

INSTITUTE OF CURRENT WORLD AFFAIRS

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India: Success story.

25 - A Nizamuddin West
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Mr. Richard H. Nolte
Executive Director
Institute of Current World Affairs
366 Madison Avenue
New York 17, New York.

Dear Dick,

India is about to lick a problem 3500 years old. It will have done so because of years of study and effort, because of 10 years of timely American aid, and because it created a magnificently functioning organization. The existence of this organization is perhaps as noteworthy as what it has accomplished, for, with one task completed, it can be used to attack others.

The Atharva Veda, written about 1500 B.C., described a fever and classified it according to the form attacks of it took--daily, on alternate days, and every third day. It called the fever the 'King of Diseases' and associated it with insects whose appearance and habits it described. So old in India was the awareness of malaria--the word itself did not enter the English language until the 1820's--and its association with mosquitos. Six years ago the Government of India, after years of experimentation, research, and programs to control malaria, launched a National Malaria Eradication Program (N.M.E.P.). In two years time the program will have been completed and the 'ancient curse' of India all but wiped out.

This achievement will be especially fitting because so many of the major discoveries in malaria research have been made here, including the vital discovery, from which all other investigation has stemmed, that malaria is transmitted by mosquitos. Sir Ronald Ross, a British doctor, proved this in 1897. But there were earlier discoveries. T.E. Dempster, a member of a British army commission in the Punjab, in 1845 employed for the first time the spleen rate as an index for the incidence of malaria--a technique that "continues to this day to be the most valuable measure for estimating the incidence of the disease," according to the present director of the N.M.E.P. Sir Rickard Christophers, head of the first malaria research organization in India, was the first person to determine how really severe malaria affects a population. Christophers did his work in Singbhum district on the Bengal-Bihar border. Lt. Colonel J.A. Sinton, director of the Malaria Survey of India from 1927 to 1938 (the successor body to Christophers's Central Malaria Bureau, which was founded in 1909), pioneered studies on the overall effect of malaria on the population and on what the disease cost the country. Lt. Colonel Jaswant Singh, after World War II the director of the Malaria Institute of India--the new name for the Survey--discovered the most useful stain for revealing malaria parasites in human blood. That malaria research institutions were headed by military men for so long is not surprising when one realizes that of the soldiers hospitalized in India

before the war at least one-fifth were incapacitated by malaria--this despite the relatively higher protection the military received, in relation to the civilian population, in the form of mosquito control in barracks, cantonment areas, and so on.

But if malaria plagued the military, it was devastating the civilian population. On economic and social as well as humanitarian grounds, the magnitude of the malaria problem warranted both research and all possible efforts at control. India has an area of a million and a quarter square miles and a population of over 400 millions. Ninety per cent of this area was malarious when the eradication program began and about 90% of the population suffered to varying degrees from the disease. This is as if twice the population of the United States living in an area less than one-half the size of the U.S. suffered from a major communicable disease.

This was India's malaria problem in the mid-Thirties: out of a total population of about 290 millions, 100 million persons suffered annually from malaria. Taking the agricultural and small town population as 60% of the total (although at that time the percentage was certainly higher, the great influx to the cities not having started; 60% is the present figure of the population living on the land), we find that at least one person of every two in the countryside had the disease. A million deaths a year were directly caused by malaria, it was estimated, and in epidemic years the total grew another quarter of a million. Another million deaths annually were attributed indirectly to malaria because the fever so weakened sufferers that they became prey to other ailments. Sinton, in his monograph What Malaria Costs India, commented on the serious effects of malaria on those who survived it. "The disease has a marked effect upon the nervous system and mentality of individuals afflicted with it," he wrote. "It is easy to see how a child, whose early years have been marked by a succession of weakening attacks of fever, will probably enter adult life with a debilitated constitution and an ill-educated mind." And as for adults, Sinton wrote, "The mental lassitude caused by the disease tends to become fixed in later life. 'Malaria perpetuates ignorance and ignorance malaria!'"

Sinton also investigated the cost of malaria to the country from loss of production, both agricultural and industrial, from wages not earned, etc. He estimated that "the economic loss to India directly due to malaria" was at least 900 million rupees yearly. Considering the cost to families and to the nation of the indirect effects of malaria, he decided that the loss must be over a billion rupees. "It is even probable that the amount may be twice this sum at least," Sinton added, and, he concluded: "As malaria is preeminently a rural disease, and agriculture is the chief support of the country, the loss which the staple industry of India sustains must be enormous. The influence of this disease upon agriculture is therefore one of the most important economic problems in India."

