

Granville F. Knight, M.D., F.A.C.A.

ALLERGY AND NUTRITION

15525 POMERADO ROAD, SUITE C-3

POWAY, CALIFORNIA 92064

Telephone: (714) 487-7480

BY APPOINTMENT

## PESTICIDES: AN ECOLOGICAL DISASTER!

Presented at the 12th Advanced Seminar of the Society for Clinical Ecology, Key Biscayne, Florida, November 1978.

Members of the Society for Clinical Ecology have been alerted for many years to the dangers of increasing contamination of our air, water and food--as well as other parts of our environment such as clothing, rugs, furniture, paneling, containers for food storage, etc. which are now made from petrochemicals instead of wood, leather, cotton, wool and other products of a similar nature to which man has been accustomed for centuries.

In addition to such exposures, our air, food and water may be contaminated by dozens of chemicals which the human frame was not designed to deal with. Smog is a common component of the air of all our major cities and numerous smaller communities as a result of increasing contamination from industrial effluents. For many years tap water has been treated with chlorine to control bacterial contamination. This process has been suspect and an increasing number of people are beginning to react to chlorine. Of greater import is the fact that water from the Mississippi River near New Orleans may contain as many as 68 chemicals, of which many are chlorinated hydrocarbons. Some of these are known to produce cancer in experimental animals. In addition to these compounds which result mostly from industrial wastes or contamination from runoff of pesticides or synthetic fertilizers, many cities have been adding sodium fluoride or similar compounds to the water supply with the mistaken belief that the addition of such compounds would benefit children's teeth and prevent tooth decay. Our public health service, using our tax dollars, has been urging cities not only in the United States but throughout the World to add artificial fluorides to their water supplies. This drive has been based on a misinterpretation of statistics derived from experiments conducted on whole communities without their consent to determine whether or not the addition of such fluorides would reduce tooth decay. A prominent scientist with General Electric--namely K. K. Paluev--many years ago exposed the falacy of this misinterpretation of statistics. Nevertheless, the drive continues and anyone who suggests that this exercise in futility should be stopped is ridiculed as being an alarmist. Nevertheless, evidence has

been accumulating that fluorides not only do not protect teeth from decay, but that at least one percent of the population may be hypersensitive or allergic to fluorides and suffer serious damage from continued ingestion without knowing the cause. Recent evidence suggests that cities which have been fluoridated for many years have a higher cancer incidence and that this can only be due to the addition of fluorides to the water supply.

DDT and other chlorinated hydrocarbon pesticides have been spread by wind currents throughout the world since their introduction in 1945. They have penetrated our food chains and are now found in high concentration in some fish and seals, both in the Arctic and Antarctic. What is even more alarming is the fact that under the influence of sunlight, DDT is apparently being converted to polychlorinated biphenyls or PCBs which are similar to fire retardants and which are exceedingly stable and toxic.

Most human beings carry pesticide residues in their fatty tissue and often residues of the PCBs and polybrominated biphenyls or PBBs. Moreover, recent studies suggest that the pentachlorophenols which may contain some of the potent dibenzodioxins or dibenzofurans may be an even more common contaminant of human fat and even of spermatic fluid than some of the others which have also been found to be widespread.

Degenerative diseases are on the increase as are strange varieties of so-called "virus diseases". The Bionetic Studies on the toxicity of phenoxy herbicides and other pesticides including the chlorinated hydrocarbons, the organic phosphates and some of the fungicides indicate that under these experimental conditions many of these compounds are capable of inducing cancer in experimental animals as well as being teratogenic and fetotoxic. The presence of the extremely toxic tetrachlorodibenzodioxins (TCDD) in some of our phenoxy herbicides as well as in hexachlorophene is alarming. TCDD is up to one million times more toxic than thalidomide in producing deformed young. A number of serious episodes which occurred worldwide illustrate the dangers of our increasing chemicalization. The widespread use of phenoxy herbicides which are sprayed by helicopter and airplane on our national forests and grazing lands throughout the country creates a very serious problem with ethical as well as physical ramifications. These phenoxy herbicides are in the form of "Agent Orange" which was banned in Vietnam seven years ago after evidence accumulated incriminating the spraying of 2,4-D plus 2,4,5-T together with other pesticides as being under strong suspicion, not only of causing widespread illness, but an increase in the number of deformities in children born of mothers in sprayed areas--as well as an

abrupt increase in liver cancer.

