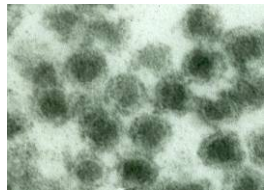
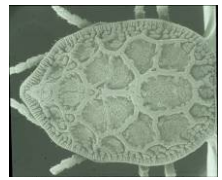
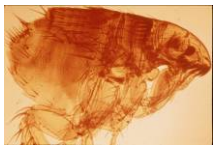



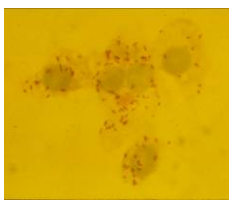


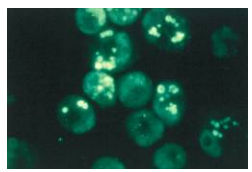
104 Years of Public Health Entomology at CAES





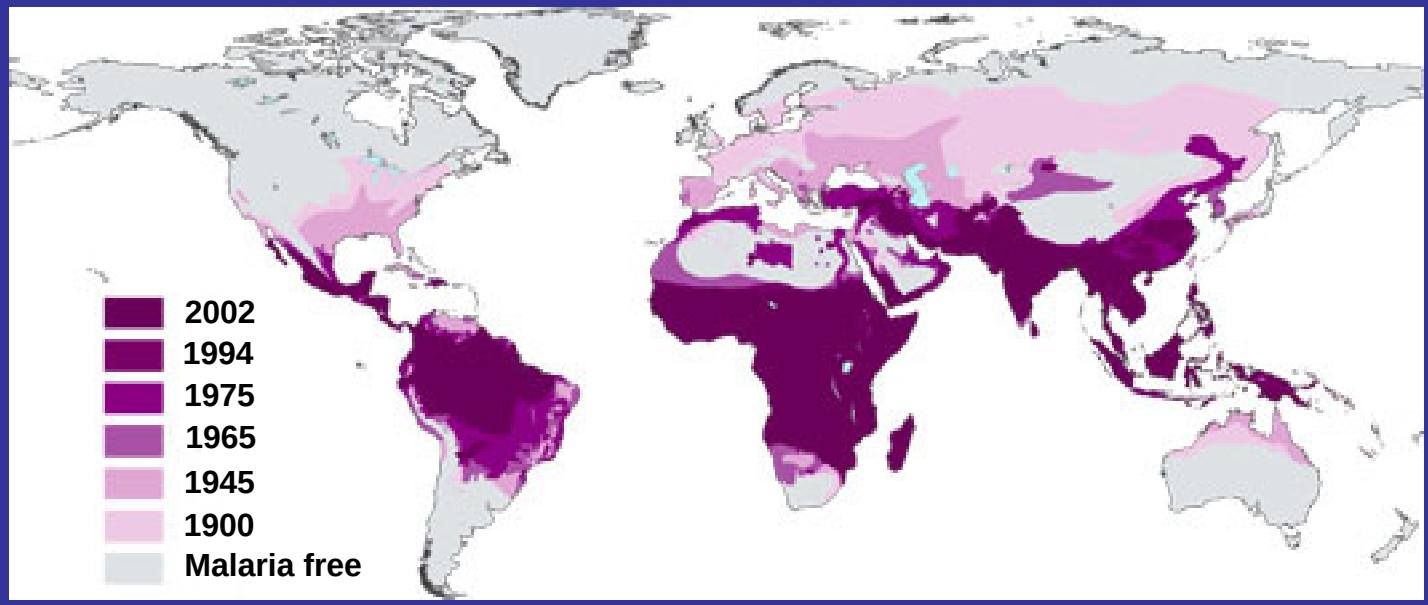
John F. Anderson
Spring 2008 Open House
April 24, 2008