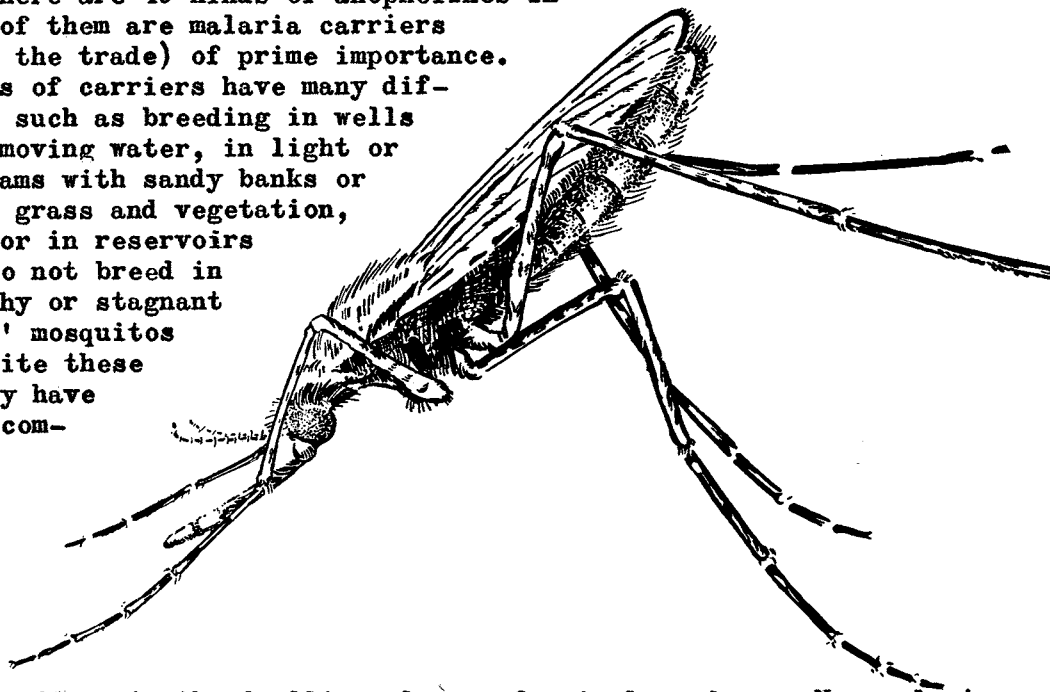
In more recent years, experiments and surveys have borne out Sinton's views. An enquiry in Mysore state based on 730 families showed that malaria control--not eradication--had increased earning power by more than 100 thousand rupees, and that the return for money spent on control was at the ratio of 93 to 1. In the Punjab in two districts alone, anti-malaria measures allowed for an increase in rice production worth two million rupees, according to a senior malariologist from the World Health Organization. Malariologists working in the eradication program have told me of visits to villages where, at the height of the harvest season, the entire adult pop-

ulation was unable to work because of fever, and of villages where few babies lived through their first year.

The importance of malaria having long been appreciated, what measures were taken against it? Anti-malaria campaigns began here as early as the end of the last century--and they followed directly upon Ross's proof that mosquitos carried the disease. These efforts consisted of attacks on mosquito larvae by spraying oils and chemicals like Paris green on breeding areas. Although local in scope, this technique was successful in holding down the incidence of malaria. By the mid-Thirties pyrethrum sprays had been developed and were used directly against adult mosquitos. But pyrethrum, used in commercial sprays like 'Flit', was too expensive for a nation-wide campaign and could only be successful up to a point. The habits of some mosquitos rendered it inefficient and its lethal capacity was quickly dissipated. For military and some urban use, pyrethrum sprays were reasonably effective. The great break-through in anti-malaria work came with the development of DDT during the war--to be exact, in 1944.

DDT--dichlor-diphenyl-trichlorethane--is a 'residual' spray and that makes all the difference. When mixed with oil to make a solution or with water producing a suspension and sprayed on surfaces such as the walls and ceilings of a house, it will kill mosquitos for from two months to one year--and, happily, malaria-carrying mosquitos are more susceptible to DDT than are other varieties. The harder the surface and the less it is overlaid after spraying by dirt, dust, smoke smudge, etc., the longer lasting the killing power. Because of their habits, as well as their susceptibility, this property of DDT makes it especially effective against malaria-carrying mosquitos.

