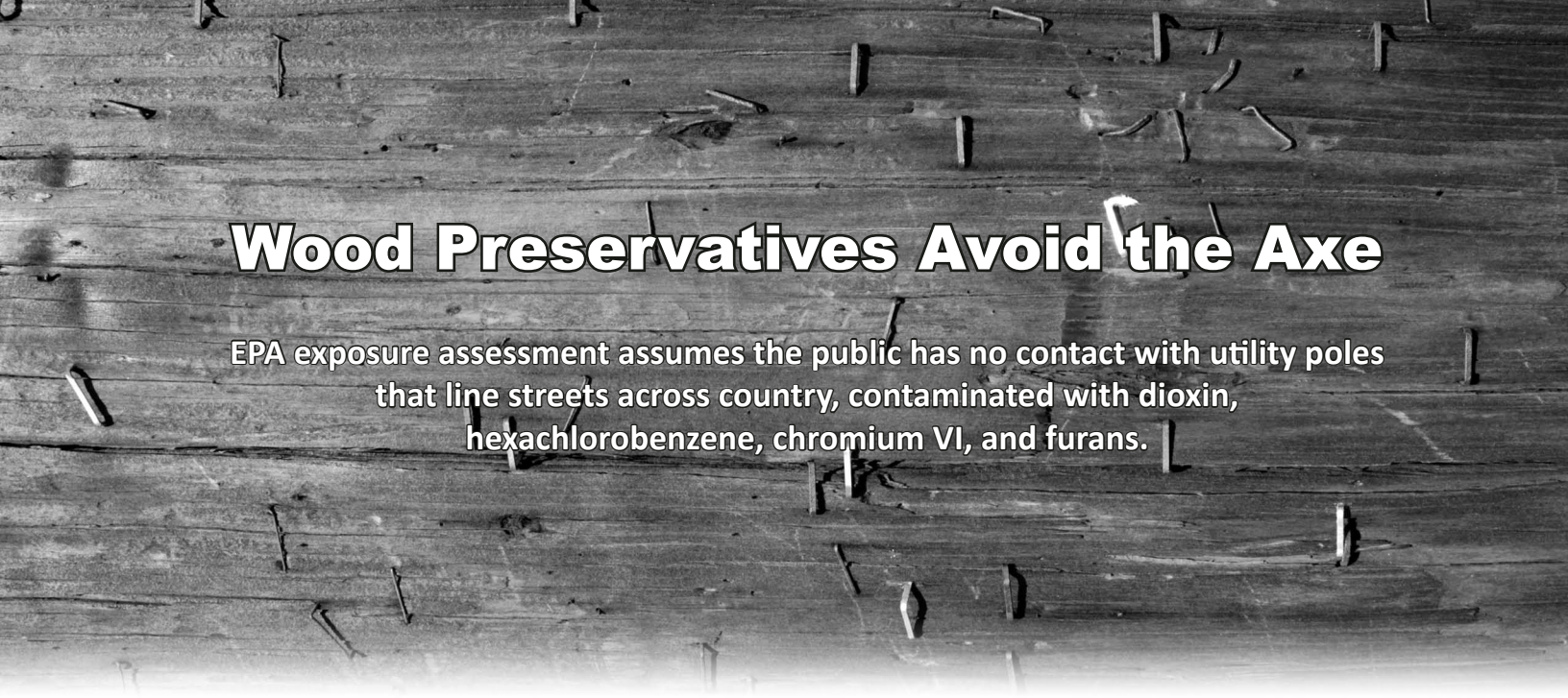
40% believe golf course pesticides are a potential health hazard

In the piece, Jay Feldman, executive director of Beyond Pesticides, points out the hazards of pesticides to human health and the environment and the high degree of inadequate health and safety data, indicting EPA's cumulative risk assessment process, which specifically permits the continued use of the potent nerve poison chlorpyrifos (trade name Dursban) on golf courses (after banning its residential uses in 2000) with the assumption that young children do not play golf. Mr. Feldman urges golfers to play a more active role in developing guidelines and approaches that support golf course superintendents' strategies to avoid toxic chemical use.

EPA's "rebuttal" by Debra Edwards, Ph.D., director of the Office of Pesticide Programs, does not dispute most of the specifics outlined in the Feldman interview. Instead, she uses her space on the *Golf Digest* website to offer a boilerplate characterization of the pesticide registration program. "[E]PA bases its decisions to register pesticides for use in the United States on scientific data showing that the pesticides meet applicable safety standards to protect human health and the environment when used as directed on product labeling," Dr. Edwards says. She refers to "rigorous risk assessment" and "uncertainty factors" without addressing the deficiency of false assumptions, such as young children not playing golf, and lack of attention to synergistic effects and mixtures.

Some say that the debate with EPA is becoming increasingly irrelevant as the market moves ahead to address key issues of environmental health. This has happened in the food and agriculture sector where organic food has grown to a nearly $20 billion industry. Most non-golfers (66%), according to a 2007 *Golf Digest* survey, understand that pesticides used on golf courses can be a health hazard. This number has doubled since the magazine conducted a similar survey in 1994. A majority, or 64%, of golfers is willing to "play golf under less manicured conditions to minimize the use of pesticides on the course." An even greater majority, 85%, is willing to "sacrifice some level of golf course landscape "perfection" to save water/prevent groundwater pollution."

To read the full article and Beyond Pesticides analysis of EPA's "rebuttal," visit Beyond Pesticides Golf and the Environment webpage, www.beyondpesticides.org/golf.



Wood Preservatives Avoid the Axe

EPA exposure assessment assumes the public has no contact with utility poles that line streets across country, contaminated with dioxin, hexachlorobenzene, chromium VI, and furans.

The U.S. Environmental Protection Agency (EPA) released for public comment, on April 16, 2008, its revised risk assessments for three heavy-duty toxic chemical wood preservatives: chromated copper arsenate (CCA), pentachlorophenol (PCP), and creosote. Beyond Pesticides has maintained that the hazards associated with the use, storage and disposal of these three chemicals are unnecessary, given the availability of alternative materials. Chromated arsenicals, such as (CCA), were phased out in 2002 for treatment of decks and patios, picnic tables, playground equipment, walkways/boardwalks, landscaping timbers, and fencing, and continue to be used on utility poles and wood treated for industrial purposes. The arsenic in CCA is a known human carcinogen and has been linked to nervous system damage and birth defects. It also contains chromium VI another potent carcinogen. Creosote, a complex mixture of many chemicals, is a carcinogen and mutagen. PCP, also a carcinogen, is already banned in several countries due to health or environmental risks under the Stockholm Convention on Persistent Organic Pollutants, which the U.S. signed in 2001, but has failed to ratify. PCP and its contaminants are classified as a "persistent organic pollutants" by the United Nations Environment Programme ("UNEP"). It is widely used on utility poles and railroad ties and is contaminated with dioxin, furans and hexachlorobenzene. These chemicals are all endocrine disruptors and thus can have adverse effects on development at extremely low doses, affecting development, reproductive capacity, sexual development and causing diseases like cancer later in life.

Beyond Pesticides has called for a banning of these heavy duty wood preservatives and said that the voluntary phase-out of residential uses of these chemicals does not adequately protect public health or the environment. Even though wood for residential use may no longer be treated with these toxic chemicals, industrial uses (railroad ties, utility poles) continue to put workers and the public at risk. Occupational exposures increase the risk of cancers in workers. These chemicals also impact the environment and have been found in surface waters. In fact, the major source of contamination in surface waters and groundwater is wastewater from wood preserving facilities. Individuals living or working near wood preserving facilities are exceptionally susceptible to being exposed to surface water or groundwater, increasing their exposure and risk. These preservatives are also known to leach from previously treated wood. Children are at risk if they put their unwashed hands in their mouths after touching soil or wood that is contaminated with these preservatives. As a result, public and environmental health continues to be compromised.

On December 10, 2002, a federal lawsuit, led by Beyond Pesticides, was filed in federal court by a national labor union, environmental groups and a victim family to stop the use of arsenic and dioxin-laden wood preservatives, which are used to treat lumber, utility poles and railroad ties. The litigation argued that the chemicals, known carcinogenic agents, hurt utility workers exposed to treated poles, children playing near treated structures, and the environment, and cites the availability of alternatives. The lawsuit [Civil Case No. 02-2419(RJL)] was dismissed by Judge Richard Leon, U.S. District Court (Washington, DC), on March 21, 2005. Despite numerous requests by Beyond Pesticides and scientists, going back to 1997, which urged EPA to cancel the "heavy duty" wood preservatives, the judge found that, "Beyond Pesticides did not make formal requests to cancel and suspend the wood preservative pesticides registrations until late 2001 and early 2002." Thus, the decision reads, "…EPA did not became [sic} obligated to respond to Beyond Pesticides until the formal petitions were filed…." Jay Feldman, executive director of Beyond Pesticides, called the judge's ruling "unsound, given that EPA has been unresponsive to scientific findings in a timely manner, and inherently unprotective of public health," calling into question the ability of the *Federal Insecticide, Fungicide, and Rodenticide Act* (FIFRA) to protect public health and the environment.

