



MAYO CLINIC  
LABORATORIES

# VECTOR-BORNE DISEASES

Diagnostic Testing  
and Clinical Interpretation

## OUR VECTOR-BORNE DISEASE DIRECTORS



### Bobbi Pritt, M.D.

Dr. Bobbi Pritt is certified by the American Board of Pathology in clinical & anatomic pathology and microbiology. Her research interests include the evaluation and development of novel laboratory methods to aid in the diagnosis of parasitic and vector-borne diseases. Dr. Pritt works collaboratively with academic and public health partners to provide laboratory diagnostics and education in these areas to a global population. Some of her recent work resulted in the implementation of rapid and highly sensitive molecular tests for malaria, microsporidiosis, Lyme disease, and *Borrelia miyamotoi* infection. Dr. Pritt also played a key role in discovering and describing two new tick-borne pathogens: *Ehrlichia muris eauclairensis* and *Borrelia mayonii*. The latter bacterium causes Lyme disease in the upper Midwestern United States.



### Elitza Theel, Ph.D.

Dr. Elitza Theel is certified by the American Board of Medical Microbiology. Her research interests include development and evaluation of novel methods for antibody and antigen detection as diagnostics, specifically for vector-borne and fungal diseases. Dr. Theel also spearheads an international laboratory outreach initiative in Belize. This initiative is focused on increasing the in-country diagnostic testing capacity for vector-borne diseases and on enhancing the current quality assurance/quality control practices in clinical laboratories throughout the country.

## OUR MICROBIOLOGY LABORATORY DIRECTORS



### Bobbi Pritt, M.D.

#### Division Chair

Parasitology  
Vector-borne diseases  
Infectious diseases  
anatomic pathology



### Matthew Binnicker, Ph.D.

Molecular virology  
Viral infections in transplant recipients  
Viral respiratory infections



### Andrew Norgan, M.D., Ph.D.

Clinical microbiology  
Infectious diseases  
anatomic pathology



### Robin Patel, M.D.

Biofilm-related infections  
Molecular bacteriology  
Sequencing-based bacteriology



### Audrey Schuetz, M.D.

Anaerobic bacteriology  
Antibacterial susceptibility testing  
Infectious diseases anatomic pathology



### Elitza Theel, Ph.D.

Infectious disease serology  
Vector-borne diseases  
Fungal diseases



### Nancy Wengenack, Ph.D.

Mycobacteriology  
Mycology  
Antimycobacterial and antifungal susceptibility testing



### Joseph Yao, M.D.

Hepatitis viruses  
Human immunodeficiency virus (HIV) infection  
Hepatitis and HIV antiviral susceptibility testing



### Jane J. Hata, Ph.D.

Laboratory Director, Florida  
Clinical microbiology



### Christopher P. Marquez, M.D.

Laboratory Director, Florida  
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### Erin H. Graf, Ph.D.

Laboratory Director, Arizona  
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### Thomas Gryz, Ph.D.

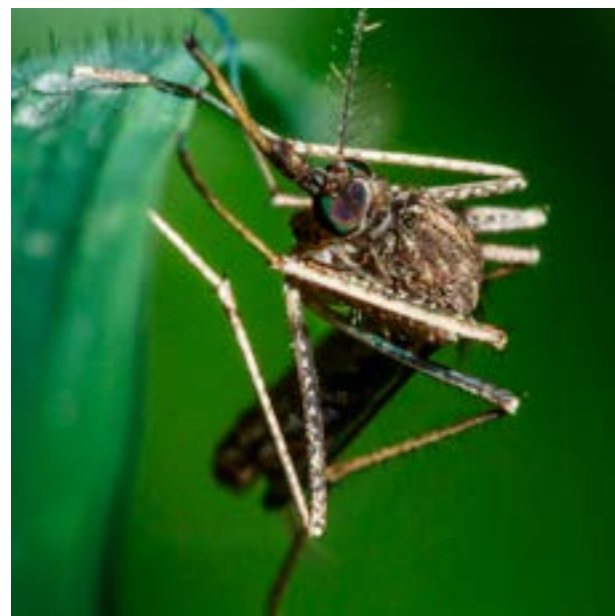
Laboratory Director, Arizona  
Clinical microbiology

