# BOOK REVIEWS

## The Pesticide Regulation Treadmill

**Our Children's Toxic Legacy**. How Science and Law Fail to Protect Us from Pesticides. JOHN WARGO. Yale University Press, New Haven, CT, 1996. xvi, 380 pp., illus. $30 or £22.50.

Odd things can happen in Washington during an election year. This July, a bill that dramatically changes how the government sets limits for pesticide residues in foods sailed through Congress in a few days; President Clinton signed it on 3 August. The bill, the Food Quality Protection Act of 1996, instructs the Environmental Protection Agency (EPA) to set legal limits, or tolerances, to ensure "reasonable certainty of no harm" to public health, replacing a previous risk-benefit balancing standard. The new law also requires tolerances to protect infants, children, and other sensitive subpopulations from possible adverse effects of pesticides in their diets.

In a single stroke, Congress enacted reforms long stuck on the legislative back burner, which a few months ago no one expected this Congress to pass. The Delaney anti-cancer clause (as it applied to pesticides in foods) is replaced with a "negligible risk" standard, as recommended by a 1987 National Research Council (NRC) report, *Regulating Pesticides in Food: The Delaney Paradox*. Protecting the very young from pesticide hazards, an issue raised by the 1989 controversy over Alar and the focus of of the 1993 NRC report *Pesticides in the Diets of Infants and Children*, is now a central goal of regulation.

John Wargo, a pesticide policy expert in the School of Forestry and Environmental Studies at Yale, worked on both the 1987 and the 1993 NRC studies that laid the groundwork for these reforms. His new book, *Our Children's Toxic Legacy*, shows convincingly that major changes in the way we manage pesticide risks were needed—and still are. Wargo may have intended this work to support an effort to pass a bill like the one Congress just enacted, but it will serve equally well as a guide for health scientists and environmentalists who must now press the EPA to carry out its new mandates assertively in the face of inevitable industry resistance.

Wargo begins with a detailed history of the discovery and benefits of synthetic pesticides, of DDT use to combat malaria in the 1940s, and of the promotional efforts by industry and government that rapidly expanded pesticide use in agriculture and for other needs after World War II. Government enthusiasm for licensing pesticides created thousands of entitlements—registrations granted to pesticide makers—long before the scientific evidence needed to assess the health and environmental risks of their uses existed.

When Congress assigned the newly formed EPA the task of managing pesticide risks in the early 1970s, it gave equal weight to protecting those economic entitlements. The resulting legal framework has fostered nearly endless debate over uncertain risks and benefits of pesticide use. Congress instructed the EPA to review the safety of pesticides on the market in 1972, expecting the task to take four years. It has taken 24 so far, and may never be completed. Even in cases where the EPA suspects that a pesticide poses substantial public-health risk, products containing the chemical remain on the market, often for years, while risks and benefits are assessed and debated.

The 1996 law gives the EPA new powers to use tighter, more health-protective tolerances to force reduction in use of the most hazardous pesticides. But Wargo's book suggests how formidable a task it will be to marshal the necessary scientific evidence. He reviews risk-assessment science, focusing on exposure assessment, and explains why children are especially sensitive to pesticide toxicity. He presents a model for examining the distribution of risk from pesticide residues in children's diets, which should dovetail with the EPA's new mandate to set tolerances that protect the very young. Those who have read the 1987 and 1993 NRC reports cited earlier will find this material familiar, as Wargo provides methodological detail but no new data or novel analysis here.

Wargo's strongest impact is to make clear why pesticide regulatory decisions are often so contentious. His account of the science needed to support decisions is a litany of things we don't know, questions research has raised but not answered, and in particular exposure data we need but can't obtain in any practical way. What long-term effects does pesticide exposure have on the endocrine and nervous systems, on behavior, reproduction, or development, in our own species and in others? How do sporadic exposures to dozens of different pesticides—real-life as opposed to single-substance toxicity tests—interact? How much of which pesticides does any particular group of people actually ingest in the foods they eat? We know such questions matter, but they cannot be answered firmly enough yet to sustain the burden of proof the EPA must meet to take away a registrant's long-held economic entitlement.