6 A great deal of attention has been paid to the presence of the extremely toxic TCDD in 2,4,5-T, Silvex and one or two other phenoxy herbicides. This fantastically toxic compound has been shown to be exceedingly stable and toxic in very tiny amounts. It has been recovered finally from mother's milk, from rodents, from birds and from the livers of cattle grazing in sprayed areas. It was also found in fish in the estuaries of Vietnam several years after the spraying was stopped. It is therefore undoubtedly accumulating in our food chain.

The experimental studies done by the Bionetics Research Laboratories-- which by the way, were never published--are cause for concern. However, the fact that tremendous amounts of 2,4-D are used throughout the country as compared to 2,4,5-T may be of even greater importance. In the Bionetics Studies birth deformities were produced in experimental animals at a lower dose of 2,4-D than of 2,4,5-T and Silvex. Interestingly enough, most of these compounds including 2,4-D, 2,4,5-T and Silvex produced a high incidence of focal pneumonia (viral pneumonitis?) in experimental animals. This is in accord with the observations of Morton S. Biskind, M. D., Mobbs and others, including myself, who believe that contact with pesticides apparently lowers resistance to infection. At least, exposure to these pesticides is frequently accompanied or followed by, symptoms of so-called "flu" or the frequent so-called virus infections which are across the country. Whereas the so-called "flu" used to occur mainly in the winter months, now we have epidemics year round. I believe the pesticides and other chemicals are playing a very important part in reducing the resistance of the population to infection and to exposure to other chemicals. The synergistic action of such chemicals even in small amounts has been demonstrated in Nova Scotia by investigators who suspected <sup>that</sup> the Reye's Syndrome occurred primarily in children exposed to chemical sprays being used in the forest as well as to some type of virus.

It is of great interest that studies in primates and in other animals have indicated that some of these pesticides are capable of definitely reducing immunological defenses. Many of them also induce cancer in experimental animals and this may be through a mechanism whereby the chemical intercalates with DNA strands thereby either inducing deformities in the young or mortality before or at birth. Judging from experiments done many years ago, wherein club foot was found to be due primarily to a lack of riboflavin at a certain gestational period, it is probable that interference of this type is common. This would also suggest that those individuals who are

nutritionally deficient may be more susceptible to the action of chemicals of various types including pesticides. It should be remembered that because of our exposure to many chemicals in foods, air and water; they undoubtedly have a synergistic action which may multiply the effect of small amounts of many chemicals far above the additive effect.

Last year I described some of the serious episodes which have occurred throughout the World resulting from exposure to pesticides. This was only a small sample of mass poisonings which have occurred because of the use of these chemicals. I will recapitulate these tragedies and add several which have occurred since that time. Documentation is available to substantiate these statements:

1. A study of the Cracow region of Poland between 1961 and 1968 indicated a marked increase in the incidence of leukemia, particularly in areas where insecticides, fungicides, herbicides, seed dressings and other plant protective agents had been widely used.

2. Bauer, Schultz and Spiegelberg of Hamburg, Germany, reported in 1961 the occurrence of several outbreaks of chloracne and severe poisoning in workers engaged in the production of pentachlorophenol in several different factories. This was found to be due primarily to contact with the tetrachlorodibenzodioxins and dibenzofurans released as a result of small explosions. Many of the workers were incapacitated over a period of years and some had not recovered after eight years. An increased incidence of cancer is to be expected in these individuals.

3. Epidemic of hepatomas in trout  $\pm$  12 years ago due to aflatoxins from mouldy cottonseed meal.

4. In 1969, almost 250 reindeer disappeared in a pine forest of northern Sweden. The next year 100 corpses were reportedly found. Forty females had aborted while others were dead with retained fetuses. The forest had been sprayed with a mixture of 2,4-D and 2,4,5-T ("Agent Orange") and after one year, leaves from the sprayed area still contained up to 25 ppm of 2,4-D and 10 ppm of 2,4,5-T.

