

Malaria: The Killer That Could Have Been Conquered

A well-known entomologist documents how U.S. antipesticide activists stopped DDT, the pesticide that could have stopped malaria from killing millions of people around the world

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Malaria, which could have been conquered 20 years ago, is still the single most important tropical disease and a major obstacle to the economic and social development of vast areas of the world. Before the discovery of the pesticide DDT in the early 1940s, there were at least 300 million cases in the world annually, and more than 3 million of those who were stricken died each year. Thanks to the pesticide DDT, millions of lives were saved from malaria's grip in the years immediately following World War II. There was hope that DDT would bring an end to this mass killer, once and for all.

But it did not happen, because of an irrational campaign of fear against pesticides, launched in the United States by Rachel Carson and her book ***Silent Spring***. Today, more than 2 billion people – 40 percent of the world's population – live in malarious countries; 270 million of them are infected; and it is estimated that there are now more than 100 million clinical cases each year (about 300,000 new cases per day). This disease now poses a greater threat to travelers in tropical countries than all other diseases combined. Malaria still kills millions of people annually, more than any other tropical disease, and most of the victims are children. Africa is hardest hit, with nearly 85 percent of the world's cases. More than 30 percent of childhood deaths there are directly caused by malaria.

Malaria is deservedly called the "queen of diseases." Its death toll is staggering. In 1923, the great epidemic of malaria in Russia caused more than 5 million cases and 60,000 deaths. In Egypt, in 1942, just after the mosquito ***Anopheles gambiae*** invaded the fertile Nile Valley, 135,000 people died of malaria. In the United States, in the 1930s, there were still 6 million to 7 million cases every year. Thousands of people gagged as they swallowed a bitter quinine pill every day to protect themselves from the chills and fever that accompany the disease. When DDT was discovered, one of its first triumphs was the quick eradication of malaria from North America.

DDT Wages War on Malaria

[\(click here and read what is Malaria\)](#)

In 1943, DDT became available for use against the mosquito vectors of malaria and yellow fever, typhus-transmitting body lice, the fleas that transmit plague, and many other insect pests. Its discovery rapidly changed the world and provided its inhabitants with new hope. After 1945, the Communicable Disease Centers of the U.S. Public Health Service assumed responsibility for administering national malaria eradication programs in 18 countries, directly supported by the State Department's Agency for international Development (AID). A control program in Greece, for example, began in 1946, and in three years the annual number of cases dropped from 2 million to about 50,000.

Malaria still ravaged millions, however. In 1955, 10 percent of the people in the world had a malaria attack, and somebody died of the disease every 10 seconds. James Wright, chief of vector control at the World Health Organization (WHO), observed that every year malaria **was contracted by 300 to 400 million persons**, and that it **killed 3 or 4 million** of them. That year, the **World Health Organization Assembly** announced a worldwide war on malaria. That objective was incorporated into U.S. policy by Congress in 1957, under the Mutual Security Act.

The major weapon against the **Anopheles** mosquito (the single genus that transmits malaria) was to be DDT. The program would also seek to eliminate the parasitic malaria-causing **Plasmodium** protozoans from human blood, by using a variety of antimalarial drugs.

Between 1953 and 1962, 147,590,000 pounds of DDT were used in malaria-control programs. In 1963, 130 million pounds of DDT were used inside houses, along with 8 million pounds of **dieldrin** and a million pounds of **lindane**. The latter two were soon discontinued because the mosquitoes rapidly developed resistance to them.

By 1960, nearly 1.5 billion people lived in areas that were formerly malarious, but from which DDT had eradicated the disease. By 1969, of 146 countries originally classed as malarious, eradication had been accomplished in 36; 53 were engaged in eradication programs; and 27 were carrying out significant malaria-control programs. In Pakistan, for example, there were **7 million cases in 1961**, but **only 9,000 in 1967**. The U.S. Agency for International Development gave the Pakistani government \$25.3 million and loaned Pakistan \$35 million more to finance the DDT malaria eradication program. **"The unparalleled benefits stemming from those programs are due almost entirely to the use of DDT,"** said the U.S. Centers for Disease Control. **"DDT provides the only safe, economically feasible eradication measure available today."**

Enter Rachel Carson

That these "unparalleled benefits" would stop was the result of the writings of Rachel Carson **and the lies** with which she mobilized the nascent environmentalist movement to end the use of DDT.

In 1962, Rachel Carson published *Silent Spring*, a book that falsely alleged that DDT was causing great harm to humans, beneficial animals, and the environment. The hysteria generated by Carson and her disciples forced bans on DDT **that have resulted in hundreds of millions of human deaths** – and human suffering beyond the ability of statistics to reveal.

The campaign Carson launched hit hard at the war on malaria, causing it to falter. In 1967, the World Health Organization changed its goal from worldwide **"eradication"** of malaria to **"control of the disease, where possible."** Some 63 participating countries, which had

already spent considerable sums on the fight, simply gave up the battle.

A resolution was approved by a large number of concerned scientists at the 22nd session of the WHO Assembly in Southeast Asia in 1969 urging manufacturers of DDT to **"continue producing the life-saving insecticide so that they could continue to protect citizens from malaria."** A ban on the production of DDT in the United States, they said, would deny the use of DDT to most of the malarious areas of the world. The direct result of such a denial would be **"to bring down upon the afflicted countries hundreds of millions of cases of malaria, and millions of human deaths from malaria within the next decade."**

Despite the scientific evidence demonstrating that DDT is harmless to human beings, William Ruckelshaus, the administrator of the U.S. Environmental Protection Agency (EPA), banned DDT in 1972 ([See: EPA](#)).