Have You Ever Seen Someone Near a Utility Pole? EPA Hasn't!

Send a picture and help EPA see the reality of wood preservative exposure in your community.

Children playing around utility poles treated with chemicals like pentachlorophenol with contaminants including dioxin, furans and hexachlorobenzene. People, pets and wildlife exposed daily. The pictures speak for themselves and they reflect the reality that people know.

Yet, in documents EPA released on April 17, 2008 the agency says people don't come into contact with utility poles or these chemicals, known by EPA to cause cancer, kidney and liver disease and reproductive effects.

Why? Because the hazard to human health, if recognized by EPA, would require that it put a risk number in its risk assessment (for which the agency is seeking public comments by June 16, 2008) that would force the banning of pentachlorophenol (PCP), its contaminants, and other deadly wood preservatives.

Like so many times in its risk assessments, EPA just waives away reality. Here's what EPA has to say about public exposure to hazardous utility poles: "The opportunity for residential consumer contact is limited since PCP-treated wood is not sold to the general public. Rather it is predominantly marketed for commercial installations as utility poles. Where utility poles are installed on home/school or other residential sites, child contact via the dermal or oral routes is not anticipated since play activities with or around these pole structures would not normally occur and any incidental exposure would therefore be negligible."

Pregnant woman at bus stop.

In response to comments Beyond Pesticides and others submitted in January 2005, pointing out that utility poles line the streets and backyards and are often next to bus stops and school yards, while millions of poles are removed from service and can end up in gardens or places around the home, EPA only had this to say: "PCP is not registered for residential uses."

The undoctored stock photos on this page illustrate how common exposure to utility poles, both in use and recycled, is in everday life.

Since EPA does not accept the reality expressed by the written word, Beyond Pesticides is calling on you to take pictures of utility poles (telephone poles) in your community when you see people coming in contact with them. Take pictures of children playing around them (it could be used as base in a game of tag), people posting signs on them, or leaning on them at bus stops. Then send the picture to EPA's docket (with a copy to Beyond Pesticides), which you can send either electronically (go to the bottom of the document, hit the browse button and upload your picture) or send by mail by following the directions below.

The good news is that we do not need these chemicals. There are alternative materials that are better for health and the environment.

TAKE ACTION: *Let the EPA know that the wood preservatives pentachlorophenol, chromated copper arsenate (CCA) and creosote pose unnecessary risks to worker health and to your community. Submit your photos and/or comments no later than June 16, 2008. You can submit them online at www.regulations.gov, using the following docket numbers: CCA (Docket ID- EPA-HQ-OPP-2003-0250), Creosote (Docket ID - EPA-HQ-OPP-2008-0248), PCP (Docket ID - EPA-HQ-OPP-2004-0402). If submitting by mail, send to Office of Pesticide Programs (OPP) Regulatory Public Docket (7502P), Environmental Protection Agency, 1200 Pennsylvania Ave., NW., Washington, DC 20460-0001.*

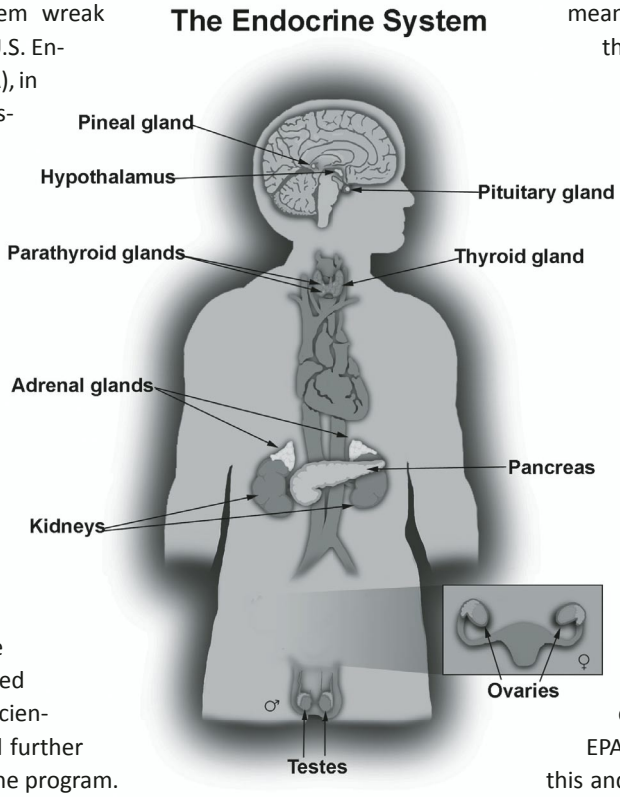
For more information about these wood preservatives, visit Beyond Pesticides' Wood Preservatives webpage, www.beyondpesticides.org/wood.

Pesticides That Disrupt Endocrine System Still Unregulated by EPA

EPA proposes regulatory review process for endocrine disrupting pesticides 11 years after mandated by Congress and may be over a decade behind schedule when program gets off the ground and sees results.

By Nichelle Harriott and Jay Feldman

Common household products –detergents, disinfectants, plastics, and pesticides– contain chemical ingredients that enter our bodies, disrupt hormones and cause adverse developmental, disease, and reproductive problems. Known as endocrine disruptors, these chemicals, which interact with the endocrine system wreak havoc in humans and wildlife. The U.S. Environmental Protection Agency (EPA), in response to an 11 year-old Congressional mandate, published a list of 73 pesticides and related chemicals that it intends to review for endocrine disrupting effects, once it finalizes its standards for review. EPA's list of 73 pesticides selected for evaluation includes only 29 of the 56 pesticides that are defined as known or suspected endocrine disruptors by the European Union and *Our Stolen Future* author and The Endocrine Disruptor Exchange (TEDX) president, Theo Colborn, Ph.D. In effect, EPA has chosen to prioritize for review 44 pesticides not identified as endocrine disruptors by other scientific bodies, draining resources and further delaying the regulatory impact of the program.



The scientific evidence of the endocrine disrupting mechanism –which defies classical "dose-makes-the poison" toxicological theory with exquisitely low doses causing effects based on timing of exposure– spurred Congress to act in 1996 as a part of the *Food Quality Protection Act* (FQPA). The law required EPA to, within two years of passage, "develop a screening program, using appropriate validated test systems and other scientifically relevant information, to determine whether certain substances may have an effect in humans that is similar to an effect produced by a naturally occurring estrogen, or such other endocrine effect as the Administrator may designate."

It is still not clear when EPA will meet its statutory duty under FQPA. EPA published in December 2007 a Federal Register notice (72 FR 70842) announcing its draft policies and procedures for the Endocrine Disruptor Screening Program "that it is considering adopting." Prior to that, in June 2007, it published the list of 73 pesticides and inert (or undisclosed ingredients in pesticide products), entitled *Draft List of Initial Pesticide Active Ingredients and Pesticide Inerts to be Considered* in the Federal Register (72 FR 33486). As if to send a signal that this was a meaningless gesture that should not concern the public, the agency in the FR notice stated, "Nothing in the approach for generating the initial list provides a basis to infer that by simply being on this list these chemicals are suspected to interfere with the endocrine systems of humans or other species."

Endocrine Disruption and Risk Assessment

Risk assessments justify use patterns for widely used pesticides based on assumptions about toxicity and exposure, which are truncated by the lack of data on endocrine disruption. The analyses are skewed in favor of the continued use of hazardous chemicals. Beyond Pesticides has urged EPA and local decision makers, because of this and other regulatory inadequacies, to embrace the precautionary principle, and promote the avoidance of toxic pesticide use in favor of non-chemical practices.

What is the Endocrine System?

The endocrine system consists of a set of glands, such as the thyroid, gonads, adrenal and pituitary glands, and the hormones they produce, such as thyroxine, estrogen, testosterone and adrenaline, which help guide the development, growth, reproduction, and behavior of animals, including human beings. Hormones are signaling molecules, which travel through the bloodstream and elicit responses in other parts of the body. Endocrine systems are found in most animals, including mammals, non-mammalian vertebrates (such as birds, fish, amphibians, and reptiles), and invertebrates (such as snails and insects).