5. A few years ago (1974), because of mislabeling, a shipment of polybrominated biphenyls (fire retardant plastics) was mixed with grain fodder used for cattle and pigs in Michigan. This feed was widely distributed and consumed before it was suspected as the cause of illness and death in about 30,000 head of cattle and pigs throughout the state. By that time, many thousands of animals had to be slaughtered. It is probable that

several million human beings in that area still have PBBs in their blood. Many complain of excessive fatigue, aching bones and muscles and other symptoms suggesting chronic poisoning.

6. The kepone disaster at Hopewell, Virginia, which caused severe neurological damage to workers in the plant and contamination of rivers flowing into Chesapeake Bay, has destroyed the fishing industry in these rivers and also parts of the Bay. Since this chemical is almost indestructible, it will be many years--if ever--before the contamination disappears.

7. The widespread and repeated use of DDT and other chemicals by aerial spraying in American and Canadian forests in a vain attempt to control the gypsy moth has been a complete failure. This chemical onslaught has killed natural predators of the moth, and done untold damage to wildlife as well as upsetting the ecological balance of the forest floor. The phenoxy herbicides compound the effect. In addition to damage to wildlife, the destruction of alder and other plants and trees providing nitrogen for the soil could have a far-reaching effect in encouraging the survival of conifers that contribute little to enrichment of the forest soil.

8. The use of "Agent Orange", namely 2,4-D plus 2,4,5-T (or Silvex), by the U. S. Department of Agriculture to destroy brush in our national forests has been reported many times to cause severe illness. This was true in Globe, Arizona, in Minnesota, Virginia, Texas, several areas in Canada, in Los Angeles and San Diego, and, most recently, in Oregon and Washington. In some instances birth deformities and abnormal bleeding have been noted in both animals and man, including menstrual bleeding in women past the menopause. The use of these herbicides along roadsides, etc., has compounded the problem. The deadly tetrachlorodibenzo-p-dioxin, (TCDD), has now been recovered from the tissues of small animals in sprayed areas and most recently from the milk of human mothers. It has been found in the tissue of steers grazed on acreage sprayed with 2,4,5-T. Since TCDD is one of the most toxic chemicals known and is exceedingly stable, the outlook is grim. After a suit in Eugene, Oregon, a restraining order has been issued which prevents any more spraying of this type in the Siuslaw National Forest, at least for this year. It was found that the Environmental Impact Statement, prepared by the U. S. Forest Service, was not only incomplete but misleading.

Since the use of "Agent Orange" was banned in Vietnam in 1970, why is our government permitting its use in the United States?

9. In 1970, herds of cattle belonging to Lewis Trotter and John Mayo of San Acacia, sixty miles south of Albuquerque, New Mexico were drift-sprayed without warning from helicopters hired by the Bureau of Reclamation. The Bureau of Reclamation was attempting to kill salt cedar trees along the riverbanks. The chemical used was Silvex, which is

similar to 2,4,5-T and contains the deadly TCDD. The cattle became sick and many died: Forty per cent of the cows aborted. The remainder were finally removed from the sprayed areas but, in spite of adequate food and care, continued to lose weight and finally had to be sold at a tremendous loss. The Trotter children and those of John Mayo became ill, but, hopefully, have finally recovered.

10. A salvage oil company sprayed a horse arena on a horsebreeding farm in eastern Missouri. Over the next several weeks hundreds of birds, several cats and dogs and numerous rodents died after being exposed to the arena. Sixty-two out of eighty-five horses exercised in the arena became ill and forty-eight died. It was finally discovered that the oil used to lay the dust contained a relatively large amount of 2,4,5 trichlorophenol and about 32 parts per million of TCDD.

11. In July of 1976, there was an explosion at a 2,4,5 trichlorophenol plant at Seveso, Italy. The large cloud of gas which was released was high in TCDD and hundreds of exposed human beings became ill. Thousands of birds and animals were killed. Almost a thousand residents of this area had to be evacuated and many will undoubtedly not only lose their houses, but all their belongings that were exposed to the gaseous cloud. I suspect that the houses will have to be bulldozed under, as will the soil which was exposed to the highest amount of the dioxins. (Soil is now being bulldozed and buried.)