Unfortunately, when the mosquito control programs were halted, a resurgence of malaria often occurred, with higher levels of malaria than before because of the presence of much higher human population densities in the previously malarious areas (more people had moved into those areas, under the protection of DDT). By 1976, annual cases of malaria had shot up to 800 million worldwide, with more than 8 million deaths every year. A look at just two examples, India and Ceylon, gives the picture:

India had more than **100 million cases of malaria annually** in the 1940s and **2.5 million people died** of malaria each year. After a DDT spraying program had been implemented, that casualty rate **dropped to fewer than 100,000 cases and fewer than 1,000 deaths.** The Indian government had been spending 60 percent of its entire health budget on malaria control, and it paid off. Government officials later commented, **"We thought malaria had been eradicated."**

The tide turned in the late 1960s, as a result of Rachel Carson and the American pseudoenvironmentalists' scare campaign against DDT. By 1972, there were again more than 1 million cases; the number escalated to 4 million in 1974, and to **more than 6 million in 1976** (most authorities believed the number was actually **closer to 12 million**). With the help of DDT manufactured in Sri Lanka and Bangladesh, the government of India is today once again gaining the upper hand, but a tremendous task lies ahead.

Ceylon (now Sri Lanka) in the early 1950s had suffered **3 three million cases of malaria a year**, with more than **12,000 deaths.** DDT spraying began in 1946, and by 1962 there were **only 31 cases total**, and the next year **only 17 (with no deaths).** When the spraying was halted after Rachel Carson's frightening book was published and public opposition to DDT developed, the malaria rates climbed back up: 308 cases of malaria were reported in 1965; 3,466 in 1967; 17,000 in January 1968; and 42,000 in February 1968. **Millions of cases were reported in 1969 and 1970.**

By 1991, more than 40 percent of the people in some 100 countries were exposed to malaria. Nearly 200 million people, mostly in tropical Africa, lived in high-risk areas with virtually no antimalarial programs. **"In just one night sleeping unprotected in rural areas, a person may be bitten 100 times by infected mosquitoes,"** one report stated. In such places, promoting the use of mosquito nets, especially those impregnated with insecticides like permethrin, is about all that can be done at present.

The cost of health care plus the loss of human resources due to malaria in Africa alone will be nearly \$213 billion by 1995. Malaria is worsening, with 2 billion people now exposed, in at least 25 countries, says the World Health Organization.

DDT's Benefits

Before WHO began its worldwide malaria eradication program, India produced less than **25 million tons** of wheat per year, and starvation was widespread. By 1968, a healthier population was able to produce **more than 100 million tons** of wheat annually. That same sort of success was repeated in every country – after malaria was controlled. Malnourished and ill people cannot perform enough hard work in the fields to produce very much food. They may also have impaired antibody synthesis and immune deficiency difficulties. Protein deficiency causes conditions such as **marasmus** and **kwashiorkor**, and milder levels of protein malnutrition affect about half of all children under 20 years of age in underdeveloped countries. The resultant weakness leads to great increases in infectious diseases such as hepatitis, tuberculosis, dysentery, amoebic liver abscesses, schistosomiasis, and typhoid fever.

The shortage of essential agricultural chemicals, the result of antipesticide activities, has also contributed much to the daily toll of human illnesses and deaths resulting from dietary inadequacies. More than **40,000 children starve to death every day**, according to the U.S. Agency for International Development. That adds **up to 15 million horrible deaths a year**. Malnourished children may never develop their full brain capacity, which presages great difficulties in future years for the nations with persistent food shortages.

The second most important medical benefit of DDT after malaria control, according to WHO, was the tsetse fly control program. The blood-sucking African tsetse flies (**Glossina**) transmit protozoan flagellates that cause deadly sleeping sickness of humans and deadly nagana of cattle. Before DDT, according to WHO, the tsetse fly denied 40 million square miles of Africa to human settlement.

Another serious pest in northern Africa and in Central America is the little blackfly (**Simulium**) that transmits the parasitic roundworms causing "river blindness" (**onchocerciasis**) in human beings. Before DDT, more than 20,000 Africans were blind, including more than 30 percent of the population in some villages. The fly larvae live in swift streams and for many decades were impossible to control. A happy accident brought DDT into the battle against the disease-carrying blackfly. A mule carrying DDT to a malaria spraying project in the Volta River basin in the 1950s slipped while fording a stream and spilled its load of DDT powder into the water. Blackfly larvae were killed for a mile downstream, but other aquatic life was not adversely affected. Soon, many rivers were being sprayed with DDT from airplanes and there was a great reduction in the number of afflicted people.

DDT powder also provided excellent control of body lice in Europe in 1944, thus preventing the spread of typhus. During World War I, troops and civilians alike were crawling with lice that transmitted the typhus **rickettsiae** and some 3 million Russians and millions of other Europeans died of typhus as a result. DDT was developed just in time to prevent similar epidemics during World War II. When dusted into the hair and inside the clothing of civilians or soldiers it quickly killed 100 percent of the lice. The deadly bubonic plague, or Black Death, killed one-fourth of the entire population of Europe and two-thirds of the population of Britain during the 14th century. It had killed nearly 100 million people during earlier epidemics. Since 1940, DDT was found to be toxic to the fleas that were capable of transmitting the plague bacilli from rodents to humans. It was dusted in the burrows and runways of rodents and kept the plague at very low levels.

Mankind's Most Life-Saving Chemical

Many other diseases were also prevented by the use of DDT, including three types of **leishmaniasis** that are transmitted by tiny sand flies in genus **Phlebotomus**. Cases of leishmaniasis became almost unknown in areas where the malaria spray programs were carried out. There were also fewer problems with bed bugs and other pests in and near the sprayed houses.

The scientific community worldwide has acknowledged its appreciation of DDT. **"DDT still provides the most effective, cheapest, and safest means of abating and eradicating malaria, and this remains true despite the development of resistance to DDT (which is not insuperable),"** said the director of WHO in 1969, concluding that:

It is so safe that no symptoms have been observed among the 130,000 spraymen or the 535 million inhabitants of sprayed houses. No toxicity was observed in the wildlife of the countries participating in the malaria campaign. Therefore WHO has no grounds to abandon this chemical which has saved millions of lives, the discontinuation of which would result in thousands of human deaths and millions of illnesses. It has served at least 2 billion people in the world without costing a single human life by poisoning from DDT. The discontinuation of the use of DDT would be a disaster to world health.