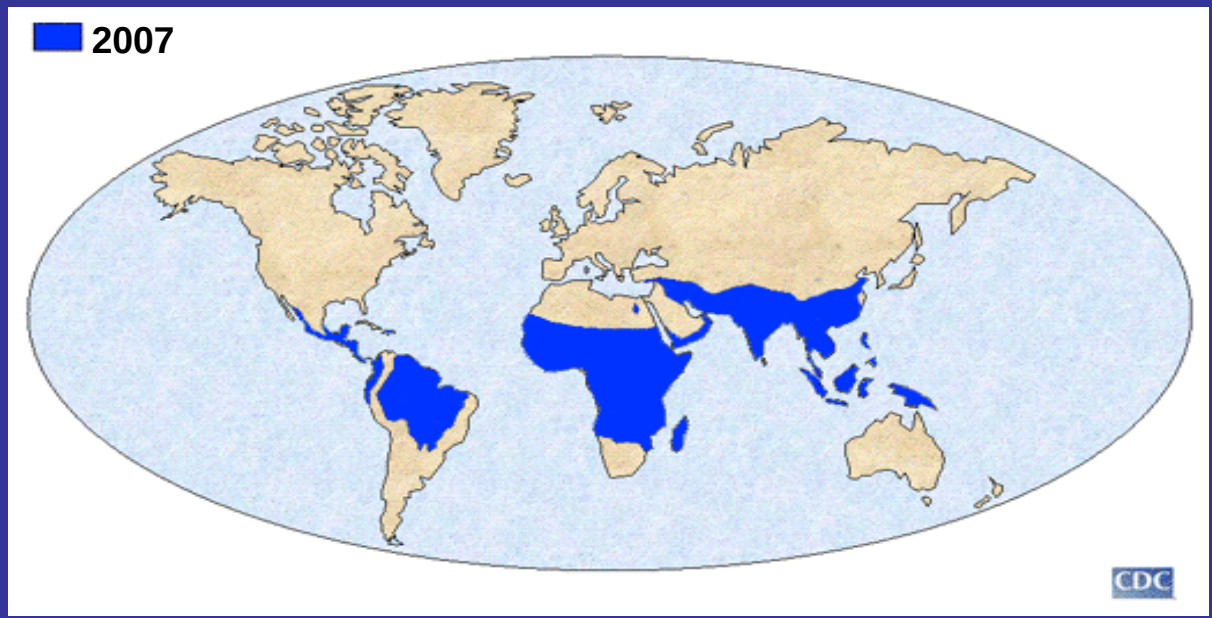





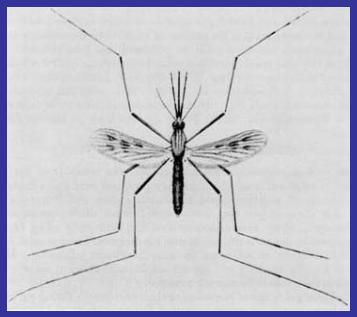

“The Landing of William Penn” by Thomas Birch

Distribution of Malaria





Malaria in Connecticut during and after the Civil War

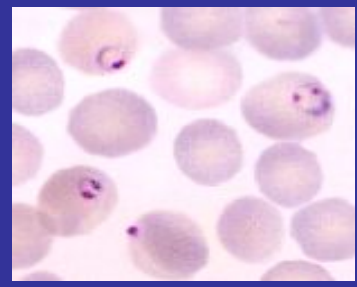


Anopheles quadrimaculatus **(primary vector in United States)**

1861: An epidemic spread from southwestern CT into RI and MA

1881: Maximum mortality occurred

1894-1903: 1,073 deaths from malaria reported by the Connecticut Board of Health



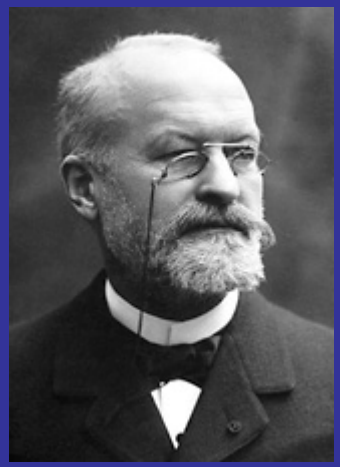
malaria parasites inside red blood cells

Malaria often followed impoundment of streams for power or water supply.

