

NEWS in Science and Technology



from the

CONNECTICUT ACADEMY OF SCIENCE AND ENGINEERING

Vol. 8, No. 2 / Summer 2009

The following is an Executive Summary of the Academy's quarterly Bulletin (Vol. 24,2) that includes topics and issues in science and technology deemed by the Academy to be both timely and relevant to Connecticut's interests. Each item is briefly summarized from press releases and reports of the National Academy of Sciences, the National Academy of Engineering, and the Institute of Medicine. Hyperlinks are included to the original online source, where more detailed information is available.

NOTE: Online versions of this newsletter and the Bulletin are available on the Academy website at www.ctcase.org.

FEATURE ARTICLE

➤ Experiment Station in Forefront of Efforts to Monitor, Test Mosquito-Borne Viruses

The Connecticut Agricultural Experiment Station (Experiment Station) in New Haven began its thirteenth year of mosquito collection and testing for encephalitis viruses during the first week of June 2009. "There have been nearly 30,000 cases in the United States and to date over 1,000 people have died from an encephalitis virus that was not even known in North America until just 10 years ago," said Theodore G. Andreadis, chief medical entomologist and director of the state Mosquito Trapping and Testing Program.

THE KEY VIRUSES:

EEE (Eastern Equine Encephalitis) – According to Experiment Station scientists, EEE is largely unpredictable and it is unclear how the virus overwinters. The latest outbreak of EEE in New England occurred in 2005-2006, when seven cases were reported in New Hampshire and six in Massachusetts. In addition, EEE was identified in a flock of penguins at the Mystic Aquarium in 2003, highlighting its ability to infect birds.

West Nile – West Nile virus appears to overwinter in mosquitoes and is an annual threat to public health in the state. There is a strong correlation in time and place where the virus is found in mosquitoes and where subsequent human infections occur. West Nile virus has been detected by the Experiment Station in 21 species of mosquitoes, not all of which bite humans. In Connecticut, there have been 69 human cases, including three fatalities, caused by West Nile virus since 2000.

Other viruses known to cause human disease, and isolated one or more times over the years, include: Cache Valley, Jamestown Canyon, LaCrosse, and Trivittatus. One human case attributed to Jamestown Canyon virus occurred in Simsbury. LaCrosse virus was detected for the first time in Fairfield. It is a leading cause of mosquito-borne encephalitis in children in the nation's Midwestern and Appalachian regions.

HISTORY/TIMELINE:

Late summer 1996 – A large number of mosquitoes infected with eastern equine encephalitis (EEE) were detected in Westerly, RI, just over the Connecticut border. Andreadis and then Station Director and CASE member John F. Anderson created an emergency program of mosquito collection, identification, and testing.

September 5, 1996 – Trapping began and continued until October 18 at 80 locations in 20 towns. A paper about the emergency surveillance reported that 6,440 female mosquitoes representing 16 species were collected, with 36 EEE virus isolations from eight mosquito species. Upon learning of the discovery of EEE, the governor and officials from the Connecticut Department of Public Health (DPH) notified the public,

and some areas were sprayed to suppress mosquitoes. No human cases occurred (30% of EEE virus victims usually die and many survivors suffer permanent neurological damage).

1997 – The governor requested and the General Assembly funded an arbovirus (viruses transmitted by arthropods) surveillance program at the Experiment Station under the direction of Andreadis. Trapping took place at 36 locations, mainly in eastern Connecticut, a focal area for EEE in horses.

1998 – The Experiment Station's tick laboratory was upgraded and certified by DPH and the Centers for Disease Control and Prevention (CDC) as a Biosafety Level 3 laboratory where testing for live encephalitis viruses could be done. By then, over 50,000 mosquitoes were being tested annually.

September 1999 – Over Labor Day weekend, the CDC Division of Vector-Borne Infectious Diseases announced what it believed to be an encephalitis outbreak in New York City. Anderson collected mosquitoes in Greenwich, the town closest to New York City. The Experiment Station's surveillance is noted in US General Accounting Office (GAO) review of the key events of the initial West Nile outbreak.

September 25, 1999 – The CDC reported, "West Nile virus confirmed in (bird) specimens obtained from The Connecticut Agricultural Experiment Station." The December 17, 1999 issue of *Science*, published paper co-authored by Anderson, Andreadis, Charles R. Vossbrinck from the Experiment Station and colleagues at Yale University and the University of Connecticut, containing the first peer-reviewed reports on West Nile virus in the United States.

2003 – The Experiment Station completed construction and put into operation a new, state-of-the-art Biosafety Level 3 laboratory with expanded capacity to handle mosquitoes and arboviruses.

2008 – 211,657 mosquitoes were tested. West Nile virus was found in 191 of the 15,108 pools of mosquitoes tested, but no EEE was isolated.

(continued on next page)

UConn's Birge Awarded CT Medal of Science

CASE member Robert R. Birge, The Harold S. Schwenk, Sr., Distinguished Chair in Chemistry at the University of Connecticut, was presented with the 2009 Connecticut Medal of Science, the state's highest award for scientists, at the annual meeting of the Connecticut Academy of Science and Engineering in Windsor Locks on May 20. Birge is known for his basic research on protein structure and function and in biomolecular electronics. He was the first scientist to propose using proteins to store data; a protein-based disk drive that his research group developed in 1982 was the first such memory device ever produced.