Malaria, as we all know, is carried by the anopheline species of mosquito. There are 40 kinds of anophelines in India and six of them are malaria carriers ('vectors', in the trade) of prime importance. These six types of carriers have many different habits, such as breeding in wells or sluggishly moving water, in light or shade, in streams with sandy banks or with verges of grass and vegetation, in ricefields or in reservoirs (Anophelines do not breed in drains or filthy or stagnant water as 'pest' mosquitos do.), but despite these variations they have two habits in common. They live from the blood of animals and humans, and they customarily harbour or rest, particularly after feeding, in the dwelling places of animals and men. Now malaria is transmitted this way. An anopheline bites a person infected with malaria, gorges itself, and then, belly full and contented, it flies to the nearest



wall or ceiling to rest. During the next week or 10 days the malaria parasites develop sufficiently in the body of the mosquito to reach its salivary glands; then it is ready to pass on the disease. Should the infected mosquito alight on a wall sprayed with DDT, however, it will absorb enough of the poison left from spraying to die. Thus the chain of transmission is broken. Depending on the strength of the DDT remaining on the wall, the mosquito will die in several hours or after two periods of resting. If the first exposure does not kill, the mosquito may feed again, but it will do so before a week is out when it is not infectious. After feeding a second time it returns to a wall, receives its second exposure to DDT, and dies. Again, the chain of transmission is broken.

Hence DDT, with its property of residual effect, makes possible malaria control or eradication. With the chain of transmission broken, new malarial infections cannot take place, nor can there be reinfections. Yet there is still a reservoir of parasites in already infected humans. Does spraying to prevent transmission have, therefore, to go on forever? The answer is no. Three things may happen to an individual with malaria. He may die. If so he is no longer a source of the disease. He may, if he has falciparum malaria, have an attack of fever. But this can be detected--and would be under the eradication program--and cured by drugs. He may have vivax malaria, which may lie dormant and undetected, but if he is not reinfected, the disease will die out within him naturally in three years. Thus, if by spraying all dwellings and buildings for three years, transmission can be prevented, the reservoir of malaria, by the passage of time and by vigilant surveillance, can be destroyed. Then it doesn't make any difference, except to human comfort, how many mosquitos there are; there is no disease left for the anopheline to carry. This is the logic first of malaria control and of its extension, malaria eradication.

Some of this knowledge Indian malariologists did not have at the end of the war (for instance, that malaria parasites die out in three years), but they knew enough so that with DDT available they could think in terms of more than local anti-malaria work. In 1946 the Government of India Health Survey and the National Development Committee recommended the establishment of a nation-wide anti-malaria organization. Various provincial governments as well as the Federal Government experimented with DDT for malaria control during the next few years with great success. In 1951 the newly established Planning Commission recommended that an all-India anti-malaria program be given top priority, and the United States, the World Health Organization, U.N.I.C.E.F., and the Rockefeller Foundation joined forces with the government to help. The plan produced called for the creation of 125 malaria control units, covering about one million population each, in the worst malaria areas. In December 1952 the Governments of India and the United States signed an agreement bringing into existence the National Malaria Control Program. The Americans were to provide aid in kind--the DDT, spraying equipment, transport--and some funds. The Federal Government was to provide malaria research, training programs, and direction and would act as the channel for American aid. The states of India were to assume most of the cost of field operations.

The aim at this time was to control malaria, "to bring malaria transmission down to a level at which it would cease to be a major health problem." The program was a huge success. It was extended from 125 units to 200 covering 145 million persons, and the incidence of malaria in control areas dropped sharply. At the beginning of the program in Andhra

state in 1953, for example, 18.3% of children were infected by parasites, whereas in 1957, only 12.7% of the children had malaria. In Bihar the percentage dropped from 56.1% to 11.2%; in Madhya Pradesh it dropped from 34.7% to 4.6%; in Orissa from 34.1% to 1.4%. These percentages were determined by spleen rate. A number of diseases cause enlargement of the spleen; one of them is malaria. By measuring spleens for abnormality, the endemicity of malaria in an area can be determined. The proportion of malaria cases to those of other diseases in the areas under the control program went down with equal sharpness--from 10.8% to 3%.