## THE RIGHT TESTS FOR DETECTION AND DIAGNOSIS

Mayo Clinic's internationally renowned clinical microbiology laboratories span all areas of conventional, molecular, and serological medical microbiology, offering a broad selection of tests designed for rapid identification and in-depth characterization of the pathogens associated with infectious diseases.

Mayo Clinic Laboratories offers a full menu of individual tests and panels that aid in the diagnosis of vector-borne diseases (VBD). In addition to our comprehensive testing menu, we developed multiple VBD testing algorithms to help guide and optimize diagnostic testing.

For more information about our VBD testing options and algorithms, visit [mayocliniclabs.com/vectorborne](https://www.mayocliniclabs.com/vectorborne).



## Diagnostic testing for:

### Tick-Borne Diseases

Lyme Disease  
Babesiosis  
Anaplasmosis  
Ehrlichiosis  
Rocky Mountain Spotted Fever (RMSF)  
*Borrelia miyamotoi* Disease

### Mosquito-Borne Diseases

Malaria  
West Nile Virus  
Eastern Equine Virus  
Western Equine Virus  
California (La Crosse) Virus  
St. Louis Encephalitis Virus  
Chikungunya Virus  
Zika Virus  
Dengue Virus

### Other Vector-Borne Diseases

Visceral Leishmaniasis  
Parasite Identification (Arthropods)  
Chagas Disease

## TICK-BORNE DISEASES

Tick-borne diseases (TBDs) occur worldwide, but historically, only certain pockets of the United States posed a risk for infection. However, the geographic range of ticks continues to expand in North America, leading to higher risks of TBD exposure for the public. As a result of increasing exposure and the rising number of potential tick-borne pathogens, it is increasingly important to recognize who to test, when to test, and what test to use for patients who present TBD symptoms.

We offer a full menu of individual tests and panels that aid in the diagnosis of TBDs. In addition to our comprehensive testing menu, we have developed multiple TBD testing algorithms to help guide and optimize diagnostic testing.

Pictured above: *Ixodes* tick

## Lyme Disease

### SYMPTOMS

Fever, headache, fatigue, and a characteristic bull's-eye pattern (e.g., erythema migrans) skin rash, although only 70% or less of patients will present with a classic rash.

In Europe, patients can present with more severe dermatologic manifestations, including acrodermatitis chronica due to *Borrelia afzelii* infections or more severe neurologic infections as a result of exposure to *B. garinii*.

**!** *If left untreated, infection can spread to the joints, heart, and nervous system.*

### PATHOGEN

#### Bacteria:

*B. burgdorferi*, *B. mayonii*, *B. afzelii*, and *B. garinii*

### VECTOR

*Ixodes* ticks (black-legged ticks)