Pesticides and Related Chemicals Recognized by the Scientific Community as Known or Suspected Endocrine Disruptors

Chemical	Type	Listed by	EPA to Review
2,4-D	Herbicide	European Union	Yes
Acephate	Insecticide	European Union	Yes
Acetochlor	Herbicide	Colborn, European Union	No
Alachlor	Herbicide	Colborn, European Union	No
Aldicarb	Insecticide	Colborn, European Union	Yes
Allethrin	Insecticide	Colborn, European Union	Yes
Amitrole	Herbicide	Colborn, European Union	No
Atrazine	Herbicide	European Union	Yes
Bifenthrin	Insecticide	Colborn, European Union	Yes
Butyl benzyl phthalate	Inert	Colborn	Yes
Carbaryl	Insecticide	Colborn, European Union	Yes
Carbofuran	Insecticide	European Union	Yes
Chlorpyrifos	Insecticide	Colborn	Yes
Clofentezine	Insecticide	Colborn	No
Cypermethrin	Insecticide	Colborn	Yes
Diazinon	Insecticide	Colborn, European Union	Yes
Dicofol	Insecticide	Colborn, European Union	Yes
Diethyl phthalate	Inert	Colborn, European Union	Yes
Dimethoate	Insecticide	European Union	Yes
Diuron	Herbicide	European Union	No
Endosulfan	Insecticide	Colborn, European Union	Yes
Fenarimol	Fungicide	Colborn	No
Fenbuconazole	Fungicide	Colborn	No
Fenitrothion	Insecticide	Colborn, European Union	No
Fenvalerate	Insecticide	Colborn	Yes
Fipronil	Insecticide	Colborn	No
Hexachlorobenzene	Insecticide	European Union	No
Iprodione	Fungicide	Colborn, European Union	Yes
Lamda-cyhalothrin	Insecticide	Colborn, European Union	No
Lindane	Insecticide, Rodenticide	Colborn, European Union	No
Linuron	Herbicide	Colborn	Yes
Malathion	Insecticide	Colborn, European Union	Yes
Mancozeb	Fungicide	Colborn, European Union	No
Maneb	Fungicide	Colborn, European Union	No
Methomyl	Insecticide	Colborn, European Union	Yes
Methyl bromide	Insecticide	European Union	No
Methyl parathion	Insecticide	European Union,	Yes
Metribuzin	Herbicide	European Union	Yes
Pendimethalin	Herbicide	Colborn	No
Pentachloronitrobenzene (pcnb)	Fungicide	Colborn	No
Pentachlorophenol (pcp)	Wood Preservative, Microbiocide	Colborn, European Union	No
Permethrin	Insecticide	Colborn, European Union	Yes
Piperonyl butoxide (pbo)	Insecticide (synergist)	European Union	Yes
Prodiamine	Herbicide	Colborn	No
Propanil	Herbicide	European Union	No
Pyrimethanil	Fungicide	Colborn	No
Resmethrin	Insecticide	European Union	Yes
Simazine	Herbicide	European Union,	Yes
Sumithrin	Insecticide	Colborn, European Union	No
Thiazopyr	Herbicide	Colborn	No
Thiram	Fungicide	Colborn, European Union	No
Triadimefon	Fungicide	Colborn, European Union	Yes
Triadimenol	Fungicide	Colborn, European Union	No
Trifluralin	Herbicide	Colborn, European Union	Yes
Vinclozolin	Fungicide	Colborn, European Union	No
Ziram	Fungicide	Colborn, European Union	No

EPA has listed an additional 44 pesticides for review that have not been identified by the scientific community as endocrine disruptors.

Why the concern about endocrine disruptors?

Exposure to endocrine disrupting chemicals may occur within the womb, at the workplace, at schools, home or from the ingestion of chemical residues in food and water. According to Dr. Colborn, endocrine-disrupting chemicals have been reported in semen, the ovarian follicle, the womb environment, and in breast milk at elevated concentrations, and have also been implicated in studies of marine mammals, which show increased sterility, growth retardation, perturbation of immunologic function, and reproductive abnormalities.

What are endocrine disruptors?

Endocrine disruptors function by: (i) Mimicking the action of a naturally-produced hormone, such as estrogen or testosterone, and thereby setting off similar chemical reactions in the body; (ii) Blocking the receptors in cells receiving the hormones (hormone receptors) thereby preventing the action of normal hormones; or (iii) Affecting the synthesis, transport, metabolism and excretion of hormones, thus altering the concentrations of natural hormones.

Environmental effects

Growth retardation, sex organ malformation, feminization of males and masculinization of females, and decreased fertility; Hermaphroditic deformities in frogs, pseudo-hermaphrodite polar bears with penis-like stumps, panthers with atrophied testicles, and intersex fish in the Potomac have all been documented; Reproductive abnormalities observed in mammals, birds, reptiles, fish, and molluscs; Amphibians exhibit severe malformations in almost every species; Atrazine, one of the most abundantly applied herbicides in the U.S., chemically castrates and feminizes exposed male amphibian larvae and also affects larval development and growth; S-methoprene, a growth regulator used for mosquito control in ponds, shown to alter early frog embryo development; Distorted sex organ development and function in alligators at Lake Apopka, Florida linked to a DDT-related organochlorine, dicofol.

Widespread antimicrobial use. Antibactericals, used in a range of household and personal care products including liquid soaps, detergents and wipes, contain ingredients like triclosan and its chemical cousin triclocarban, which are now found in large quantities in waterways across the U.S. Triclosan has been found to alter thyroid function in frogs, while triclocarban is observed to enhance sex hormones in rats and in human cells.

Health Effects

Reproductive health. Chemical disruption of sex hormones, since connecting DES (diethylstilbestrol) use in mothers in the 1970's to cervico-vaginal cancer in their daughters has since been tenuously associated with adverse reproductive outcomes, including birth defects, neurobehavioral developmental disturbances, leukemia in offspring and testicular cancer. Pesticide families associated with reproductive effects include organochlorines, organophosphates and synthetic pyrethroids, whose effects have also been linked to prenatal exposure. Reproductive specialists attribute a worldwide sperm count decline by approximately 50% since the1930s to exposures to high concentrations of estrogens or estrogen-like substances during embryonic, fetal, and early postnatal development. Higher levels of organochlorines, including DDT metabolites, are found in fat samples of males with undescended testes. The onset of puberty in girls, shifting the mean from 11.2 years to 8.87 years for African Americans and 9.96 years for Caucasian girls, is linked to chemical exposure that stimulates sex hormones.

Neurodevelopment. Pesticides affecting estrogenic and androgenic hormones (testosterone) during development can adversely affect neurodevelopment. The thyroid hormone system, regulating a number of biological processes in the body and essential for proper neuronal proliferation, cell migration and differentiation in the brain, is impacted by environmental agents. Scientists believe that many neurological disorders observed in children, such as ADHD (Attention Deficit Hyperactivity Disorder) and autism, may be related to the prenatal chemical disruption of the thyroid system. Organophosphates and synthetic pyrethroids are believed to alter thyroid function, interfere with brain development and cause deficits in cognitive functions in the developing fetus. Other effects include physical and mental retardation, alterations of the cardiovascular system and musculoskeletal defects, alterations of the menstrual cycle, obesity, and failure to develop secondary sex characteristics.

Inert Ingredients

Inert ingredients pose serious concerns, not only because the identity of these chemicals are withheld from product label information, but also because the effects of these "secret" ingredients on human and environmental health have been underplayed, despite many now being recognized as endocrine disruptors. Phthalates, widely found in pesticide formulations as inert ingredients, are found in 75% of urine samples from normal men in a Centers for Disease Control (CDC) study. Three types of phthalates; diethylhexyl phthalate, di(n-octyl) phthalate, and di(n-hexyl) phthalate, have been found to interfere with the thyroid system, as well as reducing testosterone synthesis which then leads to a host of male developmental and reproductive disorders, such as decreased sperm quality, cryptorchidism (the absence of the scrotum) and hypospadias (defect of the urethra).

Conclusion

In her book, *Our Stolen Future*, Dr. Colborn states that the decline of animal species can no longer be simply explained by habitat destruction and human disturbance, but also by reproductive failures within populations brought on by the influence of endocrine disrupting chemicals. These chemicals, many of them used as pesticides in food production and homes, are leaving a devastating legacy.

A fully cited version of this article, as well as other information on endocrine disruptors, is available on the Beyond Pesticides website, www.beyondpesticides.org/infoservices/pesticidesandyou.

Pesticides Trigger Parkinson's Disease

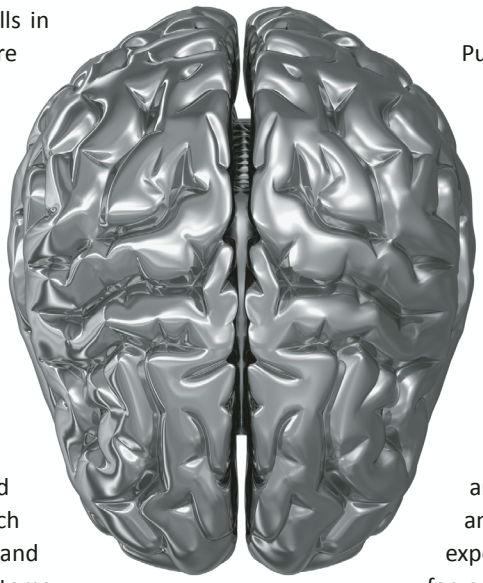
Astounding body of scientific literature finds strong evidence linking Parkinson's to normal pesticide exposure and fuels movement to phase-out numerous classes of pesticides and adopt safe management approaches.