During the years of the control program in India, events took place in other parts of the world that altered India's goals. It was discovered that in areas that had been subjected to DDT spraying for three years, persons had no malaria parasites in their blood. The Venezuelan Government, following this up, stopped spraying, and malaria did not reappear. Also, it was discovered, as early as 1951 in Greece, that some types of anophelines were becoming resistant to DDT. Malariologists decided that the solution was massive spraying over a three-year period and not lower-intensity spraying over a long period; the parasite reservoir had to be eliminated before DDT resistance developed in mosquitos. Resolutions of the WHO took note of these developments, and the WHO resolved in 1955 to request governments to intensify malaria control programs into ones of eradication. A regional committee session of the WHO held at Delhi in 1956 adopted eradication as a goal for all countries of the area. The prospects for the success of these programs improved greatly when, in 1957, stimulated by our aid missions abroad, the U.S. Congress began appropriating funds under the Mutual Security Program directly to countries around the world that had malaria eradication programs. Previously funds had been channeled through the World Health Organization or some other international body.

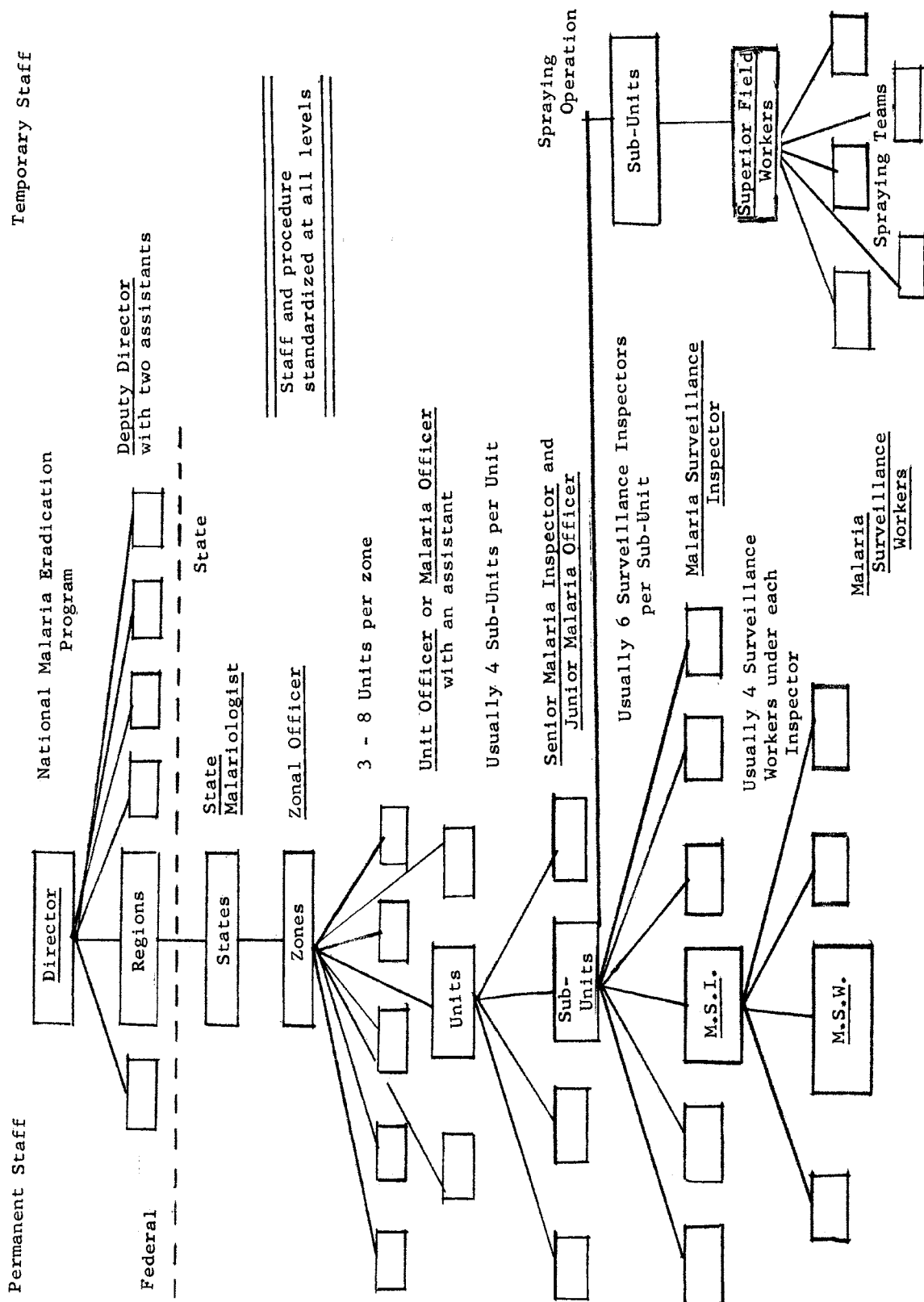
India's National Malaria Eradication Program came into effect in April 1958 with the signing of another agreement between the United States and the Government of India. As before, the American contribution was to be partly in funds and partly in kind, DDT and transport. No spraying equipment was needed because India by then produced its own hand compression sprayers--the sort we used at home to spray the string beans--and stirrup pumps. A large amount of credit for this self-sufficiency goes to a Mr. Fred W. Knipe of the Rockefeller Foundation, who helped get production of these pumps started. WHO also contributed funds for the purchase of insecticides.