### PRIMARY DISTRIBUTION

United States – Northeast, Mid-Atlantic, Northcentral, and Pacific Coast regions

Canada

Asia

Europe

### FEATURED TESTING



**LNBAB** | Lyme Central Nervous System Infection IgG with Antibody Index Reflex, Serum and Spinal Fluid

**LYME** | Lyme Disease Serology, Serum

**LYWB** | Lyme Disease Antibody, Immunoblot, Serum

**!** *Not recommended to be performed without initial positive first-tiered equivocal Lyme enzyme immunoassay.*

**ELYME** | Lyme Disease European Antibody Screen, Serum

**ELYMI** | Lyme Disease European Immunoblot, Serum

**PBORR** | Lyme Disease, Molecular Detection, PCR, Cerebrospinal Fluid, Synovial Fluid, and Tissue

**PBORB** | Lyme Disease, Molecular Detection, PCR, Blood

**!** *Not recommended to be performed with concurrent Lyme disease serology testing (Mayo ID: LYME).*

**TICKS** | Tick-Borne Disease Antibodies Panel, Serum

**EHBAP** | Ehrlichia/Babesia Antibody Panel, Immunofluorescence, Serum

**TKPNL** | Tick-Borne Panel, Molecular Detection, PCR, Blood

## Babesiosis

### SYMPTOMS

Flu-like symptoms, including fever, fatigue, malaise, and headache. Patients may have hepatomegaly and/or splenomegaly.

**!** *In severe cases, hemolysis, acute respiratory distress syndrome, or shock may occur without prompt diagnosis and treatment.*

### PATHOGEN

#### Protozoan parasites:

*Babesia microti*, *B. duncani*, and *B. divergens*-like (MO-1 strain)

### VECTOR

*Ixodes* ticks (black-legged ticks)—*Babesia microti*

### PRIMARY DISTRIBUTION

United States – Northeast, Upper Midwest, and Pacific Coast regions

Canada

### FEATURED TESTING



**BABG** | *Babesia microti* IgG Antibodies, Serum

**LBAB** | *Babesia* Species, Molecular Detection, PCR, Blood

**TICKS** | Tick-Borne Disease Antibodies Panel, Serum

**EBBAP** | Ehrlichia/Babesia Antibody Panel, Immunofluorescence, Serum

**TKPNL** | Tick-Borne Panel, Molecular Detection, PCR, Blood

## Anaplasmosis

### SYMPTOMS

Fever, headache, muscle pain, malaise, chills, nausea and abdominal pain, cough, and confusion.

**!** *Due to the potential for severe symptoms and death, consider presumptive treatment while awaiting test results.*

### PATHOGEN

#### Intracellular bacterium:

*Anaplasma phagocytophilum*

### VECTOR

*Ixodes* ticks

### PRIMARY DISTRIBUTION

United States – Northeast, Mid-Atlantic, Northcentral, and Pacific Coast regions

Canada

Europe (less frequent)

### FEATURED TESTING



**ANAP** | *Anaplasma phagocytophilum* (Human Granulocytic Ehrlichiosis Antibody), Serum

**EHRL** | *Ehrlichia/Anaplasma*, Molecular Detection, PCR, Blood

**TICKS** | Tick-Borne Disease Antibodies Panel, Serum

**EBBAP** | Ehrlichia/Babesia Antibody Panel, Immunofluorescence, Serum

**TKPNL** | Tick-Borne Panel, Molecular Detection, PCR, Blood

## Ehrlichiosis

### SYMPTOMS

Flu-like symptoms, including fever, fatigue, malaise, myalgias/arthralgias, and headache.

**!** *Due to the potential for severe symptoms and death, consider presumptive treatment while awaiting test results.*

### PATHOGEN

#### Rickettsiales bacteria:

*Ehrlichia chaffeensis*, *E. ewingii*, and *E. muris* subsp. *eaucلائrens*

### VECTOR

*Amblyomma* ticks for *E. chaffeensis* and *E. ewingii*.

*Ixodes scapularis* for *E. muris* subsp. *eaucلائrens*

### PRIMARY DISTRIBUTION

United States – Southeast and Southcentral regions

Europe (less frequent)

### FEATURED TESTING



**EHRCP** | *Ehrlichia* Antibody Panel, Serum

**EHRL** | *Ehrlichia/Anaplasma*, Molecular Detection, PCR, Blood

**EHRC** | *Ehrlichia chaffeensis* (HME) Antibody, IgG, Serum

**TICKS** | Tick-Borne Disease Antibodies Panel, Serum

**EBBAP** | Ehrlichia/Babesia Antibody Panel, Immunofluorescence, Serum

**TKPNL** | Tick-Borne Panel, Molecular Detection, PCR, Blood

## Rocky Mountain Spotted Fever (RMSF)

### SYMPTOMS

High fever, chills, severe headache, muscle aches, nausea, vomiting, and fatigue.