The reforms just enacted by Congress may help make pesticide regulation a more effective tool for public health protection, but Wargo's analysis offers few grounds for optimism. His subtitle is "How Science and Law Fail to Protect Us from Pesticides," and he makes a compelling case that regulation ultimately cannot ensure safety. In his preface, Wargo challenges the basic presumption in law that science can measure risks precisely enough to let government prescribe ways to use pesticides safely. Then, chapter by chapter, he systematically demolishes that premise by showing again and again how incomplete, imperfect, and uncertain the data are that bear on almost every critical issue. Science that can't resolve questions that matter and law that guarantees disputes over all debatable issues are destined to preserve the economic benefits of pesticide uses, not to eliminate their risks.

Pesticide regulation currently costs American industry and taxpayers more than a billion dollars a year, but the public health benefits of this effort have been shrinking. EPA bans of chlorinated hydrocarbon insecticides and of the fumigants EDB and DBCP in the 1970s and early 1980s eliminated a substantial fraction of the pounds of pesticides applied in that era and selectively reduced the use of compounds with high chronic mammalian toxicity relative to other pesticides. But the agency's actions since 1986 have reduced pesticide use by less than 1 percent, and the chemicals impacted by those actions are no more toxic than those the EPA has chosen not to restrict. Growth in reliance on pesticides has offset gains from regulation, and the overall toxic risk of pesticides in use today is as great as it was 25 years ago. (See C. M. Benbrook *et al.*, *Pest Management at the Crossroads*, shortly to be published by Consumers Union.)

Robert van den Bosch in his 1978 book *The Pesticide Conspiracy* used the term "the pesticide treadmill" to describe escalating dependence on chemical pest control in agriculture. Today, it seems pesticide regulation is also a treadmill: We're running hard just to stay in place.

The most serious flaw in Wargo's analysis is that he does not embrace the clear impli-

cations of his own assessment. He makes a devastating case that the very nature of science and law has prevented regulation from reducing pesticide risks to socially acceptable levels. It seems odd, then, that his prescribed solution is better regulation: some refinements of risk assessment, to improve data quality, better account for risk distribution, and deal more frankly with uncertainty; and reforms of the regulatory process, to be more open about risk and make more "precautionary" decisions. He argues for all the changes that Congress enacted this summer, and a few others.

Worthy as these reforms are, they will not get us off the pesticide regulation treadmill. Ultimately, we need policies that focus more on managing *pests*, in safe, ecologically sound ways, and are less centered on managing *pesticides*. Scientists, farmers, and other pest managers, government officials, environmental groups, and others need to concentrate on promoting integrated pest management and other biologically based pest-management strategies. Instead of needing to make pesticide regulation work better, we should be working to make it less needed.

Wargo's book lacks this vision, but it makes a compelling case that such a vision is needed. *Our Children's Toxic Legacy* can't tell us how to get off the pesticide regulation treadmill, but it should remove any residual doubts that we must make the attempt.

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## Vignettes: Companion Animals

At home Rover is told to sit up and speak. Polly is asked if she wants a cracker. The news is full of the language of apes and dolphins, who, it is speculated, may be smarter than people. The scientists claim to be doing studies in communication, but the rest of us know what's afoot. We just want the whales and chimps to talk—not just about hunting shrimp or fruit but to speak to our mutual situation, claim our shared purposes, mend what Lévi-Strauss calls "the ultimate discontinuity of reality."

—*Paul Shepard*, in *The Others: How Animals Made Us Human* (Island Press)

Tales of intelligence in pets have been commonplace for millennia. The ancient Stoic philosopher Chrysippus reported a dog that could perform the following feat of reason: coming to a three-way fork, he sniffed down paths A and B, and *without sniffing* C, ran down C, having reasoned that if there is no scent down A and B, the quarry must have gone down C. People are less fond of telling tales of jaw-dropping stupidity in their pets, and often resist the implications of the gaps they discover in their pets' competences. Such a smart doggie, but can he figure out how to unwind his leash when he runs around a tree or a lamppost?