Eradication was to be achieved by a system of "centralized direction and decentralized execution," according to the director of N.M.E.P. The country was divided into 391 units covering 394 million persons, and, where possible, the units followed the boundaries of the districts that are the basic unit of local administration in the states of India. I don't much like tables of organization as a rule, but the one on page 7 may help to understand how the work of eradication has been carried out. At the top is the Director, N.M.E.P., since 1959 Dr. A.P. Ray, a likeable, dynamic man of whom more later. Under the director come six regional offices, each with a deputy director and two assistant deputy directors. Into the six regions are grouped the 15 states of India. Dr. Ray describes these offices as his "tentacles," and they act as two-way liason between the states and the director. The authority of the Federal Government technically stops with the regional offices. Responsible for the N.M.E.P. in each state is an official called the state malariologist, acting for the director of the state public health

service, and himself a senior member of the service. The states are divided into a varying number of zones under zonal officers who supervise the work done by the three to eight units, with about a million population each, into which each zone is divided. It is at the unit level that field operations really begin. Units are headed by unit officers, more often called malaria officers, who are usually physicians. They have an assistant malaria officer and some staff.

The units are divided into sub-units, usually four, headed by a senior malaria inspector assisted by a junior malaria officer. In the sub-units the work of eradication is split into spraying and surveillance activities. On the spraying side, the senior malaria inspector has what are called superior field workers, each of whom leads a spray team. These teams are organized with 12 to 15 men and 4 to 5 pumps per team. The number of spraymen in a sub-unit varies from 40 to 70 depending on the difficulty of the spraying operation—whether, for instance, villages are close together or far apart, the state of the roads and paths, the hilliness of the terrain, whether the area is jungle, etc. The job of these men has been to spray twice yearly more than 80 million dwellings. Spraying normally takes place from June to November. Houses are sprayed just before the transmission season and again several weeks after it has begun. In areas of high incidence and year-round transmission, houses may be sprayed three or four times. Spraymen are seasonal labour, except for some superior field workers, and have been recruited through the state labour exchanges. They have tended to return season after season, however, and so the spraying is not undertaken each time by green hands—an important factor, for, I am told, a good spray job requires some expertise. The pay of these men is only 50 to 70 rupees monthly (under \$15), wage scales varying from state to state and area to area. Not much money, but a welcome addition to a family in a poverty-stricken country.

The surveillance side of the sub-unit is organized like this: Under the senior malaria inspector are usually six malaria surveillance inspectors, each of whom supervises four surveillance workers. Malaria surveillance inspectors and surveillance workers are recruited with advertisements in newspapers, public notices, etc., but from senior malaria inspectors upwards all officers are merit appointments by the state public service commissions. Senior Malaria inspectors have all had training at the Malaria Institute of India in Delhi, have had at least five years experience in malaria work, and many have university science degrees. Surveillance inspectors have usually reached matriculation standard (in effect, high school graduates), and surveillance workers have only meagre training. The job of the surveillance worker is to visit every house in his area (about 10,000 persons) once every two weeks, and he must keep a record of each visit. He enquires if there has been anyone with fever in the household. If so, he takes a blood smear of the person affected and gives him drugs for a presumptive case of malaria. The worker then reports to his superior. Should the smear show parasites, several things happen. The sick person receives radical malaria treatment (All drugs, even for cases of malaria treated privately by doctors, are free; as a quid pro quo the private physician must send the government a blood smear from his patient), smears are taken of the surrounding 50 families, the teams come back to respray the surrounding 50 houses, and the authorities try to find the source of the infection: Was it a relapse or a new case, and, if the latter, how was the person exposed? Was it a stranger in the village who was a carrier, or had the sick person



to a neighbouring area? The malaria surveillance inspector is charged with visiting every village in his sector once a month to make sure that his four workers are doing their job. As few villages are accessible by road and many not even by bicycle over paths, the malaria eradication program demands a great amount of walking.