**!** *Due to the potential for severe symptoms and death, consider presumptive treatment while awaiting test results.*

### PATHOGEN

#### Intracellular, coccobacillus bacteria:

Spotted Fever Group Rickettsia (e.g., *Rickettsia rickettsii*)

### VECTOR

*Dermacentor* and *Rhipicephalus* ticks

### PRIMARY DISTRIBUTION

United States – Southeast region

Canada

Central America

### FEATURED TESTING



**SFGP** | Spotted Fever Group Antibody, IgG and IgM, Serum

**For tick-borne pathogens other than Rickettsia species:**

**TICKS** | Tick-Borne Disease Antibodies Panel, Serum

**EBBAP** | Ehrlichia/Babesia Antibody Panel, Immunofluorescence, Serum

**TKPNL** | Tick-Borne Panel, Molecular Detection, PCR, Blood

# *Borrelia miyamotoi* Disease

## SYMPTOMS

High fever, headache, myalgias, fatigue, and arthralgias. Note that symptoms—specifically fever—may occur in a biphasic manner.

## PATHOGEN

### Spirochete bacterium:

*Borrelia miyamotoi*

## VECTOR

*Ixodes* ticks

## DISTRIBUTION

North America

Europe

Japan

## FEATURED TESTING



**BMIYB** | *Borrelia miyamotoi* Detection PCR, Blood

**BMIYC** | *Borrelia miyamotoi* Detection PCR, Spinal Fluid

**TKPNL** | Tick-Borne Panel, Molecular Detection, PCR, Blood

## Tick-Borne Coinfections Testing Options

Tick-borne pathogen coinfections are more widespread than commonly recognized by medical professionals and the public. Ticks can transmit multiple infectious agents through a single bite to the host. In studies reported in *Clinical Microbiology* reviews, coinfections appear with the greatest frequency among people with Lyme disease (LD). Approximately 4–5% of patients with LD are coinfecting with either human anaplasmosis or babesiosis where LD is endemic.<sup>6</sup>

Mayo Clinic, a recognized center of excellence for vector-borne diseases, offers combined expertise with consultancy, integration of serologic and molecular testing, and enhanced reports with interpretation support.

### Serological Testing

A tick-borne testing panel can assist in the detection of coinfections, even if they are not initially suspected by the provider. Such tests can evaluate patients who present with fever, myalgia, headache, nausea and other symptoms and have a history or suspicion of tick exposure. Importantly, this testing is useful in patients presenting with more than seven days of symptoms.

## COMPREHENSIVE PANEL



**TICKS** | Tick-Borne Disease Antibodies Panel, Serum

### INCLUDED TESTS

**EHRC** | *Ehrlichia chaffeensis* (HME) Antibody, IgG, Serum

**ANAP** | *Anaplasma phagocytophilum* (Human Granulocytic Ehrlichiosis) Antibody, Serum

**BABG** | *Babesia microti* IgG Antibodies, Serum

**LYME** | Lyme Disease Serology, Serum

### REFLEX TEST (IF INDICATED)

**LYWB** | Lyme Disease Antibody, Immunoblot, Serum

## ADJUNCT PANEL



**EHBAP** | Ehrlichia/Babesia Antibody Panel, Immunofluorescence, Serum

### Molecular Testing

While two-tiered serological testing best identifies Lyme disease caused by *B. burgdorferi*, molecular amplification assays are the best detectors for acute ehrlichiosis, anaplasmosis, babesiosis, and *B. miyamotoi* infections within the first 7 days following symptom onset. This tick-borne panel offers sensitive, specific, and rapid detection of agents that cause these four diseases. Consider ordering this panel when systemic symptoms, such as fever, chills, and sepsis, are present.

