# Factor Fiction?



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## DDT, Part 2 Persistence in the Environment

Malaria killed three million people in 1997 and infected as many as 500 million worldwide." —Malaria Foundation

**Columnist's Note:** Part 1 of this series on DDT appeared in the July issue. It presented data on the early use and benefits of DDT, then discussed the politics that led to its ban. Toxicity of DDT was also covered. References for Parts 1 and 2 are listed this month.

Persistence in the Environment One often-heard claim is that DDT cannot be broken down in the environment. Actually, DDT is broken down rather rapidly by heat, cold, moisture, sunlight, alkalinity, salinity, soil microorganisms, hepatic enzymes of birds and mammals and a great many other environmental factors.18 Only in unusual circumstances where soil is dark, dry and devoid of microorganisms will DDT persist. Under normal environmental conditions, DDT loses its toxicity to insects in a few days.<sup>7</sup> If it did not break down, it would have been unnecessary to apply it again in order to control pests. Edwards provides a list of more than 140 articles documenting the breakdown of DDT in the environment.18

A key reason that traces of DDT are sometimes still found in environmental samples is that we can now detect extremely minute amounts of anything. In the span of about two decades, detection limits have been reduced by about six orders of magnitude.<sup>23</sup> Some analysts have even reported DDT in samples collected before DDT existed. University of Wisconsin chemists, for example, were given 34 soil samples to analyze. They reported that 32 of the 34 samples contained DDT. What the chemists didn't know was that the soil samples had been hermetically sealed in 1911, and no DDT existed in the U.S. until 1940.<sup>24,25</sup> The author wrote later: "The apparent insecticides were actually mis-identifications caused by the presence of co-extracted indigenous soil components."

Still later, it was found that red algae also produces halogen compounds that are misidentified as DDT by gas chromatography. Also, halogen compounds containing bromine or iodine, rather than chlorine, may falsely register as DDT on the gas chromatograph.<sup>26</sup> Various PCBs were commonly misidentified as chlorinated hydrocarbon insecticides during the 1950s and 1960s, and were routinely reported as "DDT residues."

Claims About Bird Declines In *Silent Spring*, published in 1962, Rachel Carson stated that the American robin was on the verge of extinction.<sup>9</sup> That same year, Roger Tory Peterson, America's leading ornithologist, wrote that the robin was most likely the most numerous North American bird.<sup>18,27</sup> Carson's notion that the most prolific bird was about to fall extinct was one of the most eye-catching assertions in *Silent Spring* and brought the book considerable publicity.

Peregrine falcons and eagles were also high on Carson's list. In reporting on declines in population of these species, she tended to heap the entire blame on pesticides and ignored all data that would refute her theory.<sup>16</sup> Peregrine falcons were extremely rare in the eastern U.S. long before there was any DDT present. By the time DDT was introduced, there were literally no peregrine populations in the eastern U.S., but the anti-pesticide extremists later placed the blame on DDT anyway.<sup>18</sup> Bald eagles in the lower 48 states were on the verge of extinction in the 1920s and 1930s, long before DDT was discovered. They were shot on sight for fun, bounty or feathers, trapped accidentally, killed by impact with buildings and towers or electrocuted by power lines. There is still high mortality as a result of physical hazards, but much less from shooting and trapping (because if caught engaging in either activity, you may now face a prison term).

The most surprising thing is that the environmental industry and the news media continue to attribute the increase to just one thing—the 1972 ban on DDT.<sup>18</sup> Continuing the saga of showing that DDT was not bad on eagles, a recent study at the University of Wisconsin at Madison reported that lack of a suitable food supply in Lake Superior—and not DDT—was responsible for reproductive problems in eagles.<sup>28</sup>

There was no mention at all in Silent Spring of the increases of birds observed by naturalists, including those participating in the Audubon Christmas Bird Counts. Naturalists counting hawks migrating over Hawk Mountain, PA, also reported great increases in the number of raptors, following the widespread use of DDT. Dr. J. Gordon Edwards of San Jose State University has documented those bird increases and also cited numerous feeding experiments that revealed DDT in normal bird diets did not cause the deaths of any birds.<sup>18,26</sup> Dr. William Hazeltine, another concerned California scientist, regarded pesticides as one of the least important causes of avian dislocations. The chief culprits, he said, were hunters, trappers, falconers, campers and the general encroachment of humans into nesting and feeding areas.<sup>16</sup>

Bird Egg Shell Thinning On close inspection, even the oftenrepeated eggshell thinning threat to bird life holds little validity. DDT opponents alleged then and now that DDT caused eggshells to be thinned/ softened for certain types of birds. causing failure to hatch and populations to decline. Thin egg shells are a phenomenon that pre-dates use of DDT. It has been known for decades that there are many causes: diets low in calcium or vitamin D, fright, high or low daily temperatures, various toxic substances, and bird diseases (such as Newcastle disease).<sup>7</sup> It has been demonstrated repeatedly in caged experiments that DDT and its breakdown products do not cause significant shell thinning, even at levels many hundreds of times greater than wild birds would ever accumulate.26 The most notorious cause of thin eggshells is the deficiency of calcium in the diet. Some early researchers deliberately fed their birds only calcium-deficient food (0.5% rather than the necessary 2.5% calcium) and then attributed all shell problems to the DDT and DDE they had added to that calcium-deficient diet. Edwards reported that after much criticism about the use of calciumdeficient diets that were known to give the false impression regarding DDT shell thinning, the tests with DDT and DDE were repeated, but with adequate calcium in the birds' diets. The results proved that with sufficient calcium in their food, the quail produced eggs without thinned shells.26