WHO also pointed out that **"DDT has not caused any side-effects among domestic animals."**

In 1970, the National Academy of Sciences said in an 'official statement:

To only a few chemicals does man owe as great a debt as to DDT. It is estimated that, in little more than two decades DDT has prevented 500 million human deaths, due to malaria, that would otherwise have been inevitable.

Despite these scientific assessments, by 1972, during the EPA Hearings on DDT, there were fears that William Ruckelshaus intended to ban DDT regardless of the outcome of the hearings. It was evident that banning DDT within the United States would have repercussions on the international malaria eradication effort by raising unwarranted fears in other countries. To ban the use of DDT in the United States would, in effect, be forcing other countries not to use it for malaria control – with all the tragic consequences that would stem from such a decision.

As feared, William Ruckelshaus overruled his own EPA hearings judge, Edmund Sweeney, and single-handedly banned DDT use in the United States as of January 1973. (The loathsome details of this can be found in the *Congressional Record, July 24 1972, pp. S11545-46*, introduced by Senator Goldwater.) Although Ruckelshaus admitted in a letter to the president of the American Farm Bureau Federation (April 26, 1979) that **"the ban on DDT was a political decision rather than a scientific one,"** that capricious ban is still in effect in the United States.

No Substitute

In 1969, the World Health Organization announced the results of its study of possible substitutes for DDT in controlling malaria. After years of testing, involving more than 1,400 insecticides, WHO found only four that approached DDT's effectiveness – carbaryl, aprocarb, fenitrothion, and fenthion. All of these chemicals **were more dangerous** to humans than DDT, none was as efficient in controlling malaria mosquitoes, and they **would cost 4 to 20 times more than DDT**. Aprocarb and fenitrothion were later used in about 1 percent of the program and eventually large amounts of malathion were also applied. Unfortunately, the substitutes for DDT persist only half as long as DDT on the walls inside houses, so they must be applied two or three times as often as DDT to provide the same amount of protection, and they may have adverse effects on people and the environment.

In the 1950s, using DDT, it cost 17 cents to save a human life. In 1972, it cost about 21 cents per human life saved, and the WHO paid \$72,000 for DDT. The cost of using malathion to replace DDT would have been \$371,000, and the cost of using carbaryl to replace DDT would have been about \$1,300,000. In 1973-1974, the oil embargo caused a further increase in insecticide costs. Obviously, countries that could not afford enough DDT

to halt malaria could not afford the more expensive insecticides for their antimalaria programs. Before DDT, mosquito larvae were controlled by spraying oil onto surface water, by dusting marshes with arsenic (Paris Green), or by physically altering the environment (draining the water or filling depressions with soil). People avoided adult mosquitoes by screening houses, working under head-nets, sleeping under mosquito netting, and using large quantities of oil of citronella as a repellent.

Today, unfortunately, there is no practical method of controlling mosquito larvae in the United States without violating provisions of the Clean Air Act, the Clean Water Act, various wetlands regulations, or the Endangered Species Act (or running afoul of the Delaney Clause of the Food, Drug, and Cosmetic Act, which prohibits any traces of pesticides in produce or in the environment).

The Malthusian Factor

The major purpose of Rachel Carson's highly controversial 1962 book, *Silent Spring*, was to discredit pesticides, particularly DDT. There were dozens of serious errors, distortions, and omissions of fact in nearly every chapter, and they alarmed and terrified many gullible readers. [1] Worse yet, formerly responsible environmental organizations repeated those untruths in order to attract more donations from a frightened public. That activity is still contributing to human suffering and death, worldwide.

Carson cleverly dedicated her book, *"To Albert Schweitzer, who said 'Man has lost the capacity to foresee and forestall. He will end by destroying the Earth.'"* Since the major theme of the book was to halt the use of pesticides as dangers to the environment and human health, readers assumed that Schweitzer was opposed to pesticides. But on page 262 in his autobiography, that great humanitarian wrote: *"How much labor and waste of time these wicked insects do cause us... but a ray of hope, in the use of DDT, is now held out to us."* [2]

The president of a leading British scientific organization later observed that, *"If there had been a world ban on DDT, as many sought, then Rachel Carson and her book Silent Spring would now be killing more people in every single year than Hitler killed in his whole Holocaust."* Perhaps that was not Miss Carson's intention. However, the effect of her writing on world health has been at least that severe.

Some individuals living in the so-called developed nations feared that DDT would save so many lives that it would result in a dangerous overpopulation of the Earth, centered in the underdeveloped countries. Like Rachel Carson, they actively sought to halt the use of DDT by getting it banned in the United States, branding it a worldwide hazard, and attempting to legally prevent other countries from using pesticides to protect public health or boost agricultural production.

Some health authorities voiced concern that effective, widespread malaria control would open Pandora's box and release a population explosion. Artificial birth control pills were not readily available in the 1950s, and many felt that there was no alternative but to control population growth by assuring that up to 40 percent of the children in backward nations would die of malaria. As one AID officer put it, *"Rather dead than alive and riotously reproducing."* [3]

The leading environmental organizations came down on the side of the mosquito and the disease organisms they transmitted. The *National Audubon Society* explicitly opposed the antimalarial campaign and in July 1969 it distributed 17,000 leaflets urging members to support the position that *"DDT should be banned throughout the land and banned from export."* A similar lack of concern for the mortality of millions of nonwhite humans in poor nations was revealed by Michael McCloskey, director of the Sierra Club, who said in February 1971: *"... the Sierra Club wants a ban on pesticides, even in countries*

where DDT has kept malaria under control.... By using 'DDT, we reduce mortality rates in underdeveloped countries without the consideration of how to support the increase in populations."