## COMPREHENSIVE PANEL



**TKPNL** | Tick-Borne Panel, Molecular Detection, PCR, Blood

### INCLUDED TESTS

**LBAB** | *Babesia* Species, Molecular Detection, PCR, Blood

**EHRL** | *Ehrlichia/Anaplasma*, Molecular Detection, PCR, Blood

**BMIYB** | *Borrelia miyamotoi* Detection, PCR, Blood

## MOSQUITO-BORNE DISEASES

Worldwide, mosquito-borne diseases (MBDs) cause millions of deaths each year, earning mosquitoes the title of the world's deadliest animal.<sup>5</sup>

We offer a comprehensive menu of individually orderable tests and panels for MBDs. Additionally, our algorithmic approaches to MBD testing help reduce costs and optimize patient care.

Pictured above: *Anopheles* mosquito

## Malaria

### SYMPTOMS

Fever, headache, chills, nausea, vomiting, muscle pain, fatigue, sweating, chest or abdominal pain, and cough.

**!** *If not treated within 24 hours, malaria can lead to death from one or more serious complications,<sup>7,8</sup> including:*

- **Cerebral malaria**
- **Breathing problems**
- **Organ failure**
- **Anemia**
- **Low blood sugar**

### PATHOGEN

**Protozoan parasite:**

*Plasmodium* species

*P. falciparum*

*P. vivax*

*P. ovale*

*P. malariae*

*P. knowlesi*

### VECTOR

*Anopheles* mosquitoes

### DISTRIBUTION

Sub-Saharan African

Southeast Asia

Eastern Mediterranean (less frequent)

Western Pacific

South America

North America (less frequent)

- Dominican Republic
- Haiti

Oceania

- Papua New Guinea

### FEATURED TESTING



**LCMAL** | Malaria, Molecular Detection, PCR Only

**LMALP** | Malaria PCR with Parasitemia Reflex

**MAL** | Rapid Malaria/*Babesia* Smear

# West Nile Virus

## SYMPTOMS

### Mild infection:

Fever, headache, body aches, vomiting, diarrhea, fatigue, and skin rash.

### Neurological infection:

High fever, severe headache, stiff neck, disorientation or confusion, stupor or coma, tremors or muscle jerking, seizures, partial paralysis, or muscle weakness.



**If neurological symptoms are left untreated, patients may develop encephalitis or meningitis. Approximately 1 out of 10 people who develop severe central nervous system (CNS) illnesses die.<sup>1,4</sup>**

## PATHOGEN

### Positive-stranded ribonucleic acid (RNA) virus:

*Flavivirus* genus, *Flaviviridae* family

## VECTOR

Primarily *Culex* mosquitoes

## DISTRIBUTION

Africa  
Europe  
Middle East  
West Asia  
Oceania  
North America (less frequent)

## FEATURED TESTING



**WNS** | West Nile Virus Antibody, IgG and IgM, Serum

**WNC** | West Nile Virus Antibody, IgG and IgM, Spinal Fluid

**LCWNV** | West Nile Virus, Molecular Detection, PCR, Spinal Fluid

**WNVP** | West Nile Virus, Molecular Detection, PCR, Plasma



**PCR tests are recommended to be used in conjunction with serological tests.**

# Eastern Equine Encephalitis Virus

## SYMPTOMS

### Systemic infection:

Chills, fever, malaise, arthralgia, and myalgia.

### Encephalitic infection:

Fever, headache, irritability, restlessness, drowsiness, anorexia, vomiting, diarrhea, cyanosis, convulsions, and coma.

