

# WRBU: Providing entomological intelligence and taxonomic expertise

The Walter Reed Biosystematics Unit (WRBU) is a world-renowned center of taxonomic excellence, undertaking cutting-edge research to provide actionable entomological intelligence tools and products that best assess global vector-borne disease risk. In partnership with the Smithsonian Institution, WRBU has grown the U.S. National Mosquito Collection from 200,000 specimens in 1961, into the world's largest taxonomically and geographically comprehensive collection of over 1.7 million specimens today. WRBU also manages eight other families including sand flies, horse flies, black flies, biting midges, and four other families of non-biting insects.

## OUR MISSION STATEMENT



*To conduct laboratory and field research on the systematics of medically important arthropod species in support of epidemiological studies and disease control strategies of importance to the military. Multi-disciplinary research efforts focus on accurate vector identification and bionomics to provide comprehensive predictions of global arthropod-borne disease risk.*

Effective vector-borne disease interventions rely on entomological intelligence: high-quality, current information related to the correct identification, associated biology, and distribution of arthropod vectors. Well-curated archive reference collections are of critical importance to solving modern vector-borne disease problems, increasing in value as taxonomic resources decrease and biotechnology improves. Most recently, WRBU has achieved whole genome sequences from museum specimens, further increasing the value of these archive specimens.

## WRBU CORE COMPETENCIES



Diagnose and describe species, and develop identification tools



Utilize cutting-edge genetic and genomic approaches



Undertake real-time biosurveillance and vector incrimination



Map and model vector spatio-temporal distributions

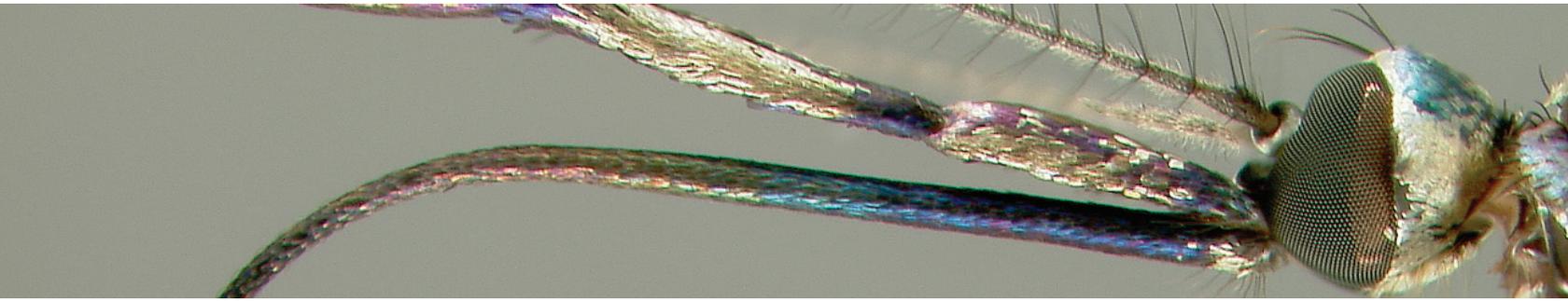


Identify, track, and report changing global vector hazards



Sustain and develop partnerships with academia, military, and industry

Incorporating molecularly identified vectors into geospatial analysis vastly improves the quality of vector-borne disease risk predictions. WRBU produces Vector Hazard Reports that provide targeted, comprehensive summaries of vector-borne disease risks, including predictive models based on high-quality vector identifications (morphological and molecular), high-resolution images, and associated pathogens and bionomics. These data-driven, actionable entomological intelligence products address the taxonomic impediment and reflect the unique, forward-facing vision of WRBU to tackle tomorrow's vector-borne disease threats.



## WRBU WEBSITE

The WRBU website ([wrbu.si.edu](http://wrbu.si.edu)) outlines the mission, staff, and ongoing research projects of WRBU. It serves to showcase our entomological intelligence tools and disseminate our holistic knowledge of global vectors, including taxonomy and systematics, genetics and genomics, biology, distribution, and pathogen association.

## SYSTEMATICS

Catalog of the Culicidae ([mosquitocatalog.org](http://mosquitocatalog.org))

Revised in 2019, WRBU provides the most up-to-date systematic catalog of all 3,557 formally recognized mosquito species, including subspecies and synonyms, important taxonomic works and global distributions. This web-based systematics catalog is searchable, allowing users to download up-to-date taxonomic checklists of species by country, region, or taxonomic groupings. The catalog includes links to vector species profiles, which provide high-resolution images and further details on distribution, bionomics, systematics, DNA barcodes, genomic resources, and associated pathogens.

## IDENTIFICATION

LUCID keys ([wrbu.si.edu/aors/aors\\_keys.html](http://wrbu.si.edu/aors/aors_keys.html))

WRBU created and hosts over 100 multi-entry, web-based taxonomic keys directly on our website. These unique user-friendly keys are aimed at non-specialists, and contain photographic illustrations of all key characters. LUCID keys are multi-entry, allowing the identification of damaged/incomplete specimens as collected in the field, and making routine species identification easier and more efficient.

## DISTRIBUTION

VectorMap ([vectormap.si.edu](http://vectormap.si.edu))

WRBU hosts and maintains the world's largest online database (~0.7 million entries) of high-quality insect vector surveillance data. The VectorMap approach is unique, in that we are the only database to evaluate data quality based on taxonomic, ecological and geospatial confidence. Distribution data is sourced, cleaned, and curated from museum collections, published literature, and global biosurveillance efforts, and is available for mosquitoes, ticks, sandflies, mites, and biting midges. Other layers include human population densities, host demographics, and environmental layers relating to vector ecology (e.g. temperature, precipitation). By 2020, users will be able to visualize genetic variation in vector populations through VectorMap, allowing point-source determinations of invasive taxa, and view patterns of gene flow.

## DNA BARCODING

The WRBU-led Mosquito Barcoding Initiative (MBI) provides unique genetic identifiers (DNA "barcodes") from vouchered, expertly identified mosquito specimens to empower accurate identifications on modern NGS platforms. The MBI dataset currently stands at 70,921 barcodes—representing 1,400 of 3,557 described mosquito species, and has uncovered substantial hidden diversity. The MBI has become a powerful phylogeographic dataset and a formidable resource for rapid biosurveillance, especially in uncharted territories.

Interested in collaborating with WRBU, or need access to the NMNH Collections? Contact us at [nmnh-wrbu@si.edu](mailto:nmnh-wrbu@si.edu).