The price of malaria eradication, like liberty, is eternal vigilance, and Dr. Ray sees that it exists from the bottom to the top of the organization. He calls it "concurrent and consecutive supervision," meaning that a man's work of the moment is checked and also what he supposedly did some days before. A senior malaria inspector, for example, usually accompanied by several of his superiors, inspects a spraying team at work. Under his eye their work is excellent. He then finds where they sprayed five days before and goes to that village. He asks the women in the houses if the spray team came. Yes. Did they spray your house? Yes. Please let me see. He goes in and finds--because he can see the DDT crystals on the walls if the work has been well done--that the spraying has been slipshod. If the failure was due to lack of expertise, the superior field worker gets a reprimand--he may also be docked a month's pay--and his spray team more training; if the bad job was due to laxness, the superior field worker is fired. Or perhaps the senior malaria inspector finds that all but one room in a house has been sprayed; the woman of the house thought this was enough. Again, the superior field worker is in trouble, and the officer, or perhaps Ray himself, if he is along, will explain to the woman that if adults contract malaria they will probably live, but that if her baby is infected it may die. This usually has its effect. Or the officer may say, "Daughter, I have a vegetable garden, but I'm only going to put a fence on three sides of it." And he is told that he is a fool, that the cows will come in the fourth side. To which he replies, "Do you never go into the room that was not sprayed? Do your children never go into it?" The woman usually asks that the team come back and spray the whole house.

Surveillance workers are checked by officers going into a village and finding if a man has come to ask about fevers. If the villagers say no, the worker is fired immediately. If the answer is yes, the next question may be, Did a man come with him? No. Has any other man come to the village this month to check for fevers? If the answer is no, the malaria surveillance inspector is fired immediately. Surveillance workers are supposed to record on a standardized chart their visits to each house in a village or hamlet--each house in India is numbered for this purpose--and to record the blood smears taken. An investigating officer can take the smear cards for example, and go to the house from which a smear allegedly came. If the family reports that no smear has in fact been taken, then the blood probably came out of the surveillance worker's own arm and he is fired for laxness. The hiring and firing of malaria surveillance inspectors and surveillance workers and superior field workers is done at the unit and zonal level, so retribution can be swift. These methods sound somewhat brutal, arbitrary, and unpleasant, but evidently they have to be. All those involved, with whom I've spoken, agree that at the lower levels, especially, there is little sense of responsibility and only the threat of loss of pay ensures attention to duty.

This rigorous vigilance system continues at higher levels. Senior malaria inspectors, the heads of sub-units, are often shifted to another unit for a period, and an officer from another area given their post. To protect themselves, each man gives the closest scrutiny to the efficiency of the work in his new area. "They cut each others throats," says Ray with

glee. "There is no shielding, and as a result the amount of sacking can be tremendous. In some of our best areas we had a 100% turnover in two years, and in others we ran up to 60%." The result was, Rays says, that "now we are down to about 5% turnover."

As for the malaria officers and upwards, they have to be on their toes, too, for Ray, the regional officers, the state malariologists, and the zonal officers are constantly on the move, checking, finding fault, repairing. Ray insists that every officer spend at least 15 nights a month in the field. "This is a cause," he says; "we have no private lives." If an officer at a higher level is doing poor work and informs Ray that he doesn't like malaria eradication work, Ray will find him another job in another organization. But if the man stays on and his work doesn't improve, "He is fired in disgrace," Ray says.

Keeping the N.M.E.P. running smoothly involves dealing with what may be called 'federal' issues. Despite the centralized character of Indian federalism, the state governments have spheres of great autonomy; one of them is public health. In the Indian Constitution are legislative lists that lay down the competency of the state legislatures and the Union Parliament in regard to all possible subjects. And on the State List is "Public health and Sanitation; hospitals and dispensaries." On the Union List there is no entry concerning health--and in the Constituent Assembly the efforts of some members of the federal government to have public health made a Union or a concurrent subject (then either the states or Parliament could have legislated upon it) were firmly rejected by the states. But on the Concurrent List is the entry, "Economic and Social Planning." Through this loophole the Union Government can direct a national malaria eradication program. Because the states have autonomy in the matter of public health, however, this direction has to be exercised by Ray with the weapons of a diplomat: negotiation, cajolery, and pressure.