Dr. Alexander King, head of the Malthusian **Club of Rome**, which is active in more than 40 countries on five continents, voiced a similar opinion in a 1990 book, **The Discipline of Curiosity** (Elsevier Science Publishers, p. 43). He had helped introduce DDT for use in World War II, he wrote, and was impressed by **"the enormous number of lives it saved. My own doubts came when DDT was introduced for civilian use. In Guyana, within two years, it had almost eliminated malaria, but at the same time the birth rate had doubled. So my chief quarrel with DDT in hindsight is that it greatly added to the population problem."**

As for the Environmental Defense Fund, which used the DDT issue to become a wealthy national organization, Congressman John Rarick reported to a House hearing on the Federal Pesticide Control Act on March 3, 1971, the following remarks by the Fund's chief scientist, Dr. Charles Wurster. Wurster was asked by a reporter if a DDT ban would result in the use of much more toxic pesticides and he replied: **"So what? People are the cause of all the problems. We have too many of them. We need to get rid of some of them and this is as good a way as any.."** [4]

After the U.S. ban on DDT, the environmental activists escalated their campaign to ban pesticide exports. From 1974 to 1976, the U.S. Export-Import Bank financed more than \$3 billion worth of pesticides exports, which saved millions of human lives in tropical countries. In 1976, the **Audubon Society** and the **Natural Resources Defense Council** (NRDC) sued in federal court to compel the Ex-Im Bank to stop financing pesticide purchases for use in underdeveloped countries. The National Legal Center for the Public Interest opposed that suit, and in 1980 the court ruled against the pseudoenvironmentalists. As the Legal Center spokesman put it, **"The federal court order means that American exports will not be curtailed and our nation will not be practicing environmental imperialism."**

In 1977, environmental groups filed another suit, seeking to force the U.S. Agency for International Development to submit environmental impact studies for all pesticides before they could be shipped to underdeveloped countries. That requirement would have stalled the delivery of urgently needed chemicals for weeks or months, while thousands of malaria victims died as a result of the delay.

In the 1980s, the pseudoenvironmentalists induced George Brown of California, Patrick Leahy of Vermont, Howard Metzenbaum of Ohio, and William Proxmire of Wisconsin to introduce legislation requiring the State Department to notify foreign governments when pesticides were withdrawn from the U.S. market, voluntarily or otherwise. Bills by Rep. Cecil Heftel of Hawaii and Rep. Michael Barnes of Maryland would have increased restrictions on U.S. exports and tightened standards for pesticides on foods that are imported into the United States. These bills would have indirectly stopped the use of insecticides in countries that depend upon them for public health protection, as well as agricultural productivity, because their exports may contain traces of those chemicals.

More direct harm to both health and welfare was caused when the United States withheld financial support for disease control and locust control from any country that used pesticides that had been banned or restricted by our government. In Africa, extensive starvation has followed the crop losses inflicted by the uncontrolled locust swarms.

Nevertheless, environmental groups continued to seek a ban on all exports of pesticides. In 1986, the Agency for International Development responded to the U.S. National Environmental Policy Act by issuing **"Regulation 16 Guidelines."** Secretary of State George Shultz, relying on those guidelines as his authority, telegraphed orders to U.S. embassies overseas that **"The U. S. cannot, repeat cannot, as a matter of**

longstanding policy, participate in programs using any of the following pesticides: (1) lindane; (2) BHC; (3) DDT; and (4) dieldrin." Countries that could not support their pest control programs without U.S. financial aid were therefore prevented from meaningful efforts to protect the health and welfare of their suffering inhabitants.

Readers of the slick publications that emanate from environmental organizations are delighted with colorful photographs of animals in tropical environments. Do they notice that there is never any indication of sympathy for the humans living near those animals? Humans who are sick, crippled, blinded, or dying of malaria, plague, typhus, sleeping sickness, and leishmaniasis are not shown. Nor do these publications mention the millions of people who are undernourished or starving to death as a result of the environmentalist campaigns. Unperturbed by the illnesses and deaths that are occurring as a result of their antipesticide activities, the environmentalist magazines instead devote much space to the harm caused by people in the rain forests, and bemoan decreases in the numbers of elephants and other wildlife available for tourists to photograph.

Twenty years ago, Dr. L. J. Bruce-Chwatt commented in the British medical journal, *The Lancet*:

"The news that the Environmental Protection Agency of the U.S.A. has now imposed almost a total ban on the use of DDT may be welcomed by partisans of the antipollution movement, but will cause concern to well-informed public health workers, since it increases the difficulty of controlling several tropical arthropod-borne diseases. The rich countries, preoccupied with their own environmental problems and degenerative illnesses related to affluence, should be reminded of the fact that the old plagues have not been banished from the world and that any apparently beneficial move may have an unexpected rebound effect and jeopardize the health gains achieved elsewhere over the years." [\[5\]](#)

Nontoxic to Human Beings

Use of DDT in antimalarial pesticide campaigns throughout the developing sector was simple and efficient. The inside walls of all occupied habitations in malarious regions were sprayed with DDT once or twice each year, to kill the *Anopheles* mosquitoes as they rested on the walls before and after taking their blood meals. Spraymen applied 100 to 200 milligrams (mg) of the active ingredient to each square foot of these interior walls. (A whisky jigger full – 1.5 ounces – would cover a 12 by 12 foot wall, killing mosquitoes for six months.) Insecticides applied in that manner did not enter the environment and thus did not contribute significantly to the development of "resistant" strains of the mosquitoes.

If no indication of malaria transmission was found for at least a year and if there was less than one case per 10,000 inhabitants per year, the DDT spraying of walls was discontinued and the program considered to be in the "consolidation" phase. Frequent inspections would then be required, to be sure no new malaria cases developed in the next two or three years. Only after that could the area be declared free of malaria.