## PATHOGEN

### Arbovirus:

*Alphavirus* genus, *Togaviridae* family

## VECTOR

*Culiseta* mosquitoes

## DISTRIBUTION

North America  
Central America  
South America  
Caribbean

## FEATURED TESTING



**EEEP** | Eastern Equine Encephalitis Antibody, IgG and IgM, Serum

**EEPC** | Eastern Equine Encephalitis Antibody Panel, IgG and IgM, Spinal Fluid

## FEATURED PANELS



**ARBOP** | Arbovirus Antibody Panel, IgG and IgM, Serum

**ABOPC** | Arbovirus Antibody Panel, IgG and IgM, Spinal Fluid



## Western Equine Encephalitis Virus

### SYMPTOMS

Malaise, fever, headache, nausea, vomiting, vertigo, photophobia, sore throat, respiratory symptoms, abdominal pain, and myalgia.

### PATHOGEN

#### Arbovirus:

*Alphavirus* genus, *Togaviridae* family

### VECTOR

*Culex*, *Culiseta*, and *Aedes* mosquitoes

### DISTRIBUTION

North America

- Western Canada
- Western United States

South America

- Argentina

### FEATURED TESTING

**WEEP** | Western Equine Encephalitis Antibody, IgG and IgM, Serum

**WEPC** | Western Equine Encephalitis Antibody Panel, IgG and IgM, Spinal Fluid

### FEATURED PANELS

**ARBOP** | Arbovirus Antibody Panel, IgG and IgM, Serum

**ABOPC** | Arbovirus Antibody Panel, IgG and IgM, Spinal Fluid



## California (La Crosse) Encephalitis

### SYMPTOMS

Fever, headache, nausea, vomiting, fatigue, and lethargy. More severe symptoms, including seizures, coma, and paralysis, often lead to encephalitis.

### PATHOGEN

#### Serogroup virus:

*Bunyavirus* genus, *Bunyaviridae* family

### VECTOR

*Aedes* and *Culex* mosquitoes

### DISTRIBUTION

United States – Midwestern, Mid-Atlantic, and Southeast regions

### FEATURED TESTING

**CAVP** | California Virus (La Crosse) IgG and IgM, Serum

**CAVPC** | California Virus (La Crosse) Encephalitis Antibody Panel, IgG and IgM, Spinal Fluid

### FEATURED PANELS

**ARBOP** | Arbovirus Antibody Panel, IgG and IgM, Serum

**ABOPC** | Arbovirus Antibody Panel, IgG and IgM, Spinal Fluid



## St. Louis Encephalitis Virus

### SYMPTOMS

#### Mild infections:

Fever, headache, dizziness, nausea, and malaise.

#### CNS infections:

Stiff neck, confusion, disorientation, dizziness, tremors, and unsteadiness.

### PATHOGEN

#### Positive-stranded ribonucleic acid (RNA) virus:

*Flavivirus* genus, *Flaviviridae* family

### VECTOR

*Culex* mosquitoes

### DISTRIBUTION

United States – Eastern, central, and rural western regions

### FEATURED TESTING

**STLP** | St. Louis Encephalitis Antibody, IgG and IgM, Serum

**STLPC** | St. Louis Encephalitis Antibody Panel, IgG and IgM, Spinal Fluid

### FEATURED PANELS

**ARBOP** | Arbovirus Antibody Panel, IgG and IgM, Serum

**ABOPC** | Arbovirus Antibody Panel, IgG and IgM, Spinal Fluid



## Chikungunya Virus

### SYMPTOMS

Fever, joint pain, fatigue, muscle pain, headache, and rash.

### PATHOGEN

#### Single positive-stranded RNA alphavirus:

*Alphavirus* genus, *Togaviridae* family

### VECTOR

*Aedes* mosquitoes

### DISTRIBUTION

Africa

Asia

Europe

Islands in the Caribbean, Indian, and Pacific Oceans

### FEATURED TESTING

**CHIKV** | Chikungunya IgM and IgG, Antibody, Serum

**CHIKS** | Chikungunya Virus, PCR, Molecular Detection, Serum

**CHIKC** | Chikungunya Virus, PCR, Molecular Detection, Spinal Fluid



# Zika Virus

## SYMPTOMS

Mild fever, rash, joint or muscle pain, headache, and conjunctivitis. The Zika virus may cause other neurological disorders such as Guillain-Barre syndrome.