12. Five or six years ago, millions of chickens in the State of Mississippi had to be destroyed because of a relatively high amount of dieldrin in their tissues, resulting from contaminated feed.

13. In 1968, several hundred Japanese developed a severe skin disease with acne, bronzing and other complications due to chlorobiphenyls in cooking oils made from contaminated rice hulls.

14. Severe methyl mercury poisoning occurred in Japan secondary to the consumption of fish contaminated by factory effluents of mercury. In the United States, illness and death occurred in families eating porkers that had been fed grain tailings contaminated by seeds treated with mercury compounds. Such treatment has now been banned. (Science 172:65-67, 2 April, 1971)

15. In early 1971, a leaking pipe in the cooling system of a fish meal

plant contaminated about 16,000 tons of fish meal over a two and one-half month period. This had been distributed to more than 60 companies in ten states. Seventy thousand chickens were voluntarily slaughtered by the nation's largest poultry producer after discovering PCB residues as high as 40 ppm. Later, 125,000 contaminated eggs were discovered and destroyed. A shipment of at least 60,000 reached the Washington retail market and were consumed. The extent of the contamination and the illnesses resulting therefrom will never be known.

16. Mirex has been found in the fatty tissue of forty per cent of southerners examined. It was sprayed widely throughout some southern states in a futile attempt to control the fire ant. It is now known that Mirex gradually changes to the even more toxic Kepone and that both of these are probably carcinogenic.

17. In 1976 over eight million acres in Kansas and Oklahoma were aerielly sprayed with Endrin~~g~~. Millions of fish and thousands of sheep and cattle were lost.

①  
18. Within the past six months, several manufacturing groups which have been producing the pesticide DBCP (dibromochloropropane) have observed that a large proportion of their workers (male) have become sterile. This has been substantiated in a number of different manufacturing plants and Dow, Occidental and Shell Chemical have voluntarily stopped the sale and production of this compound. It is of considerable interest that twenty-five million tons of DBCP are manufactured every year by eighty different manufacturers. This compound is extensively used in California, Texas, Florida and the Mississippi River delta to kill nematodes on cotton, soy beans, potatoes, sugar beets and other food crops. Since California has licensed more than 100,000 applicators (mostly farm workers and crop dusters) many of these could receive a greater actual exposure to DBCP than the workers in the plants. Moreover, there is evidence that DBCP is carcinogenic in laboratory animals at low concentrations. California has banned the production and use of the chemical and it is no longer a factor in our problems at this present time, except for the residues which may remain for an undetermined period of time. This is simply another example of the dangers of pesticides which have been inadequately investigated.

### DEFINITIONS

It is important to define what we are talking about. When I mention "pesticides", I use this in the broad sense so that it includes anything which is directed against pests of any type. In other words, it includes insecticides, herbicides, fungicides, rodenticides, etc. It is probable that this broad definition is the correct one since all these chemicals and compounds, although they have specificity in action, they are all biocidal and tend to destroy life. Other compounds such as PBBs and PCBs --although they are not used primarily as pesticides--do have properties which are similar to the ones we are discussing.

### TYPES OF PESTICIDES

It seems worthwhile to briefly review the types of pesticides which have been used and still are being used in this country and abroad. They may be roughly divided into the chlorinated hydrocarbons, such as DDT; the organic phosphates such as parathion, malathion and others; the carbamates; the polyvinyl compounds; pyrethrins and similar compounds; and others which are aimed at destroying insects of various types. We also have compounds of heavy metals containing mercury, for instance, which are used as seed dressings, or have been in the past, and many other compounds which are more or less a mixture of several of the basic groups. When it comes to herbicides, we have the pre-emergence and the post-emergence herbicides. The first group is represented primarily by the triazines, of which Simazine is a common example, and the post-emergence by the phenoxy herbicides which differ in their ability to destroy broad-leafed plants and even trees and shrubs when they contain 2,4,5-T or Silvex. The fungicides are a number of different groups and I will not go into these to any extent, except to say that they are all toxic.