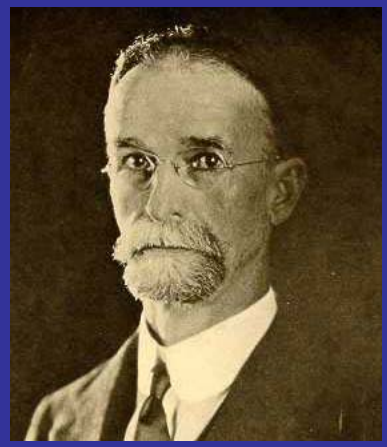
Soldiers returning from south infected with malaria parasite.

Sgt. Oliver A. Pond
Civil War Soldier from Connecticut
Discharged July, 1865

Microbe Hunters – The Golden Age of Discovery



Laveran*
malaria parasite



Theobald Smith
ticks as vectors
of a parasite of cattle

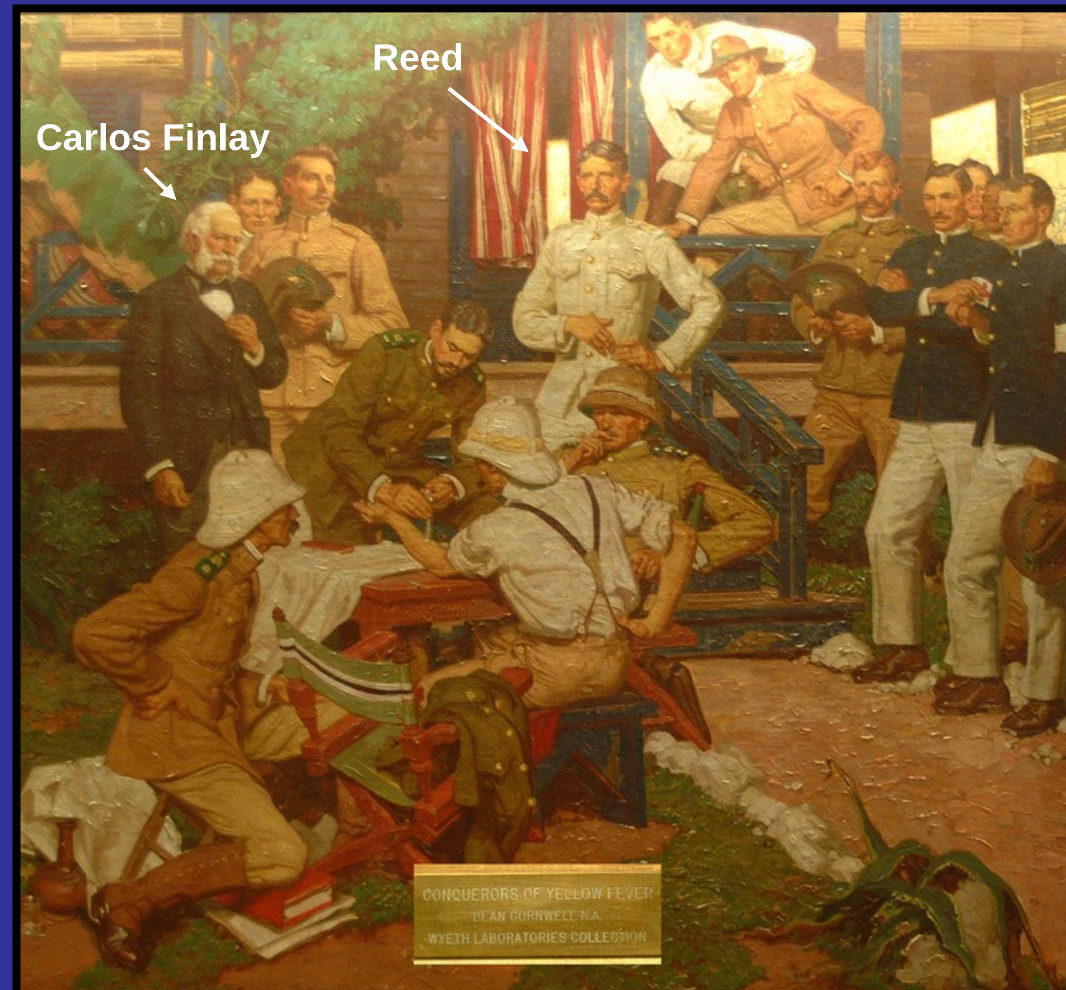
Manson

Ross*
mosquitoes as vectors
of filariasis and malaria parasites

Grassi
Anopheles mosquitoes as vectors
for human malaria

*Recipient of Nobel prize

Walter Reed



- Confirmed that mosquitoes transmitted the causative agent of Yellow Fever
- Demonstrated that Yellow Fever was caused by a virus