By Kagan Owens

With less than one percent of cases caused by genetics, researchers have been looking for the potential risk factors for developing Parkinson's disease (PD). What they are finding is startling. The epidemiological and toxicological evidence is repeatedly identifying exposure to pesticides, as well as specific gene-pesticide interactions, as significant adverse risk factors that contribute to PD.

What Is Parkinson's Disease?

The second most common neurodegenerative disease, Parkinson's occurs when nerve cells in the substantia nigra region of the brain are damaged or destroyed and can no longer produce dopamine, a nerve-signaling molecule that helps control muscle movement. People with PD have a variety of symptoms including loss of muscle control, trembling and lack of coordination. They may also experience anxiety, constipation, dementia, depression, urinary difficulties, and sleep disturbances. Over time, symptoms intensify.



At least one million Americans have PD and about 50,000 new cases are diagnosed each year. PD affects mostly the middle-aged and elderly. Treatments are available for the symptoms, but there is currently no cure for PD.

The First Link

The suspicion that pesticides might be linked to PD was theorized in the 1980's following a wave of drug induced Parkinson's-like illnesses. The drug, MPTP, which was used as a heroin substitute, is transformed in the brain after injection. The new compound, MPP+, causes the loss of dopamine producing cells and the sudden onset of a Parkinson's-like illness. The reason for the toxic effect is that MPP+ inhibits one of the enzymes in mitochondria, intracellular organelles that provide cells with energy. It was later discovered that MPP+ was not only the breakdown product of an obscure drug, but also the active ingredient of the herbicide cyperquat, the closely related paraquat, and other pesticides. This discovery sparked interest in studying the link between pesticides and PD, which has undercovered links to numerous pesticides and chemical families.

Pesticide Exposure Increases Risk

While some epidemiological studies and animal data linking PD with pesticides has been inconsistent (likely due to study design issues such as control selections, study size, variety of diagnostic criteria used and statistical analysis), convincing evidence is continually emerging that demonstrates the pesticide exposure link to PD.

Published case-control studies show a statistically significant association and elevated odds-ratios (OR) for PD (that determine the elevate disease rate above the norm of 1.0) and exposure to pesticides. Duration of exposure and level of exposure is also correlated with an increase in PD risk. In a review of 40 published epidemiological case-control studies from 1983-2005, researchers from the UK evaluated the relationship between PD and pesticide exposure, finding sufficient evidence that an association exists and is strongest for exposure to herbicides and insecticides, and after long durations of exposure. In the 31 studies that show results for pesticides in an exposure category, the ORs ranged from 0.75 to 7.0 (a ¾ to 7 times greater disease rate) -- only two of those studies reported an OR less than 1.0. A meta-analysis of 19 published, peer-reviewed studies done in the U.S. from 1989-1999 finds that individuals exposed to pesticides have twice the risk of developing PD than the general population. A 1993 case-control study finds a positive association with insecticide exposure (OR=5.75), past residency in a fumigated house (OR=5.25), and herbicide exposure (OR=3.22) to PD.

A large Harvard School of Public Health epidemiological study of more than 140,000 adults finds that those exposed to long-term, low levels of pesticides have a 70 percent higher incidence of PD than among people who report no exposure. A study of almost

3000 people in five European countries finds low level pesticide users, such as amateur gardeners, are 9% more likely to have Parkinson's, whereas high level users, like farmers, are 43% more likely.

According to scientists, people exposed to chemicals that have a particular affinity for the substantia nigra region of the brain may be at particular risk for developing the disease. In 2006, the preliminary results of a Centers for Disease Control and Prevention (CDC) funded study led by the University of North Dakota's Energy & Environmental Research Center, show that the areas of the brain in laboratory-tested rats affected by pesticide exposure are the same areas linked to neurological changes associated with PD.

Rural Living, Well Water Consumption and Farming

Rural residency, well water consumption, and/or farming positively correlates with an increased incidence of developing PD. A 2001 meta-analysis of peer-reviewed studies finds that living in a rural area, drinking well water, farming and exposure to pesticides have overall PD risk estimates between 1.26 and 1.85. Early studies in Canada find the highest prevalence of PD coincides with agricultural areas with the largest amount of pesticide use. One study discovered that many people living in rural areas, with no diagnosed neurological disorders, have lower levels of dopamine producing cells than urban populations. This suggests that even in the absence of the illness, some aspect of rural life is putting people at risk for the disease. Confirming those results, another study finds that Parkinson's patients are twice as likely to be living in rural areas and drinking well water, where farming pesticides often contaminate ground water. A California mortality study of individuals whose death certificates mention PD as an underlying cause of death and cross-referenced with agricultural and pesticide use data finds that the counties using restricted use pesticides (RUP) for agricultural purposes have about a 40 percent increase in PD mortality when compared to those counties reporting no RUP.

Occupational Exposure

Confirmed again and again, studies find that PD is associated with occupational exposure to pesticides. Studies show a two- to over a threefold increased risk of developing PD with occupational exposure, whether from working on farms, orchards, or plantations. A population-based case-control study in Canada finds that a history of occupational herbicide use is associated with an estimated threefold increase in PD risk and previous insecticide use results in an estimated twofold increase in risk. A case-control study in northeast Italy finds a 7.7 OR for farming as an occupation.

Home Pesticide Use

A study published in the *Journal of the American Medical Association* raises concerns for residential pesticide exposure. Stanford University researchers find a 70 percent increased risk of developing PD for individuals that use pesticides in their home. Exposure to garden insecticides carries a 50 percent increased risk of developing the disease. Among herbicide users, the risk of developing PD increases as the number of days in contact with herbicides grows. Respondents who reported handling or applying herbicides for up to 30 days are 40 percent more likely to develop the disease, whereas respondents that reported 160 days exposure, have a 70 percent increase.

Age-Related Risk Factors

The United Nation's World Health Organization (WHO) recently released a report on children's heightened vulnerability to chemical

Occupational pesticide exposure, rural living, farming, well water consumption and residential pesticide use have all been linked to elevated rates of Parkinson's disease.

Although age may contribute to Parkinson's disease, it is not considered by scientists to be a sole cause of the disease.

exposures at different periods of their growth and development. The report, *Principles for Evaluating Health Risks in Children Associated with Exposure to Chemicals*, highlights the fact that the stage of a child's development when chemical exposure occurs may be just as important as the magnitude of the exposure. The report states that "neurotoxic insults during development that result in no observable phenotype at birth or during childhood could manifest later in life as earlier onset of neurodegenerative diseases such as [PD]." Several studies support WHO's report showing that exposure in utero, post-natal or in childhood affect the substantia nigra causing direct damage or increasing the susceptibility to additional exposures and neurodegenerative damage in adulthood.

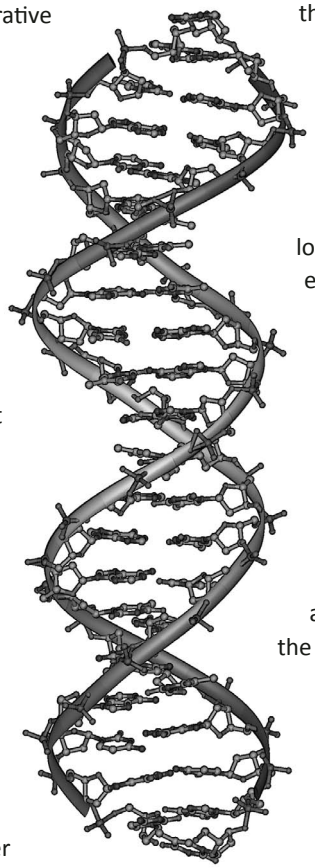
Aging is also found to be a risk factor for PD, yet researchers agree that aging alone is not a sufficient factor to explain PD. In one study, enhanced sensitivity of the aging nigrostriatal dopamine pathway to pesticides maneb and paraquat result in irreversible and progressive neurotoxicity, thus showing that exposure to pesticides combined with aging can increase the risk for developing PD. University of Rochester scientists believe environmental contaminants such as pesticides make dopamine cells more vulnerable to damage from normal aging, infection, or subsequent exposure to pollutants.

Genetic Risk Factors

Researchers screening twins for genetic effects and PD show that while genetic factors play a role for early-onset PD (begins at or before the age of 50), environmental factors are most important for those with late-onset PD. Yet, genetics are not completely out of the picture for late-onset PD. A number of genes are linked to PD as they interact with toxic chemicals in such a way that they may not cause the disease directly, but cause subtle changes in the genes that can make individuals more or less likely to develop PD later in life. Simply put by Kenneth Olden, Ph.D., former Director of National Institute for Environmental Health Sciences (NIEHS), "Genetics load the gun. The environment pulls the trigger."