The DDT used was a 70 percent "wetttable powder." It was easy to pack large amounts of the dry powder into remote areas by mule, then add the water necessary to convert it into a spray that could be easily and safely applied. No masks or protective clothing were required, because ***DDT is notoriously nontoxic to human beings***, either on the skin or when inhaled or swallowed. There was no illness caused in the more than 130,000 spray men, or in any of the millions of inhabitants who lived in the sprayed houses.

DDT is metabolized into breakdown products that are excreted in the urine, and there is no significant ***"biological magnification"*** up food chains, as once was hypothesized. To appreciate the nontoxicity of DDT to human beings, consider the following: Tests by Dr. Wayland Hayes for the U.S. Public Health Service involved feeding human volunteers

tremendous quantities of DDT to see if any adverse effects developed. The men ingested **up to 35 mg** in their food, **every day for 18 months**, and had no resultant difficulties either at the time or within the following 6 to 10 years while they remained under observation. [6] During the years of greatest DDT use, the average U.S. citizen was ingesting less than 13 mg **per year**, and DDT was so safe that even canned baby food was permitted to contain 5 parts per million of DDT. (This is a very small concentration; a single penny taken from a pile of pennies worth \$10,000 is equivalent to 1 part per million.)

Dr. Bruce Ames, an internationally acclaimed biochemist, reminds us that every day each of us ingests hundreds or thousands of parts per million of the "natural" (not man-made) carcinogens that occur in every wholesome diet. We have little to fear from infinitesimal amounts of either natural or man-made chemicals.

Does DDT Inhibit Cancers?

The workers in the Montrose Chemical Company, which produced DDT, used no gloves or protective clothing of any kind and they were inhaling the DDT dust all day. Dr. Edward R. Laws of the U.S. Public Health Service examined the Montrose workers and found that they had accumulated **38 to 647 parts per million of DDT** and its isomers in their fat tissue, **but experienced no ill effects**. At that time, the level of DDT in the fat tissue of the general population was **only 5 or 6 parts per million**. Laws stated in a publication of the American Medical Association: **"It is noteworthy that (after 10 to 20 years on the job) no cases of cancer developed among these workers, in some 1,300 man-years of exposure, a statistically improbable event."** [7]

Laws later performed experiments feeding rodents DDT **at 10,000 times** the proportion ingested by humans and then transplanting malignant tumors directly into their brains. Without the DDT there was **100 percent mortality**, but the cancers **disappeared** from the brains of **22 of the 60 mice** that had been on the DDT diets for six months.

Other scientists reported similar results. **Drs. Charles Silinskas and Allan E. Okey** found that DDT in the diet **inhibited** chemically induced mammary **cancer and leukemia** in rats. They stated that, **"If estimates prove accurate that 80-90 percent of all human cancers are caused by chemicals (as many experts suggest) the proposed mechanism for DDT's protective effect in rats may also apply to man."** [8]

Writing in *The British Medical Bulletin* in 1969, Dr. A.E. Mclean, a prominent pathologist, and his coauthors cited the increased induction of enzymes by the liver of animals that have ingested DDT. The acute toxicity of aflatoxin (a powerful carcinogen produced by common molds in grains and other seeds) was greatly enhanced in protein-deficient rats, they wrote, **"but the effect was reversed if they had previously eaten moderate amounts of DDT...."** The authors concluded: **"It appears likely that aflatoxin B1 and perhaps other aflatoxins, which are among the most carcinogenic substances known, are converted to non-toxic metabolites in the liver by the hydroxylation system."** [9]

The DDT in the bodies of poor, protein-deficient residents of tropical Africa, Asia, and India, may thus inhibit the development of tumors and cancers. Also, the population explosions of seed-eating birds following DDT spray programs **might be a result of their ingestion of DDT.**

Resistance to Pesticides

The development of "resistance" to insecticides by insects has been thoroughly studied. Individual insects can not develop resistance. They are just as easily killed after they have been exposed to doses of DDT as they would have been before such exposure. Some

mosquitoes, however (perhaps 1 in 1,000), do not die after being sprayed, because they produce enzymes that break down DDT. Other mosquitoes have enzymes that break down other insecticides or inherit behavioral traits that help them avoid enemies or conditions that could threaten their survival. The ability to produce enzymes is inherited, and the genes responsible for destroying DDT probably regulate functions of other sorts (that is, they were already useful, and were not just awaiting the development of DDT or other insecticides).

If a mosquito with a gene for the enzyme that detoxifies DDT mates with another mosquito possessing the same gene, their offspring are likely to inherit that gene. If the population is sprayed frequently with DDT, an increasing proportion of insects with that gene will survive. Those without the enzyme will perish before they can reproduce. In time, the surviving population will be genetically different from the original population, and will be "resistant" to the insecticide.

The DDT on the inside walls of houses caused the death of most mosquitoes that rested on those walls. If a single mosquito happened to be "resistant" to DDT, it might not die, but it was highly unlikely that it would encounter another resistant one, and especially not one of the opposite sex (males are not blood-suckers and thus are not attracted to humans). If resistance to DDT were to develop, however, another, unrelated, insecticide could be applied to the walls to kill the mosquitoes that were resistant to DDT – if any other effective insecticide were still available.

Unfortunately, DDT was so inexpensive that it was also used in the fields near the houses harboring malaria victims. As a result, resistance to DDT did develop among some populations of *Anopheles* mosquitoes and other insecticides had to be used for any further mosquito control. This was not a huge problem: In 1970, the director general of the World Health Organization wrote, **"The areas in which technical problems (resistance) have arisen represent only 1 percent of the total territory in which eradication measures are being applied but (because of adverse propaganda) those areas have had an influence on the global programme out of all proportion to their size."** Of the 107 malarious countries, 62 reported resistance in populations of one or more *Anopheles* species to one or more common insecticides

The Fallacy of Biological Control Effectiveness

Environmental groups like to promote what are called natural or "biological" controls against insect pests. However, for more than 30 years, and with little success, the WHO has investigated "biological control" measures that might be effective in controlling mosquitoes. In addition to ditching, draining, and filling water sources, they sought to develop genetic controls and cytoplasmic incompatibility. They studied the effectiveness of predaceous insects (***Odonata*, *Hemiptera*, and *Coleoptera***); they introduced *Gambusia* minnows and guppies into ponds; and they experimented with a great variety of viruses, bacteria, fungi, protozoans, and nematodes that might destroy mosquito larvae.