William Gorgas

Mosquito & Disease Control Measures Used in Havana, 1901

Surveillance	Quinine	Kerosene oil
Drainage	Screening	Ordinance (fines)
Fumigation	Quarantine	Education

Results in Havana

- Mosquito breeding sites reduced
- Last case of yellow fever reported on Sept. 1, 1901
- Follow-up programs prevented reintroduction from visiting ships

Panama Canal

Similar methods used in Panama allowed canal to be built without further dramatic loss of life from mosquito-borne infections.

Fourth Report of the State Entomologist of Connecticut for the Year 1904

Report on Mosquito Investigations

By W. E. Britton and Henry L. Viereck

- Listed 22 species of mosquitoes found in Connecticut
- Published survey results for breeding sites for 15 towns

W. E. Britton

Draining Salt Marshes

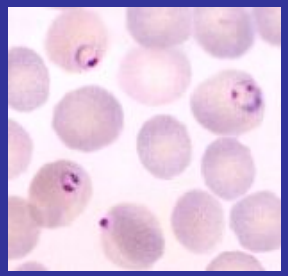
Oiling Breeding Pools

Surveillance
Biological control
Education

Screening rain water receptacles, windows and doors

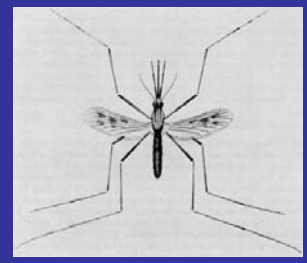
- Predicted that abolishing breeding sites would reduce the prevalence of malaria in 10 years.
- Mosquito control would increase property values.

Greenwich, Connecticut : 1913-1914



“Epidemic at Greenwich, Connecticut”

John W. Trask
Assistant Surgeon General
American Journal of Public Health (1916)



600-900 cases of malaria in 1913

A private contractor drained and filled all mosquito breeding places in Greenwich one mile back from the coast.

Work was carried out in the summer, fall, and winter of 1913

Britton mediated differences between the town health officer and the contractor.

1914: 36 cases of malaria, of which only 15 were new infections

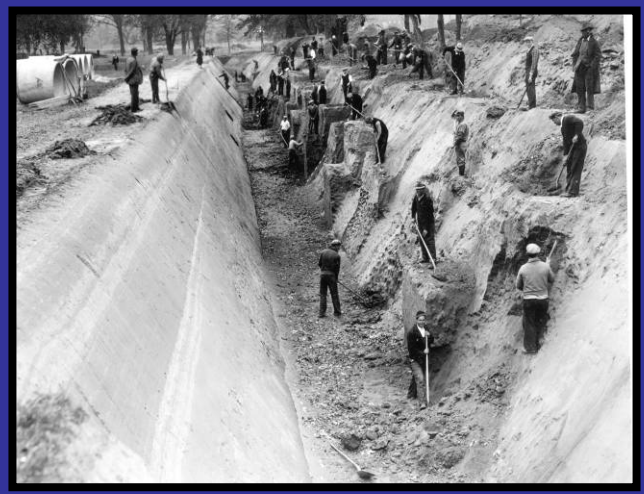
The decrease in the number of malaria cases was ascribed to the drainage work

Some Significant Early Events in Connecticut

1915: Station Director given legal authority to preside over efforts to eliminate mosquitoes

1928: 100 horses died in New London County.
The infectious agent was probably Eastern Equine Encephalitis virus (EEE), unknown at that time.

1933: Federal funds put unemployed men to work digging drainage ditches in 27 shoreline towns and elsewhere.



Draining the bottom land, East Hartford, 1935

1938: The first confirmed cases of EEE in pheasants in Connecticut

1939: Board of Mosquito Control was established

Yale Bowl: 1945
DDT for a Mosquito-free Concert

Cooperative Effort with:

- **Connecticut Agricultural Experiment Station**
- **Federal Bureau of Entomology and Plant Quarantine**
- **U.S. Coast Guard**
- **Yale University**
- **New Haven Orchestra Association**

Mist Blower

Helicopter Spraying

Before treatment: mosquitoes biting at rate of 5 bites per minute.
After treatment: 1 mosquito was seen during the concert.

