DIOXIN AND WITCHCRAFT

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Research on plant hormones in the 1930's and 1940's led to the discovery and use of the phenoxy herbicides to control broad-leaf plants. Tens of thousands of kilograms of these compounds were employed throughout the world during the latter part of the 1940's, the 1950's and the 1960's. They were one component of the "green revolution" that markedly improved the world's food supplies.

The beneficial effects of the herbicides were so pronounced in agriculture and forestry that they were regarded as "magical." There seemed to be no adverse effects on humans nor on lower animals except as alterations of the environment made life more difficult for some forms. To be sure, environmentalists opposed the use of phenoxy herbicides on the same basis as they objected to other chemicals that modified the conditions of life.

In 1962 a new factor appeared. The United States armed forces introduced phenoxy and other types of herbicides into the conflict with the North Vietnamese and the Viet Cong. The compounds were chosen because they were believed to be non-toxic for humans and were used to defoliate plants that provided cover and food for military actions. The North Vietnamese promptly claimed that use of the defoliants constituted "chemical warfare" and soon were attempting to substantiate toxic effects in exposed humans.

As early as 1965, "war protesters" and environmentalists in the United States decried the use of herbicides in Vietnam. American scientists became concerned as the use of Agent Orange expanded. This mixture of two phenoxy herbicides was chosen as the principal defoliant for the Ranch Hand operation, the spraying by fixed-wing aircraft that eventually accounted for more than 90 percent of the herbicide used in Vietnam.

The defoliation operations increased in 1966 and 1967. At this point, American scientists became alarmed at the marked shift in the ecology of South Vietnam and several visited the country to study the effects of defoliation. More scientists began protesting the probable long-term effects of deforestation but their complaints and warnings were largely lost in the outcries of the anti-war protesters. The American public as a whole was unaware of the defoliation or did not perceive it as a danger.

The National Cancer Institute in 1968 found that large doses of 2,3,7,8-tetrachlorodibenzo-p-dioxin or TCDD cause birth defects in some strains of mice. TCDD had been known since 1965 to be a contaminant of one ingredient in Agent Orange. The same year the American Association for the Advancement of Science issued a report warning of serious environmental effects of the herbicides as used in Vietnam.

The following year scientists who visited South Vietnam were unable to confirm an increased incidence of birth defects among children born to South Vietnamese women, some of whom probably were exposed to Agent Orange. In 1978, a group of women in the state of Oregon claimed that spraying of nearby forests with phenoxy herbicides had increased the number of premature births and an initial investigation was said to confirm their belief. The ensuing report was, however, so vigorously attacked as scientifically unsound that the episode aroused little interest except among environmentalists.

In the meantime, a number of industrial accidents and repeated exposures in the United States, England, and European countries established TCDD as a cause of persistent chloracne, a non-fatal but sometimes troublesome skin disease, and suggested other adverse effects from exposure to the compound. This also aroused little public interest in the United States.

The American military units decided to abandon the use of herbicides and stopped employing them in 1970. This action went essentially unnoticed but there was some increasing concern over the effects of TCDD in chemical plants, leading to successful reductions in the exposure of workers to TCDD.

The United States in the mid-1970's, although out of Vietnam, found the consequences of the conflict still present in the form of a considerable number of discontented but poorly organized veterans who had served in that country. The veterans constituted a group with deep but unfocussed hostility.

In the United States, the Veterans Administration (VA), is the government agency charged with compensating disabled veterans and with providing medical care for a sizeable number of them. A veteran's first contact with the VA often is an interview with a "benefits adviser" who guides him or her through the complexity of filing a claim for compensation or for other benefits. Such counselors are not medically trained and usually not qualified as health advisers.

One such adviser in a VA office in Chicago met in early 1977 with an ill veteran whose wife suggested that his fatal disease was caused by chemicals to which he was exposed during service in Vietnam. The counselor's suspicions aroused, she began to ask each Vietnam veteran who consulted her about his health and whether he had been in contact with chemicals in that country. Her belief that Agent Orange caused these manifold illnesses grew and, in October 1977, the first VA claims for disabilities caused by Agent Orange were filed in her Chicago office.

The adviser failed to convince her superiors that these claims were valid and so contacted Bill Kurtis, then a Chicago television reporter. The result was a frightening one-hour TV "documentary" entitled "Agent Orange: Vietnam's Deadly Fog." It depicted veterans who were certain that their various diseases and disabilities were caused by Agent Orange. Others demonstrated birth defects in their children and attributed them to the same cause. The program created a sensation on its first showing on March 23, 1978, and was promptly repeated by TV stations throughout the United States.