A subspecies of ***Bacillus thuringiensis***, named ***israelensis*** and usually called BTI, was discovered to be effective in killing mosquito larvae in 1977. The bacilli produce endotoxins that actually do the killing in the gut of the larvae, but the endotoxin is short-lived in heat and sunlight and is effective only for a few days. Viruses sometimes kill mosquito larvae in the fields, but cannot yet be mass-produced in laboratories. Mermithid nematodes (***Romanamermis*** roundworms) gave inconsistent results, except in small puddles. Several kinds of fungi show promise, especially those in genera ***Coelomomyces*, *Metarrhizium*, *Beauveria*, *Lagenidium*, and *Culicinomyces***, but none has been produced in sufficient numbers to be released as potential control agents. Attempts have also been made to utilize microsporidium protozoans, but without much success.

As of 1993, none of those methods except the removal of the water has greatly reduced the

numbers of mosquitoes in any natural habitat. If those live biological control agents were released into the aquatic environment, they would be potentially hazardous to other forms of life; thus their use in the future will be unpopular with many "environmentalists." (Similarly, the use of *Bacillus thuringiensis* sprayed on trees to control pest caterpillars has resulted in tremendous reductions of "nontarget insects," especially other types of moths and butterflies.)

North America is populated by several species of *Anopheles* that are excellent vectors of malaria parasites. Many insecticides that could control those mosquitoes have been banned, but even if still available they could not be applied to the aquatic habitats where mosquito larvae dwell. In the United States, those breeding sites cannot be treated with pesticides or oils of any kind, because of the stringent provisions of the Clean Water Act, violations of which can result in jail sentences and huge fines.

Also restricted is the use of chemicals like Altocid, which destroy arthropods by interfering with their growth and meta- morphosis but are very broad-spectrum in their action. Not long ago, Paris Green (an arsenic compound), was applied to marshes at the rate of 1 lb/acre and decimated mosquito populations. That use of arsenic has been outlawed. Larvicidal oils also gave good control, but can no longer be used. When applied at rate of up to 25 gallons per acre, these oils could control mosquitoes, but they had to be reapplied at least twice a week, and thus were very expensive. The synthetic relatives of pyrethrum (**Permethrin** and **Resmethrin**, for example) last much longer and can be applied successfully outdoors, but they are too expensive to be applied to large areas. Permethrin applied to mosquito nets is extremely effective in protecting sleeping people.

The Clean Water Act has been grossly overused, and will certainly prevent the addition of almost anything into natural habitats. An unusual situation occurred two years ago when there was a confrontation because too much clean fresh water was being allowed to flow into the marshes surrounding San Francisco Bay; supposedly, the marshes were being **"polluted" by fresh water!**

In the United States, the breeding places of *Anopheles* larvae can no longer be altered by ditching, draining, or filling those habitats, because of the stringent "wetlands" policies. Even when the water level rises no higher than a foot beneath the surface of the soil, the area may now be defined as "wetland," and manipulating such soil has landed people in jail. Fields that have been farmed for generations have recently been declared "wetlands," and can no longer be farmed.

The 'Endangered Species' Act

In addition, traditional mosquito control measures are being strangled by an irrational Endangered Species Act that has frightening enforcement policies. Around the San Francisco Bay it is illegal to interfere with the habitat of the Salt Marsh Harvest Mouse (**Reithrodontomys raviventris**), which is widespread in coastal California. The same is true for the endangered California Clapper Rail (**Rallus longirostris**), a local population of a species that is common in some places in California, as well as from the eastern United States to South America, and in freshwater marshes along the lower Colorado River. When red foxes and raccoons were eating the eggs of clapper rails in the San Francisco Bay marsh, authorities went sneaking out at dawn to shoot them, which enraged the local animal activists. An intensive trapping program replaced the shooting, but the cost is \$50,000 a year.

There are dozens of kinds of birds, mammals, fish, amphibians, insects, spiders, and plants in the marsh that could be officially designated as "endangered species" on the same questionable basis, and any one of those could then force the halting of all human activities in or near the marshes. It is doubtful that there is any currently undeveloped parcel of land in the United States without at least one animal or plant that might be listed as

"threatened" or "endangered."

The reason that "**endangered species**" are so vulnerable to political definition is the serious discrepancy between the scientific, or biological "**species**" and the political "species" promulgated by environmental activists – a difference that has been ignored by politicians and pseudoenvironmentalists. The biological definition strictly adhered to by the **International Commission on Zoological Nomenclature** requires that to be a species, an animal must be "**reproductively isolated**" – that is, capable of breeding with others of the same species, but not capable of naturally breeding successfully with members of other species.

Political "endangered species" seldom meet this requirement and thus cannot legitimately be defined as "species." Populations of animals either are a distinct species or are not. **More than 60 percent of the populations that have already been officially designated as "endangered species" do not even qualify as biological "species"!**

The Endangered Species Act appears to have been devised simply to provide a ruse that can be used by the environmentalists to prevent development or any other activity on any area of land or water in the United States or abroad. If a legitimate species is in danger of extinction, biologists should be concerned, even though countless millions of the Earth's species became extinct through natural causes long before humans appeared. The mere presence of insignificant local populations (or even legitimate "subspecies") of birds, mammals, salamanders, fish, clams, slugs, or insects, should not be used simply to halt human progress. Neither should it prevent the control of nuisances, destructive predators, or disease-carrying insects.

