



Medical Entomology in the United States Navy



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Technical and Training Manager

- Civil War (1861-1865)
 - Malaria: 1,316,000 cases / 10,000 deaths
- Spanish-American War (1898)
 - 80% of American soldiers came down with Yellow Fever
 - Over 5,000 deaths (968 from actual combat)
- World War I
 - Malaria: 7.5/ 1,000 infected (1917), over 100,000 cases in French and British forces
- World War II (1941-1945) *
 - Malaria: 647,763 (85% of U.S. forces in South Pacific were infected!)
 - Dengue: 107,941
 - Sand-fly Fever: 24,866
 - Leishmaniasis: (CL) 1,000-1,500; (VL) 50-75
- Korea - 35,000 cases
- Viet Nam – 100,000 cases
- Somalia - 290 cases

* Adapted from Cushing (1957). Based on Statistical Health Reports, Division of Medical Statistics, Office of Surgeon General, Department of the Army

- Used as a military strategy in the South
 - “Carolina was in the spring a paradise, in the summer hell, and in the autumn a hospital”
- Rice growing aggravated the problem
- British captured Charleston 1780, moved inland
 - No quinine due to Spanish monopoly on it
 - Cornwallis’s men were devastated, forced back to Yorktown, mosquito –infested swamps
 - The mosquito “helped the Americans win the war, without them there would be no United States” – McNeil

» McNeil, John Robert. *Mosquito Empires: Ecology and War in the Greater Caribbean, 162—1914*. New York: Cambridge University Press; 2010.

Malaria in the Civil War (1861-1865)

- Knew to avoid valleys, paved cities are almost entirely exempt from malaria
- Treatments: Jesuits Bark (quinine) and arsenic
- South hoped to drive Union into swamps
- Union victory in Vicksburg, controlled medicine
- 1,200,000 cases (8,000 deaths)
- June 1861, Lincoln created Sanitary Commission, led to Marine Hospital Service (1878) → USPHS in 1912

- Rockefeller Foundation Health Commission worked with military agencies
- Quinine and pyrethrum, limited due to Japanese control
- 1942, Laboratory of the Bureau of Entomology and Plant Quarantine (USDA, Orlando FL) and Foundation
- Determined DDT effective for 6 to 8 weeks sprayed inside walls
- Numerous Rockefeller officers (Fred Soper) carried out DDT trials to control lice on German and Italian POWs

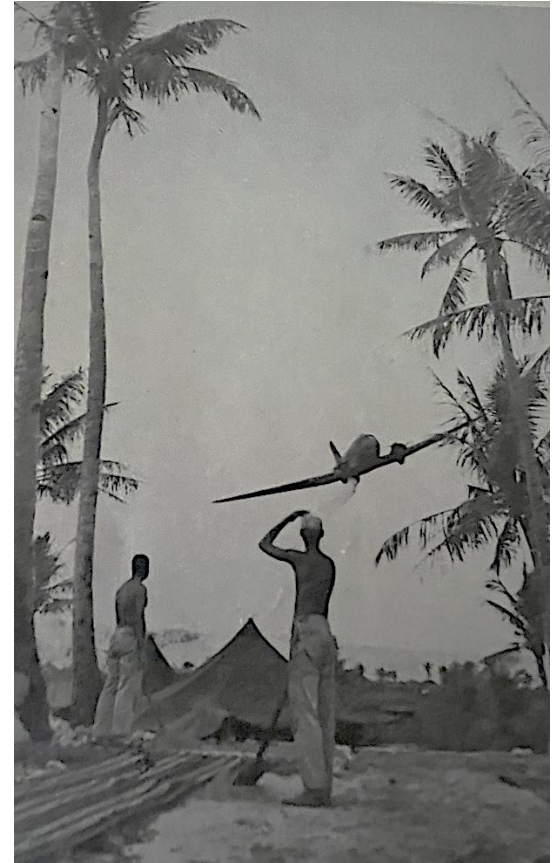
- USPHS and military first focused control efforts on training installations, 11 military districts in Florida
- Malaria Control in War Areas (MCWA) Program, developed by John Mulrennan
- 1942: Malaria control training schools for Army and Navy officers was created
- MCWA developed into the CDC in 1946

- Navy Epidemiology Units
- 1942: Ensign Kenneth Knight (1st Navy Entomologist to serve in combat)
- 1947: Malariology / PCU, NAS Banana River, FL
- 1947: Malaria and Mosquito Control Unit No. 1
- 1957: Disease Vector Ecology Control Center, Jax, FL
- 2003: Navy Entomology Center of Excellence, Jax, FL



- 1st Marine Division on Guadalcanal
- Summer / Fall 1942 the battle was nearly lost due to malaria
- 60,000 infected!
- “a very long war indeed if every division facing the Japanese must count on a second division in the hospital with acute malaria”
- Gen. Douglas MacArthur

- Saipan July 1944
- 4th Marine Division
 - 2 weeks after major combat operations
 - Massive dengue outbreak
 - Caused by numerous breeding places due to C-ration cans, empty artillery shells
 - Thousands incapacitated, complaining of feeling like their backs were broken, blinding headaches and raging fever
 - Throughout South Pacific: 84,093 dengue casualties
 - Focused cleaning up breeding sites and applying DDT



ATC DDT-oil spraying C-47 Saipan, 1944

- BUMED / Navy Marine Corps Public Health Center (NMCPHC)
 - Navy Entomology Center of Excellence, JAX
 - Navy Environmental and Preventive Medicine Unit (NEPMU) 2, Norfolk
 - NEPMU-5, San Diego
 - NEPMU-6, Pearl Harbor
 - NEPMU-7, Rota, Spain
 - NMCPHC
 - NMCPHC, CDC Det., Atlanta
 - NMCPHC, USDA, CMAVE Det, Gainesville

