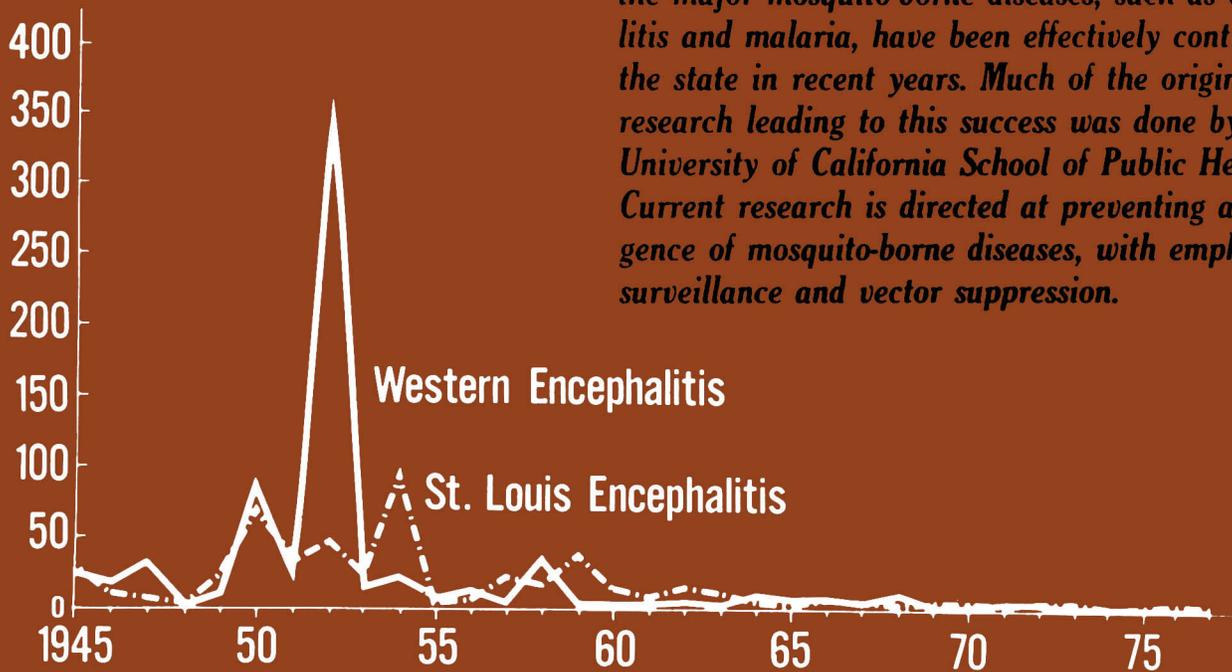


Public health

Number of cases



The mosquito control program in California has been uniquely successful, and for practical purposes, the major mosquito-borne diseases, such as encephalitis and malaria, have been effectively controlled in the state in recent years. Much of the original research leading to this success was done by the University of California School of Public Health. Current research is directed at preventing a resurgence of mosquito-borne diseases, with emphasis on surveillance and vector suppression.

Encephalitis and other mosquito-borne diseases have virtually disappeared from California in recent years.

Control of mosquito-borne encephalitis

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Three mosquito-borne viral diseases in California can cause inflammation of the brain (encephalitis): western equine encephalomyelitis (WEE), St. Louis encephalitis (SLE), and California encephalitis (CE). Since the late 1930s the University of California has been studying these arboviruses (arthropod-borne viruses).

WEE, a disease of both humans and horses, was a major veterinary health problem in the 1920s and 1930s, when outbreaks affected thousands of horses. At that time the agricultural economy depended on these animals. Later, the human diseases were recognized to occur each year and periodically to reach epidemic proportions.

A series of studies by scientists from the George Williams Hooper Foundation, the Department of Entomology, and the Schools of Public Health of the University of California disclosed that *Culex tarsalis* and *Aedes melanimon* were the principal California mosquitoes transmitting these viruses. Birds and small mammals were found to be the sources of mosquito infection. Thus, a basic cycle perpetuated the infection in nature, but there were few ob-

servable symptoms or none in the animals.

When the mosquitoes spread the infection to people and horses, however, some of those infected developed inflammation of the brain, which was called encephalitis, or sleeping sickness. Many of those who survived the disease had serious long-term brain damage. The epidemiological and entomological research identified the cause of the problem, the biology of the vectors, or carriers, and alternative control approaches.