The worst may be yet to come. Environmentalists, led by Interior Secretary Bruce Babbitt, are now proposing that "**entire environments**" be protected as "endangered," so that all of the populations of animals and plants living in them will be protected, **before** any have begun to decline in numbers. That procedure could prevent the use of all "natural enemies" against mosquito larvae. The "**natural enemies**" of pests could not be introduced into such environments, because they might also attack other insects or in some way have an impact on other animals or plants in the habitat. In fact, some environmentalists have already objected to the use of the **Gambusia** minnows that so frequently control mosquito larvae.

The future looks bleak for humans in these United States, but definitely much brighter for mosquitoes and other pests.

Malaria Treatment

In the 1960s, doctors in some countries were already having trouble curing malaria. The plasmodial parasites could no longer be killed by the usual medicines – **atabrine (quinocrine), amopyroquine, proguanil, chloroquine (Aralan), primaquine, pyrimethamine, or sulfadoxine**. Later, strains developed that were also resistant to **mefloquine** (a synthetic quinine). In Vietnam in 1965, some resistant falciparum cases were treated with daily doses of **DDS** (an old leprosy drug). This was evidently a desperation effort, trying **anything** that might prevent deaths. Only about half of those patients got well and the use of DDS was discontinued.

In 1966, there were resistant malaria strains in Vietnam, Cambodia, Thailand, Malaysia, and in the Amazon basin of South America. The U.S. Army reported strains southwest of Saigon that were resistant to all synthetic malaria drugs, *and* to quinine. Within a few years, the resistant strains developed almost everywhere else that malaria occurs. In the 1980s, **Fansidar** (a combination of **pyrimethamine** and **sulfadoxine**) was being recommended, along with chloroquine; this was slightly better than quinine alone. By 1984, there were reports of undesirable side-effects from Fansidar and warnings that it must be used with great care, especially by people irritated by sulfur compounds. **Methotrexate**, a

folic acid antagonist, has also been tested, but its future doesn't look bright. At present, chloroquine (**Aralan**) is the drug of choice, but patients are warned that if fever develops they must get to a hospital as quickly as possible.

The most promising "new" antimalarial drug is an old Chinese compound derived from extracts of **Artemisia** plants. It is called artemesinini or Qinghaosu. Largely because a new antimalarial compound would yield so little monetary profit, chemical corporations are unlikely to invest the millions of dollars required for researching and developing them. They are not even eager to manufacture Qinghaosu.

As a result of this lack of effective treatment for malaria, it is no longer "safe" for North Americans or Europeans to travel in some tropical countries because of the prevalence of "resistant" falciparum malaria. Unless there are some wonderful new developments in the treatment of malaria, it may soon even be unsafe to travel in many areas within the United States.

What About Vaccines?

The Rockefeller Institute developed a vaccine for **Plasmodium vivax** in the 1940s. It was a total failure, even when supplemented by a stimulating agent called "Freund's adjuvant." Freund's team had worked on bird malaria, with successful immunity to **Plasmodium lophurae** built up in ducks. The adjuvant, however, caused liver degeneration in the ducks, and worse reactions in monkeys, including autoimmune deficiencies. It was never tested on humans.

Researcher Paul Silverman, who had developed other vaccines in England, then got a million-dollar grant from AID to seek a malaria vaccine at the University of Illinois. Five years and \$1.5 million later, the team had failed. Their vaccine would reduce immunity only when applied along with Freund's adjuvant – and it was therefore impossible to test it on humans.

In 1980, the Agency for International Development doubled its investment in the search for a malaria vaccine, funding at least three teams seeking such vaccines. They were headed by Drs. Ruth and Victor Nussenzweig at New York University, Wasim Siddiqui at the University of Hawaii, and Miodrag Ristic at the University of Illinois. Five years later there was no success. Despite that fact, AID announced a "major breakthrough" and predicted that "the vaccine should be ready for use around the world within five years." Health authorities in underdeveloped nations believed that announcement and reduced their spray programs to await the forthcoming vaccine. It never came, and there was a catastrophic explosion of malaria and deaths.

According to Robert Desowitz in his book **The Malaria Capers**, the AID malaria vaccine project was surrounded by scandal. An investigation resulted in six indictments; the manager, scientists, and affiliates of AID were charged by the federal government with conspiracy, theft, criminal solicitation, and tax evasion. In 1983, Ristic was granted another \$2.38 million; in 1990 he was indicted on four counts of theft and evicted from the University of Illinois. (The University had been siphoning off 65 percent of the research funds as "**overhead expense**.") In Hawaii, Siddiqui had immunized owl monkeys, but only with the addition of Freund's adjuvant. In 1989, he and his assistant were charged with theft, criminal solicitation, and criminal conspiracy; on the very day he was arrested, AID announced it was granting him another \$1.65 million. The University of Hawaii replaced Siddiqui with Dr. Satoru Izutsu from Hong Kong.

By 1986, AID had spent \$69 million on vaccine research but there was still no vaccine. The AID malaria manager, James Erickson, who had supervised the awards of millions of dollars, was accused of extreme financial mismanagement. In 1990, he pled guilty, was sentenced to six months in a halfway house, and fined \$20,000. AID later offered \$23 million to India

and Africa for permission to test vaccines in their villages, but neither country would permit tests to be performed on their citizens. Finally, AID offered \$20 million to Papua-New Guinea for a 5-year field project there (later reduced to \$10 million for 8 years of research on the natives).

After 25 years, the AID malaria vaccine research project was still a disaster. According to *The Malaria Capers*, from which these details were taken, AID failed because it **"was run by amateurs, succumbed to sleaze and corruption, fostered mediocre science, and it overinflated the experimental results."** [10]

All of these expensive failures may also indicate that it is simply impossible to develop a safe vaccine that will confer a protective immunity against malaria. Nevertheless, the World Health Organization appears to be basing most of the worldwide fight against malaria on its hope that such a vaccine can and will be developed in the near future.