At its inception the eradication program was sponsored, planned, and aided, financially and with materiel, by the Union Government--the DDT and transport, of course, were U.S. aid. The Union also provided the technical direction, supervision, and evaluation of the program. After the initial stages had been passed, however, the Union discontinued sole sponsorship and now the program is planned in three-way conversations between the Union Planning Commission, Ray's N.M.E.P. headquarters, and the state governments. Planning responsibility has been transferred more and more to the states, while overall direction continues to lie with the Union, that is, with Ray. Yet Ray has made it clear to the directors of public health in the states that they must take charge of their own programs. This presumably had a beneficial psychological effect, and it also put Ray in a position where he could hint, or in extreme occasions say bluntly, "This is your program and things aren't going well. Either they improve or I'll withdraw my aid and support." This approach, Ray says, had its effect, for even if a health director or the chief minister of a state were inclined to resist, officials in neighbouring states who were cooperating with Ray would put pressure on the recalcitrant official in order to protect their own eradication programs. Ray evidently found the threat of withdrawing his support, both tangible and intangible, a lever sufficient to the need in the early days of the program. Now this technique has been largely replaced by more positive methods.

The first of these was bringing state malariologists and

other officers from the states to Delhi for training and orientation at the Malaria Institute, although in many cases officers were already alumni of the Institute. The second technique was to get the direct participation of the state public health directors in the program at the national level, thus gaining their support by involving them in it while at the same time gaining their interest and indoctrinating them. This, it seems to me, has been Ray's most successful innovation. In 1962 Ray instituted a system of yearly review of the entire N.M.E.P. effort by 'Independent Appraisal Teams'. This year, for example, there were nine teams for the appraisal, which took place in February. Each team was headed by the director of a state public health and had two other members. One member came from the defence forces, the Union Health Ministry, or a like organization, and the other member was a malaria expert from the World Health Organization, the U.S. aid mission, or some other 'outside' organization. Each team spent three weeks in the field in its assigned area checking the eradication program. No health director appraised the program in his own state. The reports of the teams were checked by three 'consultants'---who had given the teams an orientation briefing before the appraisal began---and then passed on to Ray. This year the consultants were the Director of the National Institute of Communicable Diseases in Delhi, the Southeast Asia malaria consultant of WHO, and a malariologist from the U.S. aid mission. As a result of this system, the state health directors are now "sold" on the eradication program and give Ray full cooperation, and Ray, himself, is provided with reports that help him to improve his organization.

Let's return to the progress of the eradication program itself. The program, as has been said, began in April 1958, and the plan was to establish 391 units covering 394 million persons in all the malarious areas of the country. One hundred and forty-five units had already been set up under the malaria control program. These had to be expanded to the scale of the new units so that all would be in the 'attack' phase of the operation: full-scale spraying of all dwellings and the use of curative measures against all malaria cases discovered. The surveillance operation, to work parallel to that of spraying, came into existence in 1960, but only became stabilized in 1961. By the close of 1962, the attack phase was completed in 140 units, and they had entered the 'consolidation' phase---in which there is no more mass spraying but surveillance activity is continued. By the end of 1963, another 88 units had changed from attack to consolidation. The position now is that in 80 units covering 96 million persons the work of the eradication program has been completed and the units have entered the 'maintenance' phase---in which the watch against recurrences of malaria is handed over to the general health services of the state. Two hundred and eight units have entered the consolidation stage due to the very low incidence of malaria in them. In 103 units the attack phase and surveillance are going on concurrently. Of these units, 73 are scheduled to go into the consolidation phase in 1965 if they are judged ready by the independent appraisal system. The 30 units left in the attack phase after 1965 will likely remain so for some time. Ten of the units cover extraordinarily difficult terrain, and the other 20 are in areas bordering Burma, Pakistan, and Nepal. Generally speaking, none of these three countries has reached India's level in anti-malaria work and India is, therefore, maintaining a cordon sanitaire for its own protection. Pakistan is making rapid strides toward malaria control, however, and has begun its program in border areas, thus helping India considerably. The units on the Burma border and on the western parts of the border with Nepal will, Ray expects, need spraying for a long time.