Because research has identified threshold levels of the mosquito vector population below which few human and horse cases occur, the State Department of Health and local mosquito agencies have focused on reducing the proven vectors of the three viruses, while veterinarians have used a vaccine to immunize horses against WEE. (There is no licensed vaccine for people.) Because of this program, mosquito-borne encephalitis as a clinical disease has nearly disappeared from California in the past 20 years. Meanwhile, epidemics have continued to occur in other regions of North America.

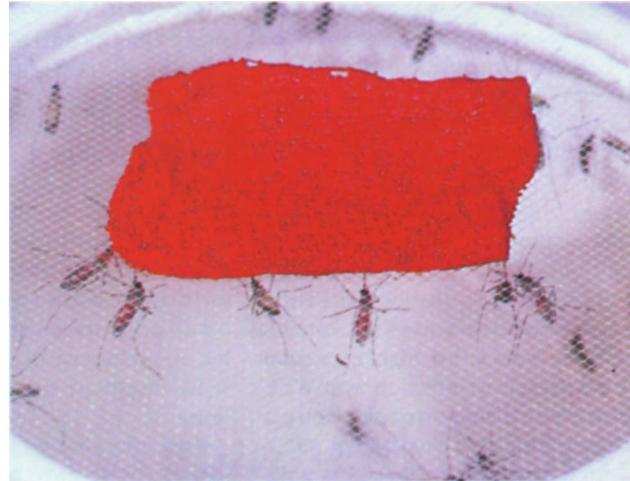
Photo by Richard De Witt



◀ Viewed under black light, mosquitoes recaptured after being marked with fluorescent dust and released into a field population enable researchers to determine survival rates, movement, and mosquito population density.

Blood studies of rabbits and other mammals in the Finney Lake study area showed that they were not a source of encephalitis virus to vector mosquitoes.

▼ Finney Lake in the Alamo River drainage, resulting from irrigation agriculture in the Imperial Valley, is a focus of *Culex tarsalis* transmission of encephalitis arbovirus.



Female mosquitoes feed on gauze pads soaked with a suspension of encephalitis virus, rabbit blood, and sucrose in studies to determine their ability to spread disease.

Despite this gain, there is little reason for complacency. All three encephalitis viruses have persisted in California in their basic cycles between wildlife and mosquitoes. It has not been technically or economically feasible to reduce the vector populations to a sufficiently low level over large areas to eradicate the basic infection cycles. In fact, research demonstrated that this approach would not work, because migratory birds probably would reintroduce the viruses with some frequency.

Currently, University scientists are giving high priority to continued surveillance studies in collaboration with the State Department of Health and mosquito abatement districts (MADs). Today it is critical to monitor closely the levels of vector populations and viral activity, because the carriers have become genetically resistant to most available insecticides. Moreover, local support of MADs has been reduced, further undermining disease control efforts.

Current evaluations of the abundance of mosquito vectors, viral infection rates in the mosquitoes, and infection rates in

flocks of sentinel chickens all indicate a resurgence of viral activity in the past two years. In 1978 and 1979 the State Department of Health reported an increase in diagnosed WEE cases in horses. If the vector population becomes any larger, it will reach the threshold levels at which, historically, human cases of the disease have occurred.

Three new research areas were recently added to the surveillance program to: (1) expand our knowledge of the biology of the principal vectors; (2) evaluate the use of genetic approaches to control vector populations, and (3) gain an understanding of the innate characteristics that allow natural populations of vectors to vary widely in their vector competence (their ability to become infected with and to transmit WEE and SLE viruses).

Field studies have revealed that approximately 40 percent of the adult female mosquitoes in a population die each day. This was deduced by marking a known number of mosquitoes with a distinctive fluorescent dust and then releasing them into a field population. Marked individuals were re-

captured, and the survival rate and flight movement determined. Similar procedures are used to estimate the mosquito field population in a given area at any time. Such studies provide information for developing statistical models that express the life expectancy and size of field populations. These models are invaluable in a genetic control program and in assessing the effects of alternative mosquito control strategies.

Basic laboratory research is being conducted on the genetics of encephalitis mosquito vectors and their competence to transmit encephalitis virus. As rapidly as possible, the most promising findings are tested in the field. The continuing objective of such research is to develop effective methods of preventing WEE, SLE, and CE viruses from reaching levels that endanger human beings and their domestic animals.

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