The Study of Mosquitoes as Vectors of Disease: 1950's

Robert Wallis (left)

Outbreak of EEE among pheasants in 1951

Robert Wallis hired in 1953 to work on EEE

Worked with scientists at UConn and Yale

Research Conducted on Pheasants

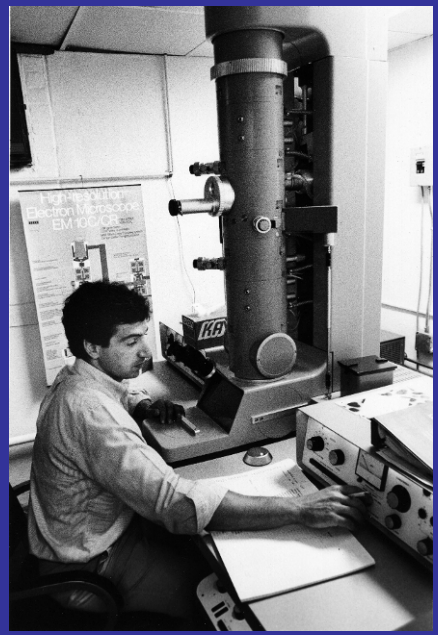
- EEE is maintained longer in feather quills than in the blood stream.
- Intra-pen transmission of EEE is caused by feather picking.
- Pheasants do not serve as reservoirs for EEE virus due to low viremias.

Other Significant Research Findings

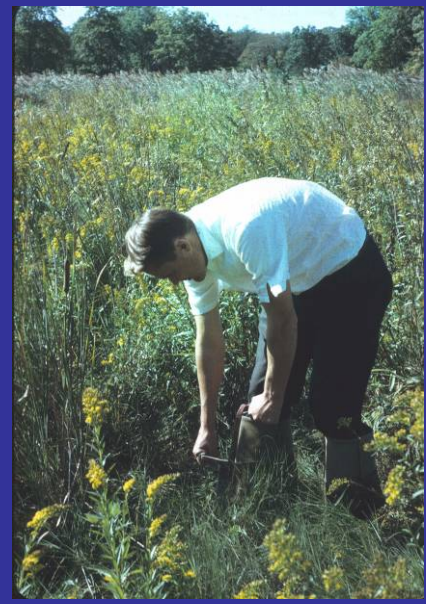
- EEE virus was isolated from *Aedes vexans* mosquitoes.
- Documented that Connecticut's sylvan-swampland ecology enabled dissemination of EEE virus among birds and mosquitoes.

Biology and Biological Control of Mosquitoes and Biting Flies: 1960's-1970's

Dr. Magnarelli with an emergence trap for horse flies in a salt marsh



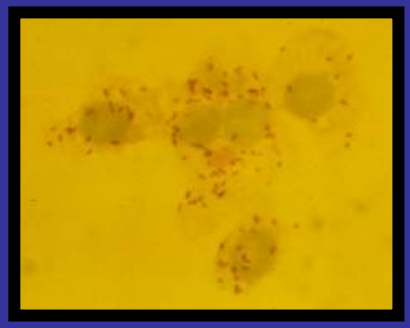
Dr. Andreadis using the electron microscope