- BUMED / Navy Medical Research Center
 - NMRC, Silver Spring
 - NAMRU – Asia, Singapore
 - NAMRU 3 - Sigarella
 - NAMRU 6 - Lima
- U.S. Marine Corps
 - 1MEDBN, 1st MLG, Camp Pendleton, CA
 - 2MEDBN, 2nd MLG, Camp Lejeune, NC
 - 3MEDBN, 3rd MLG, Okinawa
- Armed Forces Pest Management Board, Silver Spring
- Uniformed Services Health University, Bethesda

- Operation Iraqi Freedom I and II
 - Supported 1st FSSG – Forward, S. Iraq
 - CSSG-11 Ramadi, Iraq: Direct support to 1st Marine Division
- Main Issues:
 - Sand Flies
 - Mosquitoes
 - Filth Flies
 - Scorpions
 - Snakes
 - Rodents
 - Feral Dogs



Joint Task Force 536

- NEPMU-6 sent a FDPMU at the request of PACOM for Tsunami victims
- Assist in relief efforts



- Force protection
- Mosquitoes
- Filth Flies













Sand Fly Surveillance in Libya

- Leishmaniasis a historical problem
 - Over 5,000 CL cases 2005-2006
 - Over 1,000 cases from 2007 – 2008
 - Northwest Libya





- State Department initiative
- DWFP funded program
- Collaboration with NAMRU-3, NCIDPC, LSU (Lane Foil)
- Target sand fly larvae in rodent borrows using feed-through baits





- Vector assessment
- Food and water sanitation
- Dengue investigation
- FHP with Special Forces
- Education
- Building capacity



- Didactic & Hands-on
- Application rate
- Equipment use / calibration
- IVM Problem solving
- Pesticide Use and Safety
- Pesticide formulations
- Vector surveillance
- Mosquito identification



- Equipment use
- Application rate
- Equipment calibration
- IVM Problem solving
- Hands-on



The role of the United States military in the development of vector control products, including insect repellents, insecticides, and bed nets

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- Pyrethrum: used by Major Gorgas to control YF and Malaria
- 1930's: Pyrethroids
- 1950's: DEET
- 1960's: 75% DEET/ethanol liquid aka "bug juice" developed by the USDA w / DoD support
- 1990: DoD factory permethrin-treated clothing
- 1991: 3M 33% DEET along with polymers formulation registered by the EPA



Deployed Warfighter Protection Research Program (DWFP)



Delivering products that protect the warfighter from vector-borne diseases

The Deployed Warfighter Protection (DWFP) Research Program is a Defense Health Program (DHP) initiative managed by the Department of Defense's Armed Forces Pest Management Board (AFPMB). The AFPMB oversees the development and fielding of new management tools against vectors such as mosquitoes and sand flies that transmit pathogens and against other pest species that can negatively impact military operations at home and abroad.

THREATS



Mosquitoes



Sand flies



Filth flies

Mosquitoes - malaria, dengue and chikungunya fever

Sand flies - leishmaniasis, sand fly fever and bartonellosis

Filth flies - bacterial diarrhea

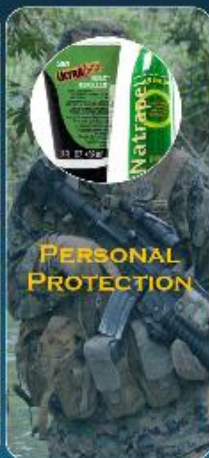
MAJOR THRUST AREAS

Development of insecticide chemistries or formulations to control mosquitoes and other insect disease carriers.



INSECTICIDES

Development of personal protection products to protect against mosquitoes and other insect disease carriers.



PERSONAL PROTECTION

Develop new or improved insecticide application technologies to enable safe and effective disease vector management.



VECTOR CONTROL TECHNOLOGIES

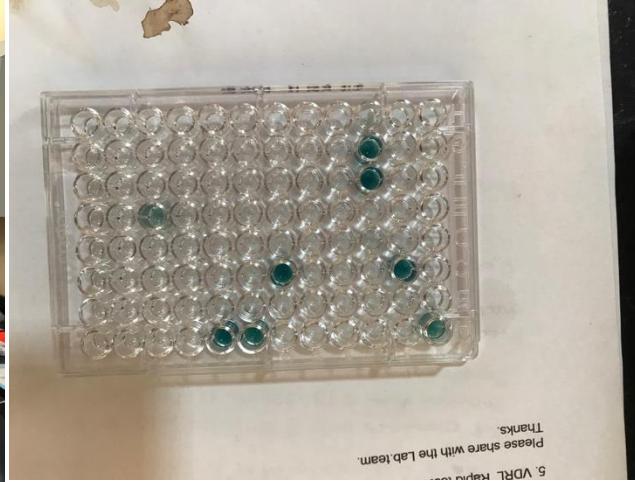
"...this will be a long war... for every division... have facing the enemy, I must count on a second division in hospital with malaria and a third division convalescing from this debilitating disease!"

--Gen. Douglas MacArthur, 1943

- Since FY11: 78 competitive + 241 non-competitive grants awarded
- 640 + publications since 2004
- Over 20 + patent applications & 21 invention disclosures filed since 2004

- Established: 2005 by George Bush
- 24 Countries in Africa
- 3 Navy Entomologist serve PMI in 6/24 countries
- Since 2015:
 - Rate of new malaria infections fell 37%
 - Global malaria death fell by 60%
 - Approximately 6.2 million lives saved over 15 yrs.





Questions?