Field trials of the new vaccine developed by **Dr. Manuel Patarroyo** began in Colombia in 1987, on Amazonian **otus** monkeys. They attained a level of 80 to 90 percent immunity and the results look hopeful. By 1992, nearly 200,000 children under 15 years of age had been vaccinated and seemed to have developed a 60 to 85 percent immunity to malaria.

A much greater challenge to this newest vaccine comes this year in Tanzania, supported by **WHO** and the **London School of Tropical Medicine**. It involves 600 children, one to five years old, living in areas where 80 percent of all children are infected with malaria parasites (mostly the deadly falciparum type).

These tests will be carefully watched by every malarious country in the world. Even if it works well, the problem of producing the complex molecule on a commercial scale will be difficult. It must be remembered that high titers of antibodies are not necessarily enough to protect persons from diseases. Also, even if a good vaccine can be developed, it would only heighten the immunity and would have to be used in conjunction with insecticide programs to kill the mosquitoes and medications to kill the plasmodia. The remarkable history of attempts to develop malaria vaccines explains why so many scientists lack confidence.

'Living with Malaria'?

In 1991, the American Association for the Advancement of Science published the results of malaria conferences around the world in a slick little overpriced booklet titled **Malaria and Development in Africa**. It is here that the World Health Organization unveiled its new **"Global Malaria Control Strategy."** This strategy intends to **"put most emphasis on the patient and only on prevention where prevention is cost-effective and sustainable."** By 1997, the goal is to have "reasonably effective" control programs in at least 85 countries with endemic malaria.

By the year 2000, WHO says, deaths from malaria in at least 70 countries should have fallen by at least 20 percent compared with 1995 levels. Later, WHO states, **"the aim is to cut the death rate in most afflicted countries by 80 percent during the last five years of the century"** (emphasis added).

The book makes no mention of actual methods of killing mosquito larvae or adults and provides no details of chemicals that might replace quinine, chloroquine, or Fansidar to halt attacks of malaria. Funding for this treatment effort is already exorbitant, and WHO estimates that by 1995 the costs will exceed \$1.8 billion (compared with \$800 million in 1987). WHO Director Peter de Raadt says that by that time at least half of the participating countries **"will have adequate malaria control programmes, if WHO meets its targets."**

No other methods are discussed in the book but, according to Dr. de Raadt, this is no problem for **"Quinine plus tetracycline still works,"** he writes, and newer drugs, such as artemisinin derivatives **"are soon to come off the production line.... Thanks to a well-implemented control strategy, it can be done."**

What is that **"well-implemented strategy"**? Nowhere in the book are any methods that might control mosquito adults or larvae discussed, nor are details presented of drugs that might halt the plasmodia. Instead, there is a great amount of talk about **"cross-sectoral approaches," "planning," "scheduling meetings," "assigning responsibilities," "surveying health conditions," "mapping the malaria situations in each country,"** and **"producing accurate epidemiological data."** Repeatedly it is stated that **"strategies must be community-specific,"** which is why priority must be given to developing new skills to implement the **"new thinking"** of the global strategy.

The aim, says **David Nabarro**, of the **British Overseas Development Administration**, should be **"living with malaria, rather than defeating it."** Even more surprising was the statement that the WHO **"formally gave up on a strategy of eradicating the mosquito carrier."** It should be noted that eradication of the mosquito carrier was **never** the strategy of the **World Health Organization**; WHO always specifically stated that the objective was *not* to eradicate the mosquito vectors, but to terminate the transmission of the malaria plasmodia by them. That certainly made more sense than trying to eradicate mosquitoes.

As enumerated in **Malaria and Development in Africa**, there are now four major components of the new antimalaria strategy for the world: (1) early diagnosis and prompt treatment; (2) planning and implementing selective prevention measures; (3) early detection of epidemics; and (4) regular reassessment of the malaria situation in each country. With this strategy, bureaucrats will surely keep busy, but **"reassessing catastrophes"** doesn't save lives, and this strategy specifies no treatments or preventive measures.

A more recent report from the Institute of Medicine concludes: **"These are grim days in the battle against malaria."** One of the authors was **Awash Teklehaimanot**, Ethiopia's chief malaria official, who wrote in a dissent from the report, **"There is too much emphasis in this report on malaria research, while little attention is given to malaria prevention and control."** Dr. James Jensen, a member of the Institute of Medicine panel, responds, **"Even with superior efforts at prevention, the parasite would gain ground through its growing resistance to drugs and pesticides"** and concludes that **"We desperately need new tools."**

With a strategy this poor coming from the experts, persons who live in malarious countries have very little to look forward to. It is difficult not to conclude that the **World Health Organization** and the **American Association for the Advancement of Science** have joined the ranks of those who respond to the malaria situation like the AID official quoted above: **"better dead than riotously reproducing."**

Notes:

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3. Robert Desowitz, 1992. **The Malaria Capers** (New York : W.W. Norton).
4. A speech by Victor Yannacone, a founder of the **EDF**, on 10 May 1970 as cited in Hearings on the Federal Pest Control Act of 1971, House of Representatives, Serial No. 92-A, 1971, p. 266.
5. L.J. Bruce-Chwatt, 1972. **"D.D.T.," The Lancet** (July 15), p.131.

6. Wayland J. Hayes, 1956. "Effect of Known Repeated Oral Doses of DDT In Man," **Journal of the American Medical Association**, Vol. 162, pp. 890-97.
7. Edward R. Laws, Jr., et al. **Archives of Environmental Health**, Vol. 15, pp. 766-75 (1967), and Vol. 23, pp. 181-184 (1971).
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9. A.E.M. McLean and E.K. McLean, 1969. "Diet and Toxicity," **British Medical Bulletin**, Vol. 25, pp. 278-81.
10. For details on **AID's James Erickson** and antimalaria research, see **Eliot Marshall**, "Crisis in AID Malaria Network," **Science**, pp. 521-23 (July 29, 1988), and **The Malarie Capers** by **Robert Desowitz** on AID's antimalaria vaccines effort.

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