For those with a family history of the disease, exposure to certain chemicals found in pesticides may increase their risk of developing PD, according to a 2005 study. Researchers looked at specially bred fruit flies lacking both forms of the DJ-1 gene that is associated with the inherited form of PD. In the study, researchers show that flies lacking forms of the DJ-1 gene are normal under standard conditions, but when they are exposed to the herbicide paraquat and insecticide rotenone, the flies suffer from extreme oxidative or cellular stress and die. Researchers say their findings suggest that a loss of DJ-1 gene function increases sensitivity to chemicals that cause oxidative stress, thus linking a genetic cause with environmental risk factors. Other research on cultured cells and in knockout mice (mice that have had a gene removed by genetic manipulation) supports these findings, showing that DJ-1 mutations can sensitize cells to the harmful effects of oxidative stress, which occurs when unstable oxygen molecules react with certain compounds like pesticides.

Two other studies link family history and pesticide exposure to an increased risk of PD by looking at glutathione S-transferase P. Glutathione S-transferases (GST) are enzymes that help rid the body of toxic chemicals that generate oxidative stress. A study published in the *Lancet* finds a significant association for PD patients exposed to pesticides and having dissimilar alleles (variant forms of the same gene causing variations of inherited characteristics) at the GSTP1 locus. The scientists believe that this helps explain the susceptibility of some individuals to the parkinsonism-inducing effects of pesticides. Researchers at the St. Jude Children's Research Hospital build on those findings, reporting in the *Proceedings of the National Academy of Sciences* that the GST pi detoxification enzyme that prevents damage to the substantia nigra region of the brain acts like a sentry at the crossroads of several biochemical pathways, any one of which can lead to PD. The job of the antioxidant GST pi is to protect the cell from death caused by either toxic chemicals in the environment, such as pesticides, or a self-destruction process called apoptosis, triggered by certain stressful conditions in the cell. If GST pi levels are reduced or this enzyme is overwhelmed by toxic chemicals,



these nerves are at increased risk of death. "The majority of these cases of [PD] appear to arise because individuals who have a genetic susceptibility to the disease are exposed to environmental toxins such as pesticides and herbicides, which trigger the formation of free radicals that kill dopaminergic neurons in the substantia nigra," states Richard Smeyne, Ph.D., associate member of the Department of Developmental Neurobiology at St. Jude. "We also know that GST pi blocks the process of cell suicide triggered by stresses that the cell can't overcome, such as an increase in the presence of free radicals or a loss of the cell's ability to produce energy."

Enzyme deficiencies in the liver may lower resistance to pesticides, as PD patients are more likely to have a genetic deficiency in the detoxifying enzyme of the liver when compared to the normal population. Scientists looking at the cytochrome P450 2D6 gene (CYP2D6) finds that this gene has a modifying effect on the risk of PD among individuals exposed to pesticides. A 1998 case-control study published in *Neuroepidemiology* finds that individuals with Parkinson's who were exposed to pesticides and had the gene known as CYP2D6 29B+ allele, are three times as likely to develop dementia along with PD than those without the gene. This allele metabolizes and detoxifies chemicals that enter the body by activating liver enzymes. Those individuals who have a mutant form of the allele may be more susceptible to pesticides because of their inability to detoxify chemicals. This study finds that individuals who have a poor metaboliser CYP2D6 genotype and have also been exposed to pesticides are more likely to develop dementia.

Two more genes, MnSOD and NQO1, encode enzymes that play key roles in oxidative stress and interact with pesticides to increase an individual's PD risk. Researchers show that among subjects that were exposed to pesticides, the combined MnSOD/NQO1 variant genotype is significantly associated with a four-fold increased risk of PD.

"All of the evidence that has been accumulating suggests that exposure to pesticides increases the risk of PD," says Gary Miller, Ph.D., associate professor of environmental and occupational health at Emory University. "We believe that a person who is destined to get Parkinson's because of genetics or other factors at age 80 might develop symptoms when they're 65 or 70 if they have been exposed to pesticides."

There is some data that shows a significant association between men, exposure to pesticides, and Parkinson's disease.

Pesticide Use Increases Risk in Men

While there is conclusive evidence that men are at an increased risk of being diagnosed with PD, how that factor comes in to play with pesticide exposure is not necessarily confirmed. There is some data that shows a significant association between men, exposure to pesticides, and PD. A mouse study looking at developmental exposure to the insecticide dieldrin finds a greater effect in male offspring than in females. In addition, the population-based study by Mayo Clinic researchers finds that men with PD are 2.4 times more likely to have been exposed to pesticides than those who did not have Parkinson's. Pesticide exposure did not increase the risk of Parkinson's in women, and no other household or industrial chemicals were significantly linked to the disease in either men or women. Researchers suggest that men are at greater risk because male study respondents are more likely the ones that use pesticides in agriculture, in their occupation and/or around the home. The Mayo clinic researchers also suggest that "pesticide use combines with other risk factors in men's environment or genetic makeup, causing them to cross over the threshold into developing the disease."

Implicating Specific Pesticides and the Mechanisms by which They Induce PD

Although the evidence showing a significant association between pesticide exposure and PD is clear, implicating specific pesticides or a group of pesticides is difficult. Exposure type, duration, product and dose are difficult to ascertain in retrospective case-control studies. Due to the possibility of recall biases, the vast number of pesticides available for use, and the fact that pesticides can work synergistically, many studies analyze pesticide exposure without regard to specifics such as product or chemical names, and, therefore, do not consistently implicate, or estimate the PD risk associated with any particular pesticide.

However, there are epidemiologic and toxicologic studies that have identified specific pesticides linked to PD. (See page 18.) Studies that identify the mechanisms by which pesticides lead to PD, such as protein aggregation (a-synuclein), effects on the striatal dopaminergic

Glossary of Common Terms

alpha-synuclein: a synuclein protein of unknown function primarily found in neural tissue, where it is seen mainly in presynaptic terminals. In rare cases of familial forms of Parkinson's disease there is a mutation in the gene coding for alpha-synuclein. (*Wikipedia*)

apoptosis: a natural process of self-destruction in certain cells that is determined by the genes and can be initiated by a stimulus or by removal of a repressor agent. Also called programmed cell death. (*American Heritage Medical Dictionary*)

dopamine: a neurotransmitter formed in the brain essential to the normal functioning of the central nervous system. A reduction in its concentration within the brain is associated with Parkinson's disease. (*American Heritage Medical Dictionary*)

mitochondria: spherical or rod shaped parts of the cell. Mitochondria contain genetic material (DNA and RNA) and are responsible for converting food to energy. (*Gale Encyclopedia of Medicine*)

nigrostriatal pathway: neural pathway that connects the substantia nigra with the striatum. It is one of the four major dopamine pathways in the brain, and is particularly involved in the production of movement. (Wikipedia)

oxidative stress: an imbalance of the prooxidant antioxidant ratio in which too few antioxidants are produced or ingested or too many oxidizing agents are produced; can result in cell death. (*Mosby's Dictionary of Complementary and Alternative Medicine*)

proteasomes: large protein complexes located in the nucleus and the cytoplasm of eukaryotes [plants, animals, protozoa, fungi and most algae] designed to degrade unneeded or damaged proteins. (*Wikipedia*)

striatum: part of the brain known for its role in the planning and modulation of movement pathways but is also involved in a variety of other cognitive processes. Parkinson's disease results in loss of dopaminergic innervation to the striatum. (*Wikipedia*)

substantia nigra: A layer of large pigmented nerve cells in the [brain] that produce dopamine and whose destruction is associated with Parkinson's disease. (*American Heritage Medical Dictionary*)

ubiquitin: a polypeptide found in all eukaryotic cells [cells of plants, animals, protozoa, fungi and most algae] that participates in a variety of cellular functions including protein degradation. (*American Heritage Medical Dictionary*)

system and altered dopamine levels, mitochondrial dysfunction (complex I inhibition) and oxidative stress, are discussed.

Conclusion

Although studies can have methodological limitations, overall the current review shows that there is a definitive relationship between Parkinson's disease and pesticides. The new research into PD is helping scientists better understand some of the mechanisms of this serious and disabling neurodegenerative brain disorder. Knowledge of the environmental factors and genetics of this illness has allowed investigators to create models of disease that are being used to examine potential causes of neuron disease such as pesticide exposure. While many researchers are seeking to support the development of more effective treatments of this human illness, the National Institutes of Health (NIH) has said, "[W]ith better knowledge of the role of pesticides and other environmental agents in causing [PD], effective prevention will be possible by eliminating or reducing use of specific environmental agents…" Researchers that have been looking at the synergistic effects of pesticides state that, "[T]he current derivation of risk assessment guidelines needs to be reevaluated." Advocates want to see the scientific knowledge support the banning of the chemical families associated with these effects. Because it is impossible to know your genetic disposition, all people should avoid contact with toxic pesticides.

Take Action

Let the U.S.EPA Administrator and Deputy Administrator know that they have a duty to alert the public to the scientific findings (laboratory and epidemiologic) that link pesticides with PD. In addition, urge these U.S.EPA officials to initiate an urgent and expedited review of pesticides' link to Parkinson's. Also let your elected members of Congress know how you feel.