Another method to obtain data is to measure the thickness of eggshells in museum collections. Measurements of the shells of hundreds of museum eggs have revealed that red-tailed hawk eggs produced just before DDT was used had much thinner shells than eggs produced 10 years earlier. Then, during the years of heavy DDT usage,

those hawks produced shells that were six percent thicker. Golden eagle eggshells during the DDT years were five percent thicker than those produced before DDT was present in the environment.<sup>26</sup> More recently, R.E. Green found that thrush eggshells in Great Britain were thinning by the turn of the century—47 years before DDT hit the market. He speculated that the thinning may have been an early consequence of industrialization, and that acids formed when pollutants belched out of coal furnaces and smokestacks may have changed soil and water chemistry enough to reduce the availability of calcium, which is critical in the diet of birds that are producing eggshells.<sup>29</sup>

PCBs were later shown to cause dramatic thinning of eggshells, as well as other adverse effects on birds, yet environmentalists continued to place the blame on DDT—despite the fact that feeding birds high levels of that pesticide did not cause them to produce thin eggshells. There are many environmental contaminants that do cause shell thinning. Oil, lead, mercury, cadmium, lithium, manganese, selenium and sulfur compounds have been shown to have adverse effects upon birds, including severe shell thinning.<sup>26</sup>

### Bioaccumulation & Biomagnification

"Bioaccumulation" refers to an increase in the concentration of a chemical in the environment (in water, sediment, soil, etc.) "Biomagnification," on the other hand, refers to increases of chemicals as they are passed up food chains. As Ottoboni<sup>5</sup> points out, "The quantity of chemical that can be stored in any body can never exceed that which would be in equilibrium with the exposure. The chemical cannot remain in the storage depot without being replenished continually from the outside. Thus, the popular notion that foreign chemicals stored in a depot become immobilized and permanently fixed in the body, with additional exposure increasing the quantity stored *ad infinitum*, has no basis in fact. The claim that our bodies can become 'walking time bombs' is nonsense." She sums it up best by pointing out that bioaccumulation is not inherently good or bad, but in the public mind it is considered, almost universally, to be the latter.

Biomagnification proponents claim that pesticide levels are "magnified" at each step of the food chain, for example, from algae to planktonic crustaceans to small fish to larger fish to predatory birds or mammals. The consumption of low levels of pesticides within each prey animal is presumed responsible for increased amounts in higher predators.<sup>8</sup> DDT is constantly broken down and excreted by the animals at each step of the food chain. If tiny crustaceans are analyzed wet-weight, but the fish that ate them are analyzed dry-weight, the difference in the amounts of dilution by water creates an impression that the dry sample contains a greater amount of pollutants than the wet sample. DDT is attracted to fat tissues more than to muscle tissues, so comparisons between samples of these two types will indicate "magnification" into the fatty tissues, even if they are samples from the same animal. Likewise, brain tissues attract more DDT than fatty tissues. Anti-DDT activists were careful to measure crustaceans, wet-weight, and compare them with levels in dry-weight muscle samples in fish, dry-weight fatty tissue in ducks that ate the fish, and dry-weight brain tissue in the hawks that ate the fish. If they measure all samples wet-weight, there is no "biomagnification." Also, if they measure only the muscle tissue from fish, ducks and hawks, there is also no "biomagnification."18,26,30

### Summary

Today, a lot of effort is spent reminding people, particularly the younger folks, about the Holocaust and World War II, because it has now been more than two generations since these events occurred and people tend to forget. As Tenner<sup>31</sup> wisely says, "With each generation, part of the collective memory of the last terrible events is lost." Well, it has been more than one generation since DDT was banned, and clearly, most people today only speak ill of DDT. They have no clue about how valuable it was, nor the politics behind its banning. And, speaking of holocausts, the banning of DDT was a holocaust. Malaria, which was being controlled by DDT, has proliferated since the abandonment of DDT. As Mooney<sup>32</sup> points out, this was an early example

of Western priorities being imposed on Third World people who may have made a different trade-off had the choice solely been theirs. Also, from Ottoboni,<sup>5</sup> "The thought that substitution of nonresistant pesticides for persistent ones will solve all of the environmental problems attributed to the latter is an example of the myopic thinking that permeates so many decisions relating to environmental protection. People apparently haven't realized that all nonresistant pesticides merely degrade to other chemicals! The only difference is that most of these new chemicals do not have the same pesticidal action as their parent chemicals." P&SF

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