Dr. Anderson's deer fly research Milford, CT

Ticks as Vectors of Rocky Mountain Spotted Fever: 1970's

Dr. Louis Magnarelli and Dr. John Anderson



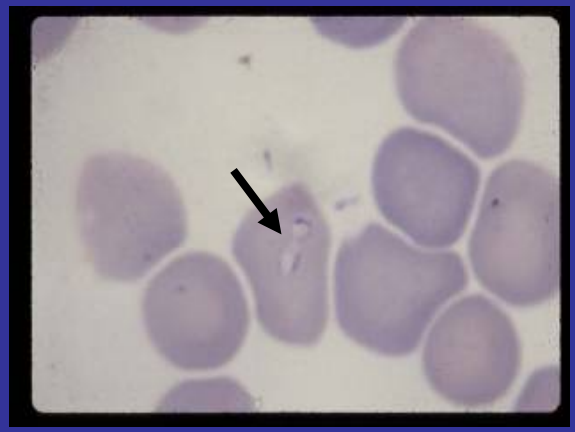
The Pathogen:
Rickettsia rickettsia

The Disease:
RMSF rash

The Vector:
American dog tick

- **Established a lab at CAES for work with human pathogens**
- **With NIH, made first isolation of causative agent of RMSF from a Connecticut patient**
- **With NIH, made first isolations of causative agent of RMSF from Connecticut ticks**
- **Developed antibody-detecting tests for RMSF in wildlife**

Ticks and Babesiosis: 1970's-90's



***Babesia* parasites in a red blood cell**

- **With Lawrence and Memorial Hospital and Connecticut Department of Health, made first isolations of *Babesia microti* from humans in Connecticut**
- **With Harvard, made first isolation of an exotic *Babesia* in North America that infects dogs**
- **First to demonstrate that *Babesia* and *Borrelia* (Lyme disease agent) could co-infect wild rodent hosts**
- **With the State Department of Health, documented that *Babesia microti* can be transmitted by blood transfusion in humans**

Lyme Disease: Its Vectors and Natural Hosts: 1980's

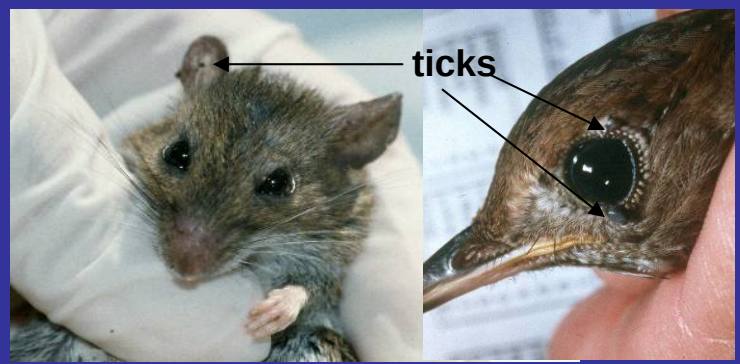
Michael Vasil
trapping mice

Extensive trapping of small mammals and birds demonstrated the wide range of hosts available to the vector tick, *Ixodes scapularis*, and the Lyme disease spirochete, *Borrelia burgdorferi*.

Elizabeth Wehrli, Carol Lemmon
removing ticks from a raccoon

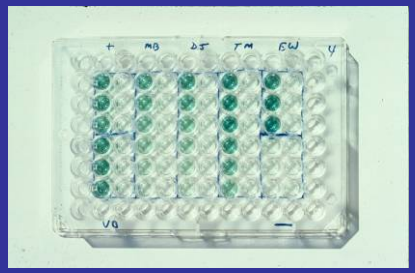
We showed that white-footed mice were the main natural host for the spirochetes and that birds could disperse both the ticks and the spirochetes.

Borrelia burgdorferi,
causative agent of
Lyme disease



Ixodes scapularis
nymphal tick

Lyme Disease Serology:
Testing Blood Samples for Antibodies



ELISA plate

Tia Blevins at plate reader

Dr. Magnarelli's lab was one of three laboratories that first developed an ELISA test for detecting *Borrelia burgdorferi* antibody in human blood samples.

Tests were developed for dogs, horses, and wildlife.

A test was developed for IgM antibody which provided evidence of active disease in humans.

We tested thousands of human serum samples from the state DPH and provided antigen samples and training to several hospitals before tests for Lyme disease became commercially available.

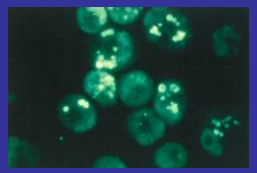
Other Tick-related Activities

Documented that dogs could develop Lyme disease with limb disorders.

white-tailed deer

Documented that deer had to be present in sufficient numbers to support the prevalence of *Ixodes scapularis* ticks, *Borrelia,* and *Babesia.*

Isolated the first variants of the common strain of *Borrelia burgforferi.*



Anaplasma

Discovered that *Ixodes scapularis* also carries the pathogen that causes human anaplasmosis.

