UCDAVIS COLLEGE OF AGRICULTURAL AND ENVIRONMENTAL SCIENCES

IMPACT

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IMPACT is a series of publications highlighting how UC Davis' College of Agricultural and Environmental Sciences makes a difference in the lives of Californians. Through research, teaching and outreach programs, UC Davis research touches almost all aspects of Californian life. Today, millions of people eat safer foods, breathe cleaner air and drink healthier water with the help of our researchers. We're making discovery work -- for California and the world.

CONTROLLING WEST NILE VIRUS

THE ISSUE

Only a handful of the world's 3,500-plus mosquito species actually cause disease, but those that do spread illnesses like malaria, yellow fever, dengue and encephalitis. While these diseases may not pose problems in California, one day the West Nile virus might. In most human cases of West Nile virus, victims are stricken with flu-like symptoms. In rare cases, death results. The virus -- which is marching westward -- also has taken an unprecedented toll on wild birds and horses.

WHAT WE'RE DOING

Scientists from the University of California, Davis, collaborate with the state government and more than 50 local agencies in the nation's most comprehensive mosquito control program. Collectively, the UC system has tremendous resources in mosquito management.

West Nile Monitoring. In 2002, the UC Davis Arbovirus Research Unit helped confirm the first human West Nile virus infection acquired in California. This unit assists the state Department of Health Services through a vigorous West Nile statewide monitoring program. Scientists work closely with the Mosquito and Vector Control Association of California to maximize the cost-effectiveness of spraying and other control programs.

"UC Davis combines human medicine, veterinary medicine and entomology," said Thomas Scott, entomology professor and director of the UC Davis Arbovirus Research Unit. "With all three, you cover all bases in understanding and attempting to control West Nile virus."

The mosquito species known as *Culex tarsalis* has proven in laboratory tests to be the most efficient at transmitting West Nile. This has serious implications for the West Coast -- *Culex tarsalis* is native to California.

Conventional methods for controlling insect-borne diseases have yielded little long-term success. Preventive vaccines are unavailable, clinical cures do not exist, and insects typically build up resistances to insecticides. UC Davis scientists are exploring fundamentally different approaches in the war against mosquitoes -- such as genetic control.

Mosquito Genetic Control. Genetic modification might make mosquitoes and insects incapable of transmitting organisms that cause diseases like malaria, dengue and West Nile fever. Although much work remains before these efforts yield practical solutions, researchers have reported promising findings in this area.

If genetically modified mosquitoes are to succeed, however, the basic ecology and population biology of mosquitoes needs to be better understood, according to Scott. For example, new genes could be introduced into laboratory mosquitoes that would block transmission of the deadly parasites. If the new genes are passed along when the insects reproduce, interbreeding might spread the desired trait through wild populations. The challenge is ensuring all traits are desirable.

Predicting Epidemics. Scott is currently developing DNA techniques to evaluate the risk of dengue outbreaks in certain communities. In Thailand, he found that a dengue-carrying female mosquito might need many blood meals to reproduce successfully, compared with
the single blood meal required by most other mosquitoes. This finding sheds light on why dengue can persist even when very few mosquitoes are present. Predicting an epidemic before it happens might not prevent it, but it could help health departments better handle them.

Virus Transmissions. John Edman is a professor of entomology and director of the Center for Vector Borne Diseases at UC Davis where researchers study diseases that are transmitted by mosquitoes, ticks and flies. Because of its climate and landforms, California must deal with a number of these vector-borne diseases, including malaria and Lyme disease, which affect people, and equine encephalitis, bluetongue and canine heartworm, which are health threats for animals. Edman has conducted field studies on the vectors of viruses such as dengue and St. Louis encephalitis in the eastern and central United States and in Puerto Rico and Thailand.

California Mosquito Research. Gregory Lanzaro is the director of the University of California Mosquito Research Program which coordinates and supports research on mosquito biology for all the UC campuses. Lanzaro has researched the genetics and population biology of mosquitoes that transmit malaria in West Africa, the disfiguring disease known as leishmaniasis in Latin America, and tropical and emerging insect-transmitted diseases in humans and animals.

A multi-campus effort involving UC Davis, UC Irvine, UCLA and UC Riverside is working on developing a genetic solution to mosquito-borne malaria. Each year, about 2.7 million people, mostly children, die of malaria.

"We're laying the groundwork for the final stages of this plan," said Lanzaro. "It may take us 20 years to get there, but if the plan works, millions of people could be free from a scourge that has plagued human beings for centuries."

A SHARED VISION

Sharing UC Davis research with the public and state agencies is critical to controlling the worst insect-borne diseases in California.

That's impact -- science and communities at work

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