### MECHANISMS OF ACTION

Obviously all these compounds are poisonous. If they were not, they would not be effective. It is also obvious that any chemical that will kill insects, fungi, and other predators is also capable of injuring other living things such as animals and human beings. To believe otherwise is to be living in a never-never world. It seems that all forms of life share the same, primordial DNA.

Since 2,4,5-T, Silvex and pentachlorophenol as well as hexachlorophene all contain the obligate contaminant TCDD, they pose a special



ecological problem. The use of "Agent Orange" (2,4-D + 2,4,5-T) was used as a defoliant in Vietnam from 1962-1970. During that time about five million acres were sprayed. In this country about six million acres of forest and grazing land are being sprayed each year. The announced aim is to destroy bush and encourage the growth of pines in the forests and grass in the fields. The use of "Agent Orange" was banned in Vietnam because this was suspected of causing widespread illness among animals and human beings as well as an increase in birth deformities and cancer of the liver. It should be remembered that the U. S. military developed 2,4,5-T as part of it's biological warfare program. The use of "Agent Orange" in Vietnam was disastrous for the environment. Moreover, several years ago the contaminating TCDD was found in fish and crustaceans caught in Vietnamese estuaries indicating that TCDD had entered the food chains. (Baughman and Messelson had perfected a method for measuring ppt instead of ppb). Since then TCDD has been demonstrated in ppt in small animals in Oregon, Texas and Virginia, in the organs and fat of steers grazed on pastures sprayed with "Agent Orange" the previous year and in the milk of nursing mothers in Oregon, Missouri and Texas.

Dow Chemical concedes the toxicity of dioxin but says there is no threat because of it's dilution. However, it is remarkably stable. The dioxins activate liver microsomes and stimulate the production of smooth and rough endoplasmic reticulum.

Pathological effects in non-human primates. One monkey fed a diet containing two ppb and another monkey fed food containing 20 ppb died in 76 and 12 days respectively. The pathological changes by light microscopy were identical to those found with Arochlor 1242 (PCBs). Toxic dose levels are comparable for human beings and monkeys.

2,4-D has a selective action on broad-leafed weeds. It stimulates excessive growth followed by plant death. Many millions of pounds are used on crops and lawns to control weeds--often combined with Silvex or 2,4,5-T. *2,4-D* ~~is~~ is teratogenic for mice (as shown in the Bionetics Studies) in smaller doses than 2,4,5-T.

*May contain dioxins including the very toxic dacthloro compound, but excluding TCDD and even the retired compound)*

SYMPTOMS OF PESTICIDE POISONING

Curiously enough, Morton S. Biskind, M. D., of Westport, Connecticut, back in 1950 or 1951 first called the attention of the scientific world to the fact that DDT could cause symptoms of poisoning, even in small amounts. He described a syndrome which included nausea, vomiting, diarrhea, sore throat, sinus congestion, headaches, marked fatigue, emotional depression, aches and pains, and neuritis in various parts of the body, together with

weird fear sensations which he attributed to contact with DDT and other pesticides of this type. His observations have been substantiated by many others, and I became interested in the subject in 1951 as a result of reading one of his articles. We have been in contact ever since and I can substantiate all his findings. It is interesting that, even though the mechanism of poisoning by the organic phosphates and the chlorinated hydrocarbons is completely different, the symptomatology is very much the same. The organo-chlorine compounds apparently attack primarily the nervous system but still produce symptoms similar to the organic phosphates. Parathion, malathion and others, in addition to attacking the nervous system, also reduce choline esterase and thus produce symptoms of overstimulation of the parasympathetic nervous system. There is a specific treatment for poisoning by the organic phosphates which is the administration of atropine, one or two milligrams intravenously every fifteen minutes if needed in order to produce atropinization. This, plus the administration of intravenous pralidoxime chloride is lifesaving, and observation of individuals who have been poisoned by the organic phosphates should be carefully monitored for at least 24 hours after the poisoning episode.

