



Book Review

Frederick Rowe Davis, *Banned: A History of Pesticides and the Science of Toxicology*. Hartford, CT: Yale University Press, 2014.

Using pesticide regulation as a lens, Frederick Davis examines the development of toxicology as a scientific field of research. In the process, he considers the continuing question about the safety of these chemical substances. In a very real sense, Davis provides “the rest of the story” beyond Rachel Carson’s 1962 book *Silent Spring* and the role it played in banning the use of DDT. Yet, as Davis notes in his preface, the warnings Carson raised at the end of her jeremiad appear to have become reality as Americans wrestle with the ongoing effects of pesticide use. How we continued to use chemicals of unknown safety becomes the answer *Banned* seeks to provide.

Davis starts not with pesticides, however, but with the appearance and early scientific response to the chemically-induced health crises at the beginning of the twentieth century. Chapter One investigates the origins of toxicology as an independent science designed to identify, evaluate, and measure the various toxicities of chemicals used for human consumption. A number of hazardous chemical exposures affected the emergence of toxicology as a science, although it would be the Elixir Sulfanilamide tragedy that prompted the development of a standardized measure of toxicity. This measure was based on the quantity of a lethal dose that killed fifty percent of test subjects, or LD₅₀. Chapter Two looks at DDT, one of the most studied chemicals in the 20th century, and one that refined the new hallmarks of toxicological testing. Scientists studying DDT continued to perfect LD₅₀ as a measure of toxicity, even as they expanded the range of testing to include wildlife studies. DDT studies also revealed one of toxicology’s blind spots, as scientists focused on lethal endpoints and ignored indirect effects. The next three chapters form the heart of Davis’s study as they consider the University of Chicago’s toxicology lab, the emergence of the organophosphate chemicals, and attempts to legislate pesticides.

Davis’s inclusion of a new set of actors represents one of the book’s strengths, and nowhere does this appear more clearly than in his discussion of the University of Chicago’s Toxicology Laboratory. The

Tox Lab, as Davis calls it, clearly represented a key institution in the development of toxicology as a scientific field. Coupled with the war, and under the leadership of E.M.K. Geiling, the scientific work done at the laboratory in anti-malarial drugs, radioactive assay methods, and the nitrogen mustards all provided important experiences and helped the emerging field develop concepts of chemical persistence, synergism, joint toxicity, and drug resistance. The laboratory also offered important space in employing and training the current and next generation of toxicology scientists. Just as DDT had demanded laboratory innovations, so too did the development and testing of the organophosphate pesticides. Chapter Four expands not only the individuals examined, such as Kenneth DuBois and his research team, but the institutions as well, including work done at Johns Hopkins and the Food and Drug Administration (FDA). The chemicals now under scrutiny proved to be far more toxic than DDT. DuBois uncovered the organophosphate inhibition of cholinesterase, while Hopkins's David Grob used occupational exposure to determine parathion's toxicity, and Arnold Lehman created a hierarchy of toxicity at the FDA. Even as these toxicologists charted the organophosphates' toxicity, elected officials began considering how they should be regulated. Two key legislative acts framed the debates over the use and safety of chemical pesticides in the postwar period: the 1938 Federal Food, Drug, and Cosmetic Act, and the 1947 Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA). Chapter Five focuses on subsequent hearings that resulted in amendments to FIFRA. No chapter better captures the complexity, uncertainty, and frustration of trying to evaluate the risks, safety, and economic rationale for pesticides. Legislators looked to toxicologists to provide definitive evidence of harm in their deliberations about regulatory policy, evidence that remained elusive. Toxicologists from the United States Department of Agriculture (USDA), the FDA, the chemical industry, academic researchers, and medical practitioners all gave careful but contradictory testimony regarding the perceived risks and potential benefits of this chemical class. The resulting Miller and Delaney amendments tried to address concerns, with the Miller Amendment charging the FDA with determining additive safety, and the Delaney Clause seeking to stop carcinogenic additives. The last three chapters assess the success of pesticide regulation, looking at *Silent Spring*, the ban on DDT, and our existing chemical landscape.

Throughout the 1950s and 1960s, leading scientists at major institutions like the Tox Lab, Johns Hopkins, and the FDA continued their

efforts to define toxicology as a scientific field. Pioneers like Geiling and DuBois wrote textbooks, established departments, created professional societies and journals. This “professionalization” of toxicology remained mostly invisible to the general public, although toxicologists’ scientific research and insights were popularized by a group of science writers. The most prominent of these was Rachel Carson, a former government employee who had enjoyed great success in her examinations of the sea. In addition to Carson, at least two others brought toxicological advances to the American public: University of California professor Robert Rudd and freelance writer Lewis Herber. The publication of *Silent Spring* in 1962 and attention it drew to DDT and the organophosphates, concurrent with toxicological research on the possibility of potentiation and no-effect level, set the stage for further chemical regulation. It appears that this may be the moment that things went awry, as public officials and Americans in general focused on the dangers of DDT and overlooked the dangers posed by the organophosphates, despite Carson’s warnings. Davis astutely identifies some of the reasons the organophosphates elude regulation, including the emphasis on carcinogenic potential and their lack of bioaccumulation. So in the face of their greater toxicity to human beings and wildlife, and in defiance of Carson’s warnings, the organophosphates became the industry standard.

Davis concludes his study with a consideration of the ways chemicals known to be toxic escaped regulation. As his careful analysis in previous chapters demonstrated, more knowledge of chemical toxicity did not necessarily result in better or safer use of those chemicals. Although not directly addressed in the work, an underlying theme that emerges from its detailed chronicle of chemical pesticides and scientific attempts to quantify risk and safety appears to be the limitations of toxicology. Even as scientists developed important concepts like LD₅₀ and techniques that identified synergistic effects, bioaccumulation, and the potentiation of chemical action, the field of toxicology remained unable to offer decisive proof of chemical pesticides’ hazard or safety. Competing concerns about agricultural need for pesticides to increase food supplies and the safety of the food produced, compounded by conflicts of interest within industry and government regulatory agencies like the USDA and FDA, meant there were no easy answers. But in telling the story of toxicology and pesticide regulation, Davis helps us understand the ways democratic process may not always result in the best outcomes. The fact that we still live, albeit uneasily and with

growing anxiety, with such outcomes make a book like *Banned* an important addition to our arsenal of consciousness, and offers hope for change.

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