—*Daniel C. Dennett*, in *Kinds of Minds: Toward an Understanding of Consciousness* (BasicBooks)

## Multipurpose Organelles

**The Peroxisome.** A Vital Organelle. COLIN MASTERS and DENIS CRANE. Cambridge University Press, New York, 1995. xviii, 286 pp., illus. $69.95 or £45.

Although the "microbody" achieved its biochemical identity as a peroxisome 30 years ago, its functions remained an enigma wrapped within a single membrane and its very existence was virtually unknown to most biologists until fairly recently. Interest in these organelles has grown with the discovery of their various roles in lipid metabolism (including beta oxidation of fatty acids and dicarboxylic acids and synthesis of lipids, cholesterol, and bile acids) as well as gluconeogenesis, glyoxylate metabolism, and disposal of hydrogen peroxide and toxic oxygen metabolites. Many of these activities had been attributed to mitochondria. Mitochondria-enriched subcellular fractions often contain peroxisomes, and researchers have, unfortunately, generally attributed all activities associated with such fractions solely to mitochondria.

Substantial excitement and research have been stimulated by the elucidation of peroxisomal dysfunction in metabolic diseases. The peroxisome is the first organelle to have a central role in a major feature film—*Lorenzo's Oil*, a moving account of the struggle of two non-scientist parents to find a cure for X-linked adrenoleukodystrophy, a progressive and devastating disease in which the peroxisomal oxidation of very–long-chain fatty acids is grossly impaired.

Included among the peroxisomal diseases are not only those in which a single peroxisomal enzyme is defective but also an intriguing group of disorders related to Zellweger syndrome in which defective membrane peptides prevent the import of peroxisomal enzymes from the cytosol into their target organelle, resulting in empty "ghost" peroxisomes and multiple functional enzymatic deficiencies in individuals in whom enzyme synthesis is normal.

This succinct, well-written monograph is both current and comprehensive and covers the enzymology, morphology, genetics, biogenesis, and ontogeny of peroxisomes in animals and plants along with topics such as carcinogenesis and peroxisomal diseases. Its wide scope will make it useful to specialists in the field as well as to biologists who are ignorant of this fascinating and ubiquitous structure that has now "emerged more clearly from the shadow of its fellow oxidative organelle the mitochondrion and assumed a distinctly individual profile." Unlike the functionally rather restricted mitochondria and chloroplasts, peroxisomes, though lacking their own DNA and an inner membrane, serve as diverse, multipurpose organelles in virtually all animal and plant cells.

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## Reprints of Books Previously Reviewed

**Adaption and Natural Selection**. A Critique of Some Current Evolutionary Thought. George C. Williams. Princeton University Press, Princeton, NJ, 1996. Paper, $14.95 or £10.95. ISBN 0-691-02615-7. *Reviewed* **152**, 338 (1966).

**Bugs in the System**. Insects and Their Impact on Human Affairs. May R. Berenbaum. Helix (Addison Wesley), New York, 1996. Paper, $15 or C$21. ISBN 0-201-40824-4. *Reviewed* **267**, 548 (1995).

**Charles Darwin**. The Man and His Influence. Peter J. Bowler. Cambridge University Press, 1996. Paper, $15.95. ISBN 0-521-56222-8. *Reviewed* **252**, 992 (1991).

**The History and Geography of Human Genes**. Abridged edition. L. Luca Cavalli-Sforza, Paolo Menozzi, and Alberto Piazza. Princeton University Press, Princeton, NJ, 1996. Paper, $35 or £25. ISBN 0-691-02905-9. *Original edition reviewed* **267**, 1530 (1995).

**A History of the Ecosystem Concept in Ecology**. More Than the Sum of the Parts. Frank Benjamin Golley. Yale University Press, New Haven, CT, 1996. Paper, $14. ISBN 0-300-06642-2. *Reviewed* **264**, 726 (1994).