Curtail your exposure to pesticides. Beyond Pesticides offers a plethora of non-toxic alternatives to pesticides. Learn how you can protect your children and loved ones from the effects of pesticides in your home, on your lawns, in schools, in hospitals and other public places. A fully cited version of this article, as well as Alternatives Fact Sheets, How-To Factsheets, information on Integrated Pest Management (IPM) in schools, and information on organic food are available at at www.beyondpesticides.org.

Specific Pesticides Linked to Parkinson's Disease

The following are specific pesticides identified in the scientific literature to be linked to Parkinson's disease. However, the actual number is most likely much higher because implicating specific pesticides or a group of pesticides is difficult.

Benzimidazoles

Benomyl (Fungicide). University of North Dakota researchers found that benomyl affects rat brains, showing that mitochondrial enzymes are sensitive targets for inactivation by the pesticide. Exposure to benomyl at low concentrations increases the risk of developing PD by inhibiting the ubiquitin-proteasome system.

Bipyridyliums

Diquat Dibromide (Herbicide). Several days after a 72 year-old farmer was exposed to an aqueous solution of 10 percent diquat dibromide he developed severe parkinsonian syndrome.

Paraquat (Herbicide). Several studies show an increased risk for PD with occupational exposure to and contact with paraquat. A case-control study in Taiwan found that those who use paraquat are at greater risk of developing Parkinson's than those that use other pesticides. A 2007 study examined a cohort of 80,000 licensed private applicators and spouses and found that farmworkers exposed to the herbicide paraquat have twice the expected risk of developing PD. For those that were exposed to herbicides and could recall their exposure history, a Canadian population-based case-control study reported one individual using paraquat, between the ages of 26 and 31 years, and is the only herbicide-exposed case in the study whose onset of symptoms occurred before the age of 40.

Paraquat induces dopaminergic nigral apoptosis and acts through oxidative stress-mediated mechanisms. In laboratory animal studies, paraquat exposure triggers processes characteristic of early stages of dopaminergic neuron degeneration by stimulating an increase in the protein a-synuclein in the brain, likely due to preferential binding of the pesticides to a partially folded a -synuclein intermediate. The protein kills the dopamine-producing brain cells which lead to PD. In 2002, researchers from the Parkinson's Institute, published that their findings "unequivocally show that selective dopaminergic degeneration, one of the pathological hallmarks of [PD], is also a characteristic of paraquat neurotoxicity."

For researchers testing the role of oxidative stress in paraquat exposed mice, they find that the "initial exposure acts as a 'priming' event, enhancing neuronal vulnerability to a subsequent toxic insult," suggesting that dopaminergic cell degeneration appears to be dependent on the sequence of toxic challenges and the interaction between cell vulnerability, damaging effects and protective responses. Nigrostriatal neurons are vulnerable to oxidative processes. Depending on the paraquat exposure, oxidative stress may be reversible or lead to neurodegeneration.

Botanicals

Rotenone (Insecticide). Rotenone, a naturally occurring pesticide, is used in laboratory studies to induce PD in rat and primate models to study various aspects of the disease in humans. Laboratory studies using rats, monkeys, mice and human neuroblastoma cells find that rotenone destroys dopaminergic neurons inhibiting brain mitochondrial function, increasing excessive oxidative activity in the brain and shifting respiration to a more anaerobic state. Rotenone can significantly stimulate the formation of a -synuclein fibrils. Aging has also been found to increase the sensitivity of dopaminergic neurons to a low, systemic dose of rotenone. Using rotenone *in vivo* and *in vitro* models, researchers find that chronic exposure to a pesticide and mitochondrial toxin brings into play three systems, DJ-1, a-synuclein, and the ubiquitin-proteasome system, and implies that mitochondrial dysfunction and oxidative stress link environmental and genetic forms of the disease.

Dithiocarbamates

Diethyldithiocarbamate (Herbicide). Exposure to diethyldithiocarbamate at low concentrations increases the risk of developing PD by inhibiting the ubiquitin-proteasome system. Diethyldithiocarbamate can also significantly stimulate the formation of a-synuclein fibrils, likely due to preferential binding of the pesticides to a partially folded a-synuclein intermediate.

Mancozeb. (Fungicide). Mancozeb affects rat brain mitochondria, showing that mitochondrial enzymes, which are sensitive targets, are inactivated by the pesticide.

Maneb (Fungicide). A case-report shows that after chronic exposure to maneb, a 37-year old man developed Parkinson's two years after the applications ceased.

University of North Dakota researchers find maneb affects rat brain mitochondria. Low levels of maneb can injure the antioxidant system in the dopamine neurons, especially with concurrent exposures to other environmentally relevant oxidative stressors, such as paraquat.

Ziram (Fungicide/Dog and Cat Repellent). Ziram shows inhibitory effects on proteasome activities at low concentrations. This suggests that proteasome inhibition as a potential mechanism for the epidemiological association of pesticides and PD.

Organochlorines

In 1996, a German study linked PD to pesticides, finding an elevated odds ratio for organochlorine pesticides.

Dieldrin (Insecticide). Low-level exposure to dieldrin, a banned but persistent pesticide ubiquitously distributed in the environment, appears to accelerate changes in the brain that can potentially lead to the onset of PD symptoms years or even decades before they might naturally develop, according to a research presentation at the 2006 American Chemical Society annual meeting. This finding "clearly shows that pesticides such as dieldrin appear to accelerate or exacerbate the already underlying disease," states Emory University's Gary Miller, Ph.D. "So it appears the more you are exposed to pesticides, the greater your risk of developing the disease earlier in life."

In studies looking at post-mortem brain tissue samples of Parkinson's patients, scientists find a significant association between dieldrin

and the diagnosis of PD. Dr. Miller and his co-researchers found levels of dieldrin three times higher in the brains of 14 people who had PD than in the brains of 12 people who did not.

Endosulfan (Insecticide). A study testing 25 pesticides to see if exposure to them increases the risk of developing PD finds that endosulfan shows inhibitory effects on proteasome activities at low concentrations.

Heptachlor (Insecticide). Perinatal exposure to heptachlor, another banned pesticide that persists ubiquitously, alters the dopaminergic system and may increase the vulnerability of dopamine neurons to toxic insult.

Lindane (Insecticide). An autopsy case-control study finds significant levels of lindane in the brain tissues of deceased Parkinson's patients.

Organophosphates

Chlorfenvinphos (Insecticide). Subchronic administration of chlorfenvinphos, a pesticide that is no longer registered by the U.S. EPA, leads to a change in the brain oxidative status in rats.

Parathion (Insecticide). Although the researchers did not find a significant association between PD and pesticide exposure, their population-based case-control study in Washington state finds that among individual pesticides, the highest odds-ratio is seen with parathion, a highly toxic neurotoxic pesticide.

Chlorpyrifos (Insecticide). Researchers find that dopaminergic neurotransmission is affected by exposure to chlorpyrifos in a laboratory mice study.

Pyrethroids

Deltamethrin (Insecticide). One study finds that because the dopamine transporter function of the brain is affected by the vulnerability of dopamine neurons to nuerotoxicants, up-regulation (increased cellular response) of deltamethrin may increase the susceptibility of dopamine neurons to toxic insult.

Permethrin (Insecticide). Studies find that permethrin affects dopaminergic neurotransmission and up-regulation of permethrin may increase the susceptibility of dopamine neurons to toxic insult.

Virginia Tech researchers discovered that exposure to some insecticides, such as permethrin, may cause a cascade of chemical events in the brain that can lead to PD. The researchers studied the levels of dopamine, dopamine transporter protein expression, and the levels of a-synuclein in mice exposed to various doses of permethrin. The increase in dopamine uptake indicates that the mouse's system is reacting to a neurochemical insult caused by the presence of the insecticide. In some individuals, dopamine-producing neurons may be challenged by genetic factors or by previous exposure to other neurotoxins. For individuals with a genetic predisposition, exposure to permethrin may trigger chemical events in the brain that result in an increased risk for damage to the area of the brain that is selectively damaged in PD. The researchers also find that permethrin exposure results in an overproduction of the protein a-synuclein at low doses. The accumulation of the protein is a major component of the formation of the Lewy bodies, fibrous tangles observed in the brains of patients with PD.

Thiocarbamate and Chlorophenoxy Herbicides

For those that were exposed to herbicides and could recall the chemicals or trade names of the products used, a Canadian population-based case-control study found that all but one PD patient had used compounds in the thriocarbamate and chlorophenoxy and chemical groups exclusively.

Triazines

Atrazine (Herbicide). A 2007 rat study found that atrazine decreases tissue dopamine levels by interfering with the vesicular storage and/or cellular uptake of dopamine.