Identified and tested more than 75,000 ticks off Connecticut residents for *Borrelia burgdorferi* since 1990.

Elizabeth Alves tick lab

Dr. Kirby Stafford joined the staff in 1987 and has focused on tick control and ecology. His informative booklet on ticks and tick control is in its second edition.

Mosquito-borne Viruses: late 1990's

Dr. Theodore Andreadis and Dr. John Anderson

1996: Began surveillance for mosquitoes infected with Eastern Equine Encephalitis in southeastern Connecticut. We collected and identified the mosquitoes; viruses were isolated and identified at Yale University.

John Shepard, Michael Thomas

Bonnie Hamid

Jodie Correia

1998: Laboratory which had been used for RMSF studies was converted to a virus isolation lab. We no longer used Yale facililties.

2004: Moved into new virus isolation lab in Johnson-Horsfall Laboratory.

Angela Penna

Dr. Andrew Main

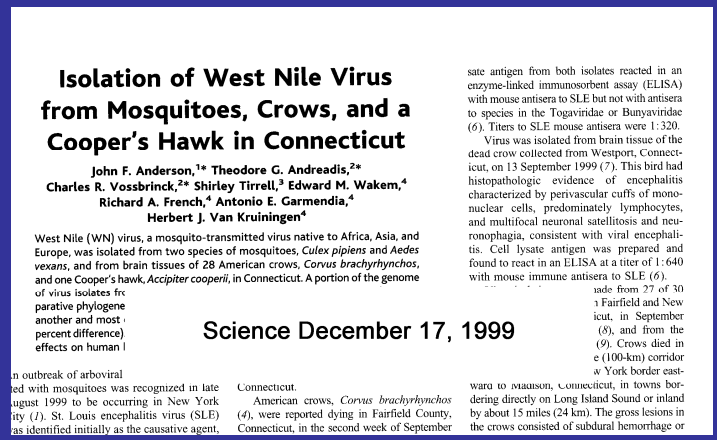
Tanya Petruff

West Nile Virus: 1999

Ball Washer,
Innis Arden Golf Club

September, 1999: First isolation of WNV from mosquitoes in the United States: Greenwich, Connecticut.

Dr. Charles Vossbrinck sequenced the DNA of the new virus



Isolation of West Nile Virus from Mosquitoes, Crows, and a Cooper's Hawk in Connecticut

John F. Anderson,[1]* Theodore G. Andreadis,[2]* Charles R. Vossbrinck,[2]* Shirley Tirrell,[3] Edward M. Wakem,[4] Richard A. French,[4] Antonio E. Garmendia,[4] Herbert J. Van Kruiningen[4]

West Nile (WN) virus, a mosquito-transmitted virus native to Africa, Asia, and Europe, was isolated from two species of mosquitoes, *Culex pipiens* and *Aedes vexans*, and from brain tissues of 28 American crows, *Corvus brachyrhynchos*, and one Cooper's hawk, *Accipiter cooperii*, in Connecticut. A portion of the genome