#### SYNERGISM

It is not only interesting but alarming to know that perhaps tiny amounts of chemicals when combined can have a much more serious effect than much larger amounts of a single chemical. Work done in Nova Scotia has demonstrated the fact that in animal experiments the application of DDT alone, and organic phosphate alone, and the combination of the two when painted on the backs of mice, has a very interesting effect. The experiment was started in an attempt to elucidate perhaps what effect, if any, chemicals might have on susceptibility or resistance to viral infection. It had been noted by very careful observers that children with Reye's syndrome seemed to be bunched in Canada in areas near forests which were being sprayed. Therefore, animal experiments were done giving injections of a virus which would not effect the control animals in the dosage given. When the animals were painted with DDT, the incidence of encephalitis was about eight per cent. When painted with an organic phosphate, it was around sixteen per cent. When the combination was used, it went up to sixty per cent. It was found later that if only the vehicle (a petroleum derivative) was used the incidence of symptoms following the injection of the viral vaccine was even more than sixty per cent. This is a typical example of the synergistic action which can take place when chemicals, even in small amounts, are encountered. Clinically, I have been certain of this but it is now nice to have it demonstrated via animal experiments.

### PHENOXY HERBICIDES

Since a great deal of my experience has been with the phenoxy herbicides, I shall discuss them to more or less <sup>to</sup> the exclusion of others. In my opinion, the widespread use of phenoxy herbicides sprayed by helicopters, planes or by other means in or on our national forests throughout the country creates a very serious problem with ethical as well as physical ramifications. This is also true because the U. S. Department of Agriculture and the U. S. Forest Service are tolerating and encouraging the use of the phenoxy herbicides, 2,4-D; 2,4,5-T and Silvex not only in and on our national forests throughout the country, but on millions of acres of grazing land which support cattle which eventually enter the retail market as food. The question thus arises as to whether the Environmental Protection Agency and the U. S. Department of Agriculture are acting in the best interests of the public which they are supposed to protect.

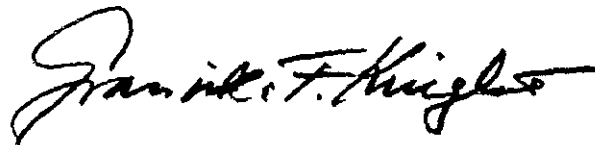
I would stress that pesticides interfere with, or stimulate enzyme action in body cells, particularly the liver. The experiments previously mentioned suggest that pesticides and the petroleum carriers or emulsifiers in which they are usually suspended can markedly lower resistance to viral infection --changing a subclinical state to one of fulminating infection. Most of the potent herbicides, insecticides and fungicides seem to have mutagenic properties similar to ionizing radiation. In other words, they are capable of attacking and damaging the genetic code present in all body cells, consisting of DNA and RNA. Because of this property and also because small amounts of many chemicals have been shown to exert a synergistic toxic effect rather than simply additive, from the scientific standpoint there can be no tolerance level set for these pesticides. It is my considered opinion that with their continued use, we are not only witnessing a marked and steady increase in viral infections, accompanied by a degeneration of general health, but are facing a cancer epidemic of staggering proportions.

In addition to our chemical contacts, the destruction of our soil by use of high nitrate fertilizers, fungicides, pesticides, herbicides and monoculture plus the destruction of hedgerows without the return of organic material and trace elements to the soil, is greatly reducing the quality of our food and thereby contributing to decreased resistance to toxins and chemicals in animals and man.

The following suggestions are made with the knowledge that they are not likely to be accepted for some time. Their application depends upon a sense of urgency which is difficult to engender. Only when enough people understand the real threat to health and life of the extended use of pesticides

will action be taken.

It is vital that physicians and scientists, as well as the public, become better informed in this area and that they learn that the primary answer to the problem of pests of practically all types lies not in chemical warfare, but in improvement of the soil to increase resistance of plants, animals and man through better nutrition. The only logical answer to this complicated problem is to gradually phase out the use of pesticides and to return to natural forms of farming by building up the organic material in the soil, adding trace elements, calcium and pulverized rock so that the biotic pyramid may once more have natural resistance to invaders. There is adequate evidence to show that a living soil, high in organic material and essential minerals, produces plants which are resistant to insect attack and, in turn, animals and man inherit these characteristics. The increasing use of pesticides can only lead to soil destruction and disaster.



Granville F. Knight, M. D.

GFK:ll  
11 9 78