Others

Pyridaben, Fenpyroximate, Fenazaquin (Insecticides). Research at Emory University found that commonly used pesticides are toxic to the mitochondria of cells, an effect linked to PD. PD has been associated with abnormalities of mitochondria, which are the "power plants" that provide all cells with energy. The Emory scientists exposed human neuroblastoma cells to the pesticides pyridaben, fenpyroximate and fenazaquin which inhibit complex I, a mitochondrial enzyme. Pyridaben is by far the most potent toxic compound. Pyridaben is also more potent in producing "free radicals" and oxidative damage to the cells, both of which are thought to be important in causing PD.

Synergistic Effects

Paraquat and Maneb. University of Rochester scientists discovered that the synergistic effects of paraquat and maneb target the nigrostriatal dopamine system and indicate progressive neurotoxicity with continuing exposure. Their findings show that while there are no or only marginal effects when these chemicals are administered individually, together they produce synergistic effects when given in combination. In another study, these researchers again chronically expose mice to a low-level combination of paraquat and maneb, resulting in significant reductions in locomotor activity, levels of striatal dopamine and dopaminergic neurons in the substantia nigra, more so than when exposed individually.

A laboratory study found that "prenatal exposure to the pesticide maneb produces selective, permanent alterations of the nigrostriatal dopaminergic system and enhances adult susceptibility to paraquat exposure." Additional studies show that exposure to maneb and paraquat during the post-natal and juvenile period causes Parkinson-like declines in dopaminergic neurons and makes the substantia nigra more susceptible to additional exposures in adulthood, "suggesting that developmental exposure to neurtoxicants may be involved in the induction of neurodegenerative disorders and/or alter the normal aging process."

Endosulfan and Zineb. Researchers at Virginia Tech examining endosulfan and zineb in human cultured neuroblastoma cells found that these pesticides, individually and together, are toxic to the impulse-conducting cells of the nervous system. Mixtures of the two pesticides had greater effects. Another study found that mice exposed to endosulfan and/or zineb as juveniles and then re-exposed in their adulthood result in significantly depleted striatal dopamine levels, thus concluding that exposure to pesticides such as endosulfan and zineb during critical periods of postnatal development contributes to neurotransmitter changes in adulthood.

Clearing the Air of Toxic Moth Repellents

Highly hazardous fumigants in mothballs have consumers looking for ways to protect clothes without contaminating homes.

By Nichelle Harriott

The scent of toxic moth poisons containing the fumigants naphthalene or p-dichlorobenzene is a familiar springtime smell in closets, chests, and clothes storage areas. The two major ingredients in mothballs, used individually or in combination, are extremely dangerous petroleum-based chemicals that can cause a range of short and long-term health effects, including cancer, blood, kidney, and liver effects.[1-4] In 1991, the state of California canceled all pesticide uses of naphthalene due to known health effects and inadequacies in existing data. However, it is registered with the U.S. Environmental Protection Agency (EPA) and is in use in other states.[5,6] With striking hazards linked to these fumigants, the use of management practices, insect traps, and other repellents takes on an important urgency.

Health Concerns

Moth repellents are pesticides used to kill the larvae of clothes moths and/or carpet beetles. These insects lay their eggs on fabric and other textiles, and when hatched, their larvae feed on organic matter trapped within the fibers, chewing away to leave gapping holes in favorite sweaters or clothing. The moth larvae feed on wool, feathers, fur, hair, leather, lint, dust, paper, and occasionally cotton, linen, silk, and synthetic fibers.[7] Mothballs, usually placed in closed or sealed closets and containers, sublime –meaning they transform from a solid directly into a gas, and the vapors build up and kill moths and their larvae.

However, direct and indirect exposures to these vapors are harmful. Mothballs are made with either, or a combination of, naphthalene and p-dichlorobenzene as the active ingredient. Note: p-dichlorobenzene has been replacing naphthalene in the formulation of moth repellents, and is also used as the primary ingredient in many restroom deodorizers.

Product labels state "avoid prolonged breathing of vapors,"[8] however, since the vapors can fill an entire home, this is literally impossible in an indoor environment. When placed in closets or rooms with poor ventilation, these vapors build up to high concentrations where they are absorbed, not only by clothes, but by beds, sofas and other soft textiles in the room, resulting in greater risks for indirect exposures.

Naphthalene

Naphthalene, also called mothballs, moth flakes, white tar, and tar camphor,[2] is an aromatic hydrocarbon that appears as a white solid in crystalline or marble-like form.[9] Naphthalene is naturally present in fossil fuels such as petroleum and coal, and is a natural constituent of coal tar and crude oil. Apart from mothballs, crystalline naphthalene is used as a deodorizer for diaper pails and toilets. It is also used as an intermediate in the manufacture of a wide range of products including phthalate plasticizers, resins, dyes, pharmaceuticals, insect repellents, and other products.[9] Since naphthalene easily vaporizes, its gas has a variety of other fumigant uses, including use as an insecticidal soil fumigant.

p-Dichlorobenzene

p-Dichlorobenzene, or 1,4-dichlorobenzene, is a colorless or white crystalline solid used as a fumigant insecticide, which is marketed as a variety of indoor products like crystals, cakes, balls, sachets, impregnated strips, blocks, varpel rope, and flakes. It is also used in attics to repel snakes, mice, rats, squirrels, and attic wombats, and repels lice and mites from birdcages.[10] It is also widely used to make deodorant blocks used in garbage cans and restrooms.[4,11] Approximately five million pounds of p-dichlorobenzene are used in the U.S. each year, the majority of which are in moth repellent products.[10] Like naphthalene, p-dichlorobenzene is also used as a fungicide on crops, and in the manufacture of other organic chemicals, and in plastics, dyes, and pharmaceuticals.[11]

Routes of exposure to moth repellents

I. Inhalation exposure. Once mothballs can be smelled, exposure is occurring. Even though most mothball applications are made within chests and closets, studies have found that mothball vapors leak from these storage units and are emitted into the indoor environment.[12,13] Vapors are rapidly absorbed when inhaled.[14] Breathing in the vapors of moth repellents can cause headaches, dizziness, irritation to the nose and throat, nausea, and vomiting. In one incident eight adults and one child reported gastrointestinal (nausea, vomiting, abdominal pain) and neurological (headache, malaise, confusion) symptoms after exposure to large numbers of naphthalene mothballs in their home.[9,15]

Intentional inhalation of mothball vapors (as a recreational drug) have been documented in twin 18-year old girls who suffered with anemia, skin lesions, mental sluggishness, and other neurocutaneous symptoms, which abated once they stopped "sniffing" mothballs.[16] Other instances of mothball abuse have resulted in peripheral neuropathy and chronic kidney failure.[14]

Inhaled vapors have resulted in histopathological changes (anatomical changes in diseased tissue) in the lungs of acutely exposed rats and guinea pigs and the nasal olfactory epithelium (nasal cavity tissue) of chronically exposed rats and mice.[1,4,15] Furthermore, a study conducted by the National Toxicology Program (NTP) in 2000, found increased incidences of two types of nasal tumors in naphthalene-treated animals. These results indicate evidence of carcinogenic activity.[9] Subsequent studies find that inhalation of mothball ingredients results in an increased incidence of benign and malignant tumors in the nasal cavity, as well as toxicity in the liver and kidneys in rodents.[17] Increased numbers of alveolar/bronchiolar adenomas and carcinomas are also reported in female mice exposed by inhalation of naphthalene.[18] A thirteen-week laboratory study also found that inhalation exposure induces liver toxicity (hepatotoxicity}, kidney and blood (hematological) toxicity in mice and rats.[19]

II. Oral exposure. Mothballs, because of their appearance, can be easily mistaken for candy and can tempt young children to touch and play with them. As a result, they pose a hazard to young children. If ingested, mothballs can be fatal. Most mothball poisonings have occurred in children.[14,18] Symptoms of poisoning include blood in urine (hematuria), anemia, restlessness, liver enlargement and sometimes gastrointestinal bleeding.[15] Naphthalene can remain in the body for several days after ingestion. Case studies have detected naphthalene metabolites, such as naphthol, in urine two weeks after oral exposure, suggesting that this chemical can linger within the gastrointestinal tract for some time, prolonging its

Least-Toxic Clothes Moth Management

1. Do not use mothballs when storing clothing.
2. Practice good housekeeping. Periodically clean areas of a home (preferably with a vacuum) that may harbor clothes moths to prevent or control infestation. Target areas include along baseboards and in cracks where hair and debris accumulate, under heavy pieces of furniture, heaters, the areas behind them, and vents.
3. Launder clothes before storage - moth larvae are attracted to sweat, dandruff, hair, food and beverage stains, and other organic materials. If possible, iron or brush clothing and other fabrics to remove any eggs or larvae.
4. Store clothing in airtight chests or containers and make sure storage containers are clean before storing clothing. Plastic bags that use vacuum suction to remove air is also a good way to store clothing.
5. If possible, air clothing in sunlight before storing. Bright sunlight and wind will reduce larvae on fabrics.
6. Avoid storing clothing in dark areas, like attics. Larvae prefer to feed in secluded, dark places.
7. Use least toxic options to control moths. Store clothes with herbs such as cloves, fresh rosemary, eucalyptus, lavender, lemon, sweet woodruff, cinnamon sticks and bay leaves also repel moths. Herbal sachets are available at most health food stores. Cedar oil (sold as blocks or shavings) is a botanical oil that can also be used to repel moths.
8. Infested fabrics can be treated by heating the infested object for at least 30 minutes at temperatures over 120°F, freezing the object for several days at temperatures below 18°F, or fumigating with dry ice.
9. Pheromone traps are available and trap certain species of moths. These can be placed in closets and other areas where clothes are stored. It is also important to launder clothes that have been exposed to the trapped moths. Note: Use traps only if there is an established moth infestation.
10. Humidity should be kept low inside buildings or storage rooms, since this type of environment is not attractive to moths..
11. Read the label first on all pesticide products to identify product ingredients!
12. On a related note, do not use toilet deodorizers that contain p-dichlorobenzene.

excretion from the human body.[9] Other acute symptoms include impaired vision and urethral swelling.