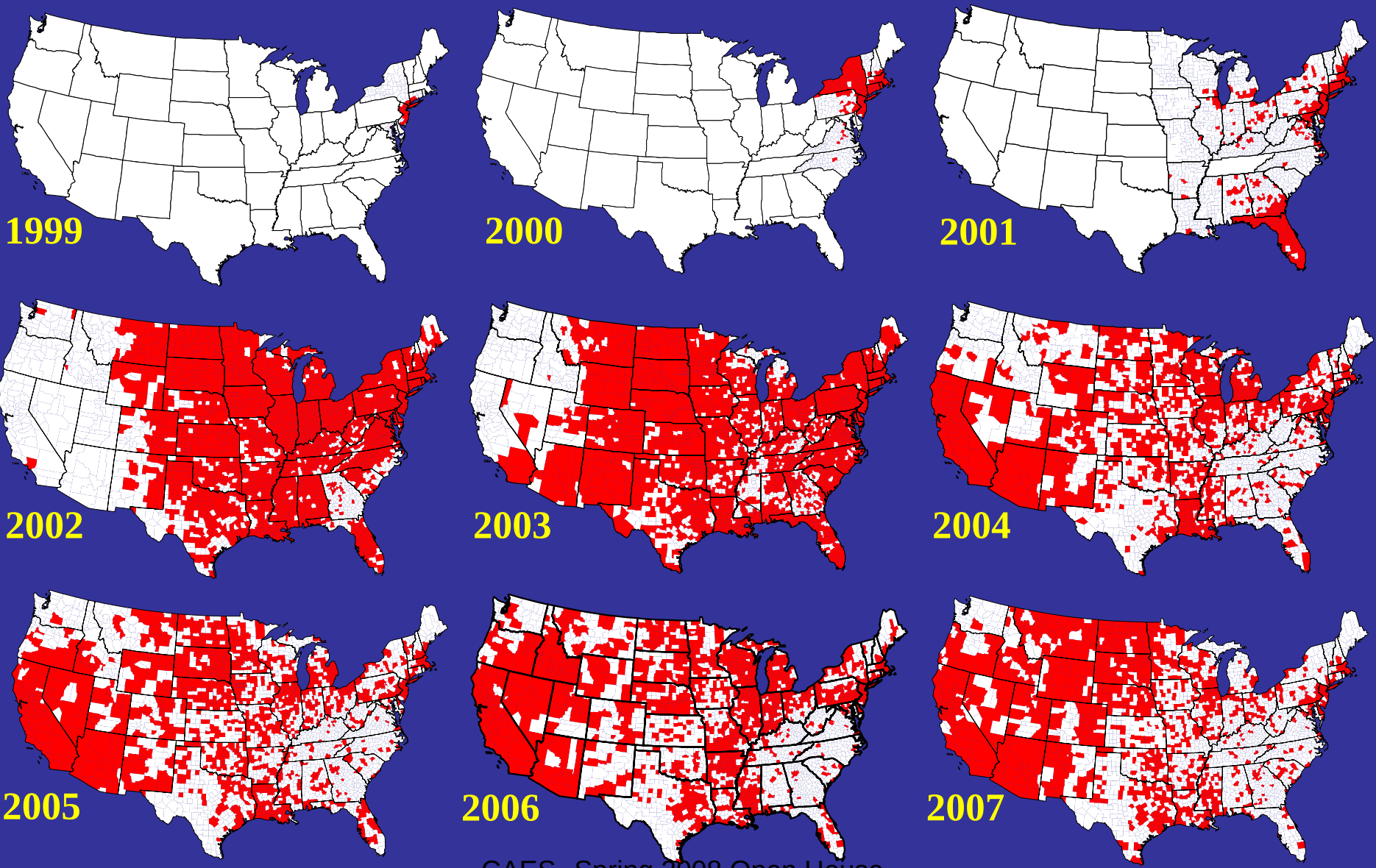
Science December 17, 1999

Results were published in December

Dr. Theodore Andreadis collected overwintering mosquitoes Stamford, CT

Winter 1999: Would the virus survive the winter? Could not find any positive mosquitoes in the scant numbers of *Culex* mosquitoes collected.

West Nile Virus in the United States



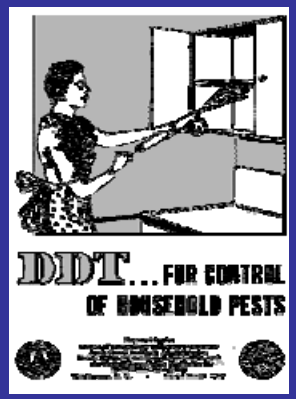
CAES--Spring 2008 Open House

Source: U.S. Geological Survey Disease Maps:

The Big Comeback: Bedbugs

1906: B. H. Walden, a station entomologist, used hydrocyanic acid to fumigate a house. After achieving total eradication, 5 more houses were treated.

Adult Bed Bugs



USDA pamphlet, 1947

1945: Practical trials were conducted at the Experiment Station using DDT against bed bugs.

2007: The Experiment Station has initiated research on bed bug control.

BioSensory trap used to capture bed bugs

Shelves of insecticides designed for bed bug control at Karpo Hardware, Hope St., Stamford, March 10, 2008

(photo by Phyllis Mazik)

BSL 3 Laboratory Staff 2007