MONITORING & TESTING:

- Two types of traps are set each year to increase the likelihood of collecting a wide range of species—one baited with a small incandescent bulb and carbon dioxide in the form of dry ice and the other baited with a hay infusion.
- Field assistants set new traps daily and collect mosquitoes caught the previous night at some of the 91 trapping locations throughout the state. Trapping generally occurs at a particular site about once each week.
- Identification is made using stereo dissecting microscopes and diagnostic keys written by Andreadis and technicians Michael Thomas and John Shepard and published in an *Identification Guide to Mosquitoes of Connecticut*.
- Mosquitoes are placed into flasks containing vero cells—cultured monkey cells—in which viruses grow.
- Flasks are incubated at 35°C. in the presence of 5% carbon dioxide and examined daily for virus growth for up to seven days. (Virus typically appears in 3-5 days. The contents of the cell culture appear cloudy when virus is present and under a microscope, destroyed cells can be seen.)
- Experiment Station virologist Philip Armstrong has developed an array of molecular techniques using polymerase chain reaction amplification (PCR) to identify nine different viruses that are known to circulate in Connecticut. Depending upon location and time of year, a sample will be tested successively for the most likely virus until positive identification is made.
- If EEE or West Nile virus is found, results are immediately reported to the state DPH. In addition, sampling is stepped up to two to three times per week at the location where the virus was found.
- Decisions about whether to initiate mosquito control are made by local officials and the state Mosquito Management Team, which includes scientists from the Experiment Station and officials of the DPH and the Department of Environmental Protection.

The Experiment Station maintains an aggressive research program on mosquitoes and mosquito-associated diseases. Researchers use PCR methods to amplify DNA to identify the source of blood found in engorged mosquitoes. From this information, the potential of a particular species to serve as a transmitter of encephalitis viruses can be further estimated. This type of testing determined that the American Robin is the major avian reservoir of West Nile virus in this region, not the crow as originally suspected after deaths of thousands of crows occurred simultaneously with the appearance of West Nile virus in the state. *Discover* magazine recognized this finding by the Experiment Station as one of top 100 science stories of 2005.

From 1996 to 2008, West Nile virus was isolated 767 times and EEE was isolated 239 times. Over the years, the Experiment Station has tested more than 1.7 million mosquitoes for viruses.

[Read more at www.ctcase.org/bulletin/24_2/24_2.pdf]

NEWS FROM THE NATIONAL ACADEMIES

➤ More Transparency in Development of US Cyberattack Policy Urged

A National Research Council report finds that the current policy and legal framework regulating use of cyberattack by the United States is ill-formed, undeveloped, and highly uncertain. Cyberattacks—actions taken against computer systems or networks—are often complex to plan and execute but relatively inexpensive, and the technology is widely available. The United States could use cyberattacks defensively, in response to a cyberattack from another nation, or offensively, to support military missions or covert actions, the report says. The report notes that the outcome of a cyberattack is likely to be more uncertain than that of traditional warfare, with potential substantial impact on the private sector, which owns and operates much of the infrastructure through which such a cyberattack would take place. Clear national

policy regarding the use of cyberattack should be developed through open debate within the US government and diplomatic discussion with other nations, the report says. The US policy should make it clear why, when, and how a cyberattack would be authorized, and require a periodic accounting of any attacks that are conducted, to be made available to the executive branch and to Congress.

[http://www.nap.edu/catalog.php?record_id=12651]

➤ 'New Paradigm' Needed for Renewal of US Sustainable Critical Infrastructure Systems

A new report from the National Research Council suggests that a new paradigm is needed for the renewal of the nation's critical infrastructure systems such as water, wastewater, power, transportation, and telecommunications. The report describes a framework for identifying new approaches, technologies, and financing mechanisms to develop sustainable systems for the 21st century. The United States should develop a broad national vision, focus on providing essential services, and use collaborative, systems-based approaches, according to the report.

[http://www.nap.edu/catalog.php?record_id=12638]

➤ Report Recommends Greater Support to Decision Makers Coping With Climate Change

Many state and local officials and private organizations are basing decisions such as how to build bridges or manage water supplies on the assumption that current climate conditions will continue, but that assumption is no longer valid, according to a new report from the National Research Council. To produce the climate information these decision makers need and to deliver it to effectively, federal agencies such as the National Oceanic and Atmospheric Administration and the Environmental Protection Agency should expand activities in these areas, the report says.

Federal agencies should follow key principles in supporting decision makers who are facing the effects of climate change, including ensuring that agencies' efforts are driven by the needs of end users in the field, not by scientific research priorities, and creating close ties between the agencies and the scientists who produce climate change information, as well as the practitioners who use it. The report urges expansion of federal research, as well as a new federal initiative to identify and serve decision makers who may not be served by particular agencies.

[http://www.nap.edu/catalog.php?record_id=12626]

➤ IOM Releases Guide on Pandemic Flu

Cases of the novel influenza strain of swine origin—known as H1N1—that spread rapidly through Mexico in April 2009 are appearing around the globe, and pandemic response plans are being activated to meet the threat to public health. In the past several years, the Institute of Medicine has released a number of reports and workshop summaries related to some of the major policy issues that arise when confronting pandemic influenza and other infectious disease threats similar to the current spread of H1N1 influenza. IOM has put together a guide, available online, to highlight information from these reports that could be useful for pandemic planning and response in the following areas:

- Communicating with and engaging the public
- Use of masks and personal protective equipment
- Use of antiviral drugs and vaccines
- Outbreak mitigation (e.g., social distancing, school closures)
- Surveillance, research, and evaluation during a pandemic

[<http://www.iom.edu/?id=66154>]

Our Thanks to Academy Sponsors

The Academy wishes to express its sincere thanks to all of its sponsors, whose support makes the important work of the Academy, including this publication, possible.

◆ Leading Patrons ◆

The Connecticut Light and Power Company