There are several cases of mortality among infants and young children that have accidentally ingested mothballs and one case documents a 17-year-old male who died five days after exhibiting symptoms that included vomiting, gastrointestinal bleeding, blood-tinged urine, jaundice, and coma.[9,15]

III. Dermal exposure. Clothing and other textiles absorb large concentrations of mothball chemicals,[12-13] which remain within cloth fibers for long periods of time, even after prolonged airing.[13]Skin irritation, and even severe dermatitis, can occur after being in contact with mothballs.[14]

Wearing clothing that has absorbed mothball chemicals can induce red blood cells destruction (hemolysis), especially in young children. Hospitals have observed hemolytic anemia in infants, including newborns, who wore clothing, or were wrapped in blankets, stored with mothballs.[2] Children are especially susceptible to this effect on the blood, because their bodies are less able to get rid of naphthalene and p-dichlorobenzene. These chemicals are easily absorbed by the skin during the handling of mothballs, and particularly when oil-based lotions have been used on the skin.[2,14] A three-year old patient whose symptoms of jaundice and pale mucous membranes, indicative of liver damage, were attributed to dermal absorption of p-dichlorobenzene given that the toddler played with crystals containing the chemical.[4]

Children who suffer from a glucose-6-phosphatedehydrogenase (G6PD) deficiency are prone to hemolysis induced by mothball exposure. Two Greek infants with this deficiency died as a consequence of acute hemolysis that resulted from exposure to naphthalene (mothballs)- treated materials. Both infants exhibited a severe form of jaundice, which often causes brain damage.[2] Higher rates of inherited G6PD deficiencies are found more often in defined subpopulations with African or Mediterranean ancestry than in other groups, and these populations are therefore more susceptible to oxidative damage from naphthalene exposure.[2,9,15]

Repeated exposure to naphthalene can cause clouding of the eye's lens (cataracts) and impair vision.[20] Researchers have also found a significant correlation between mothball exposures and non-Hodgkins lymphoma,[21] which further emphasizes mothball induced hematologic toxicity.

IV. Pre-natal exposure.

Mothball chemicals have been identified in placentas,[4] fatty tissue and breast milk.[2,22] Anemia and jaundice have been reported in infants born to mothers who "sniffed" and/or ingested mothballs during pregnancy.[14,18] This means that transplacental transfer of naphthalene and/or p-dichlorobenzene occurs during pregnancy and adversely impacts newborns.[14]

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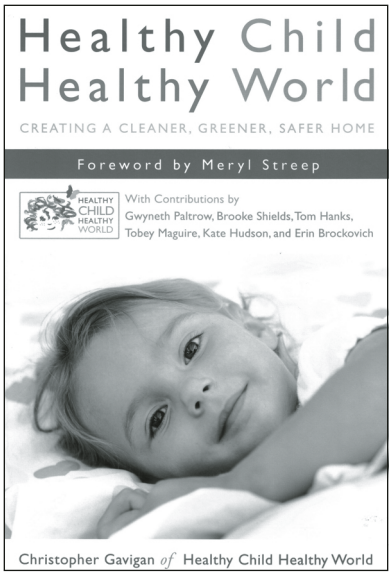
Healthy Child Healthy World: Creating A Cleaner, Greener, Safer Home

(Christopher Gavigan. New York: Dutton. 2008. $25.95, 322pp.) What motivates people to be green? Parenthood is certainly one thing. And if the miracle of life itself moves you to reach out for information to protect the bundle of joy, then the new book, *Healthy Child Healthy World: Creating A Cleaner, Greener, Safer Home*, will help turn your new found quest to keep toxic chemicals and products out of your home into a reality. This is a book for pregnant couples and new parents with the same name as the organization, Healthy Child Healthy World (HCHW), for which its executive director and author, Christopher Gavigan, works. Mr. Gavigan himself is a new parent of a healthy son, Luke, so this book is timely for his family and also fulfills a longstanding organizational mission. HCHW (formerly CHEC) and this book grow out of the vision of the organization's founders, Nancy and James Chuda, whose treasured gift of life, their daughter Collette, was taken from them at age five by Wilms' tumor, a rare form of cancer. They turned their pain into a passion and path to protect children from the daily onslaught of toxic chemical exposure with information that empowers parents to act in their homes and advocate for changes in law and corporate behavior. In addition to their genuine desire to prevent the poisoning of all children, which propelled them forward, they enlisted their good friend, Olivia Newton-John, whose daughter Chloe was a close friend of Colette, and who shared the pain, desire and commitment to speak out for change, prevention and health, attending meetings, singing at fundraisers, doing TV appearances, and hosting dinners –being by the Chuda's side on this unexpected journey.

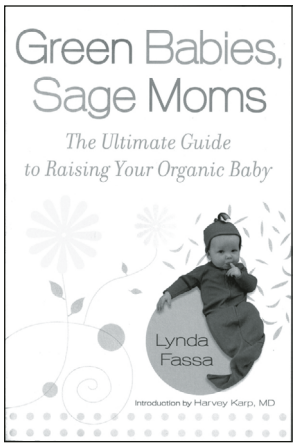


The book draws on the experiences and expertise of many people and organizations that work on the topics and issues addressed, from pest management, lawn care, pets, cleaning agents, fabrics, mattresses, paint, to baby bottles. For those who need convincing, the book provides a context for why new parents, new to the toxics issue, need to follow the advice of this book with an explanation of children's vulnerability to toxics, and the range of chemical-induced illnesses that are striking children, from cancer, asthma, allergies, autism and attention deficit and hyperactivity disorder (ADHD), hormone disruption and obesity. Additionally, the author sprinkles in experiences and perspectives from celebrities including Gwyneth Paltrow, whom we learn grew up with an environmentally conscious mother who took her as a young child to farmers' markets, "even had wheatgrass in the kitchen," and now as the mother of Apple and Moses serves up organic food, a lot of which she makes herself. She even shares two recipes for brown rice baby food and roast veggie sticks.

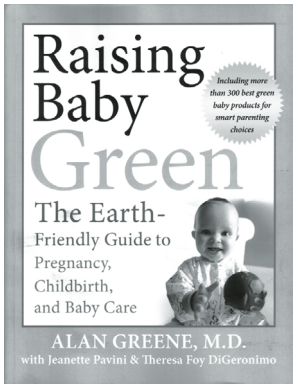
The book offers several well-placed DIYs (do it yourself) tips from Annie B. Bond on how to make safe cleaners, as well as an under-the-sink makeover. As Harvey Karp, M.D., pediatrician, author of best-selling child rearing books, and HCHW board member, says in the book, "You'll find lots of great ways to boost health, shrink risks, and stack the deck in your child's favor." While the focus is on what you can do at home, including Five Steps ("Manage Pests Safely, Use Nontoxic Products, Clean Up Indoor Air, Shop Smart, Be Wise with Plastics"), the author recognizes that every parent has to turn his or her attention to the world outside and, "Enlighten your school, day-care center, or community group." Taking it to the next level, Amy Brenneman (of "Judging Amy" fame, whose father, Russell Brenneman, Esq. she tells us is a part of the research/advocacy group Environment and Human Health, which helped secure a ban of pesticides on school playing fields across Connecticut) talks about teaching her children to be conservationists "as my parents taught me." For more information, contact www.healthychild.org.

Two Other Good Books on the Subject:

Green Babies, Sage Moms: The Ultimate Guide to Raising Your Organic Baby. **(Lynda Fassa. New York: New American Library. 2008. $14.00, 234pp.)** The author and founder of the organic clothing company Green Babies writes a concise book on raising a child in a healthy environment, interspersed with recipes and perspectives from "Green Guru" experts. www.greenbabies.com.



Raising Baby Green: The Earth-Friendly Guide to Pregnancy, Childbirth, and Baby Care. **(Alan Greene, M.D. et al. San Francisco: Jossey-Bass. 2007. $16.00, 306pp.)** Noted pediatrician and author of the popular web site www.drgreene.com, Alan Greene, M.D. guides parents through green choices for pregnancy, childbirth, and baby care.



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