It immediately provided a focus for the discontent of disgruntled Vietnam veterans, formed a rallying point for environmentalists, and aroused the print and electronic media to exploit the public's interest in this new threat. TCDD was soon linked with Agent Orange and the presence of the former in industrial wastes, notably in Love Canal, New York, and the state of Missouri, added fuel to the fire. Most scientists and physicians remained skeptical that one compound could cause so wide a panoply of symptoms and diseases after so small an exposure as described by the affected veterans. But some were not so cautious, saying that TCDD in body fat constituted a "ticking time bomb" that might be released to sicken or kill any veteran whose body fat was reduced. A physician coined a new "multisystem disease" in which TCDD caused any symptom or condition he ascribed to it.

At this point in the late 1970's and early 1980's, the mysterious TCDD had assumed the properties of black magic, — pervasive, unpredictable, and malevolent — in the minds of many people. Like such magic, to them TCDD must be the result of ill-intentioned witches or warlocks and these could only be the chemists and chemical companies who produced the noxious material. People who denounced the concept of such witchcraft by cautioning that the fearsome results attributed to TCDD and its carrier were unproved were in turn denounced as supporters of the witchcraft.

There is no doubt that the fear engendered in the United States by TCDD spread quickly and widely. Who was responsible for disseminating this "black magic?" Unfortunately the blame is widespread. It includes certainly the media, some Vietnam veterans, a fringe of scientists and doctors, a few public agencies and legislators who saw a chance to "protect" the veterans or the public. Somewhat later some lawyers assisted, especially when it seemed that enormous suits for damages could be engendered. Then too, the very caution that characterizes good scientists and physicians hampered their ability to stem the outcry and the witchhunt.

More to the point is the matter of how such an event can be handled or better still avoided in the future. Witchhunts have been stopped in individual episodes when tempers cooled, discontented groups found peace, and the excesses of belief in the attendant black magic were seen for what they are. This seems to be happening now with the TCDD episode, largely as scientific evidence mounts that the compound really presents no threat from the exposures experienced by the veterans and the public at large. But what can be done to prevent such outbreaks in the future?

More and better education of the general public in scientific matters in the spirit of Helmholz and Faraday undoubtedly is paramount. The disappearance of the deadly witchhunts of the sixteenth and seventeenth centuries paralleled the increasing education that came to characterize the Age of Enlightenment.

The public must be taught certain distinctions that are recognized as of great importance in toxicology. Animal results cannot be assumed always to parallel those in humans. Acute effects appearing suddenly and disappearing soon are distinct from persistent or chronic effects. Symptoms and diseases such as nausea and chemical burns that appear immediately must be distinguished from delayed conditions such as cancer that appear years after exposure to a causal agent. The importance of dosage must be appreciated, as every physician knows; minute amounts of an active material are usually innocuous although larger amounts may be lethal. Further, a single or a few doses may have no effect when repeated doses may have marked consequences.

The scientist too can be better prepared to present information to the public. Scientific jargon confuses and "scare language" can cause panic. Most people do not understand the

scientists' manifold and useful unitage; insofar as possible it is better to use the units of everyday weights and measures. Scientific and medical terms are very precise but only when one knows and appreciates their full meaning. "pH" is very useful to the informed — but "very acid" or "slightly alkaline" means more, even to most educated non-technical people. "Scare words" are recognized and avoided by any good physician. Alternate terms with less frightening implications are used to avoid emotional reaction, not to conceal the truth. A "fast-growing tumor" is less frightening than a "cancer." "Hemorrhage" in English excites more anxiety than "bleeding" and "partial blindness" is much more dire than "reduced vision." The scientist does well to avoid "scare language" as well in discussing adverse effects with the public.

"Comparative risk" is a useful concept that is becoming more common in public discussion. A new toxic material may, if inhaled over long periods, be perhaps twice or one-hundredth or approximately as risky to health as smoking 20 cigarettes a day for the same period. In general, people understand a comparison more readily than a value standing alone.

For the scientist talking with a lay group it is often wisest and most accurate to say "I don't know" or "It isn't known." There is, however, a hazard in such statements when an expert uses them. People have a tendency to interpret them to mean "Therefore there is danger," as the unknown is always frightening to many. Worse still a suspicious person thinks, "The expert must know but won't tell." Where possible, it is better to explain at least by giving the reason for the lack of knowledge and to do so in a way that reduces the listener's anxiety.

Obviously, any reasonable expert will speak only of what he knows. It is the wild conjectures of the incautious scientist that cause the most anxiety and set the stage for the next witchhunt.