Throughout the decade of malaria control and eradication programs there has been, contrary to what I had expected, little resistance from the villagers. For this reason it was not necessary to accompany the programs with large educational or propaganda campaigns. More educational work could have been done to good effect, some of those involved believe, but, as Ray says, health education is a slow process and "we could not afford to wait that long." Efforts at education and indoctrination have taken place usually on the spot when difficulties were encountered. An early stumbling block, and like all subsequent ones neither frequent nor widespread, was the villagers' belief that malaria workers were revenue officials. This was a dangerous misapprehension, but one easily dispelled. In several cases the villagers, believing that the presence of strangers contaminated their houses, wanted to replaster them with mud, which would, of course, have rendered the spraying useless. Explanations of the importance of spraying overcame this difficulty. Some families prevented the spraymen, who were of lower caste than themselves, from entering their houses, but again the difficulty was overcome by persuasion. Somewhat more important was the resistance to spraying that grew up after several years. The villagers were tired and suspicious of the intrusions and did not understand why they must continue. Also, at the beginning of malaria control, the authorities talked in terms of mosquito eradication. When this did not take place, the villagers began to think that they'd been misled. Now the slogan of the eradication program, painted on village walls, is "We can't get rid of mosquitos, but we can get rid of malaria."

The United States began contributing to anti-malaria work in India with the agreement signed at the beginning of the control program in 1952. It continued to grant funds and materiel through 1963. From the current year onward, U.S. aid will be in the form of loans, not grants. Of the total cost of the anti-malaria programs to date of approximately \$203 million, the United States has contributed \$78 million in the form of DDT and equipment and more than \$100 million in funds from the joint-use rupees derived from wheat sales under PL-480. The United States has also contributed the services of up to four malariologists. One of these, Dr. Raymond Laird, has been in India five and one-half years, and did malaria work in Indonesia for five years before coming here. Dr. Laird became a malariologist in 1936 and has been seconded to aid missions by the U.S. Public Health Service since 1951--when he went to Burma on his first tour abroad.

The success of the malaria control and eradication programs has been nothing short of stupendous, both in statistical and human terms. Babies in the terai region of the United Provinces, for example, do not now die of malaria before they are a year old. Adults, instead of being prostrated by fever, can harvest their rice and wheat. The nearly 100 million yearly cases (estimated) of malaria in India in 1952 had dropped to 30 million a year by 1958 when control became eradication, and at the end of 1962, this figure had fallen to less than 100,000 cases a year. At the beginning of the control program in 1952, malaria was believed to constitute nearly 11% of the sickness in India. At the end of 1963, it amounted to only .4%.

This success has in great measure been due to the dedication and personality of Dr. A.P. Ray. It is he who has made a fine scheme of organization work. When I first met Ray at his office some days ago, he was dressed in sandals, white trousers, and a smoothly starched khaki shirt open at the throat. He is a biggish man for an Indian and his movements are quick

and definite. While he talked he smoked cigarettes and played with a match-box. In a country where the standard of English spoken is high, his command of the language stands out. He is about 45 years old. Before he spent a year at the National Institutes of Health in Bethesda, Maryland working in micro-biology, his formal education and research had been done in India. He recieved his BSc. and PhD. from Patna University in Bihar. During his trip to the United States, Ray also worked briefly at Harvard and the Communicable Disease Center in Atlanta, Georgia, and spent some time enroute at the London School of Tropical Medicine. Ray entered the field of malaria studies in 1940, and later he continued this work with the Indian army in Iraq and other Arab countries and in Mountbatten's Southeast Asia command. "We have all of us grown up in every activity of malaria control," says Ray, "from work in the laboratory to the field long before the concept of eradication was accepted." The National Malaria Eradication Program that Ray now directs is the descendent of the former Malaria Institute of India. The Malaria Institute itself was expanded to become, in July 1963, the National Institute of Communicable Diseases. Within this new Institute, Ray's N.M.E.P. has autonomous status and Ray ranks with the director of the Institute, a kindly, round-faced, grizzled man named Dr. S.P. Ramakrishnan. Ramakrishnan regrets Ray's departure from the laboratory: "He was a good scientist, but I think we've lost him now because of his great executive ability."

With the malaria eradication program drawing to a close, what will happen to the organization and the men that made it a success? Ray appears to believe that they can be fused with the network of primary health centers being developed in the countryside. These health centers will not only treat sick persons but watch for recurrences of malaria and other communicable diseases, undertake work in environmental sanitation, family planning, and join in campaigns against specific diseases such as smallpox. Other individuals I've talked with are not so confident of this. They would prefer to see the organization remain intact and be given a new task, family planning for instance. One thing is certain: it will be truly a crime if the organization, its personnel, and its know-how is allowed to waste away. But what happens to it is the subject of a future newsletter.

Yours sincerely,



Granville Austin

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