## Birth defects:

Severe microcephaly with a partly collapsed skull, brain damage, reduced brain size, eye damage, joint problems—including limited motion—and reduced body movement caused by too much muscle tone after birth.

## PATHOGEN

### Single-stranded RNA virus:

*Flavivirus* genus, *Flaviviridae* family

## VECTOR

*Aedes aegypti* and *Aedes albopictus* mosquitoes

## DISTRIBUTION

Africa

Southeast Asia

South America

Central America

## FEATURED TESTING



**MZIKV** | Zika Virus IgG Antibody Capture MAC-ELISA, Serum

**RZIKU** | Zika Virus, PCR, Molecular Detection, Random, Urine

**RZIKS** | Zika Virus, Virus, PCR, Molecular Detection, Serum

**PNZIK** | Prenatal Zika Virus IgM Antibody Capture MAC-ELISA, Serum

# Dengue Virus

## SYMPTOMS

### Mild infection:

High fever, headache, muscle, bone and joint pain, nausea, vomiting, pain behind the eyes, swollen glands, and rash.

### Dengue hemorrhagic fever, severe dengue, or dengue shock syndrome:

Severe abdominal pain, persistent vomiting, bleeding from gums or nose, bleeding under the skin (which might look like bruising), difficult or rapid breathing, cold or clammy skin (shock), fatigue, irritability, and restlessness.



**Symptoms of dengue hemorrhagic fever, severe dengue, or dengue shock syndrome signal life-threatening emergencies.**

## PATHOGEN

### Single positive-stranded RNA virus:

*Flavivirus* genus, *Flaviviridae* family

## VECTOR

*Aedes aegypti* and *Aedes albopictus* mosquitoes

## DISTRIBUTION

North America

South America

Central America

Africa

Eastern Mediterranean

Southeast Asia

Western Pacific

## FEATURED TESTING



**DENGM** | Dengue Virus Antibody, IgG and IgM, Serum

**DENVP** | Dengue Virus Antibody/Antigen Panel, Serum

**DNSAG** | Dengue Virus NS1 Antigen, Serum

**DENG C** | Dengue Virus, Molecular Detection, PCR, CSF

**DENG S** | Dengue Virus, Molecular Detection, PCR, Serum

## FEATURED PANELS



**ARBOP** | Arbovirus Antibody Panel, IgG and IgM, Serum

**ABOPC** | Arbovirus Antibody Panel, IgG and IgM, Spinal Fluid

## INSECT-BORNE DISEASES

Our laboratories test for various diseases carried by insect species. The tsetse fly spreads sleeping sickness, which affects 36 countries of sub-Saharan Africa and places 55 million people at risk. Sand flies spread the leishmaniasis group of diseases, which affects 88 countries and places 350 million people at risk. Household bugs spread Chagas disease and place 100 million people at risk in Latin America. Other insects spread filarial diseases, including lymphatic filariasis, loiasis, and onchocerciasis.

Pictured above: *Phlebotomus papatasi* sand fly<sup>10</sup>

## Visceral Leishmaniasis

### SYMPTOMS

#### Cutaneous leishmaniasis:

One or more sores on the skin, papules (bumps), nodules (lumps), ulcers with crust or scabs, and swollen glands near the sores. Patients may also be asymptomatic.

#### Visceral leishmaniasis:

Fever, weight loss, enlargement of the spleen and liver, and abnormal blood tests with anemia, leukopenia, or thrombocytopenia.

### PATHOGEN

#### Parasite:

*Leishmania* genus

### VECTOR

Female phlebotomine sand flies

### DISTRIBUTION

Asia

Middle East

Africa – tropical and northern regions

Southern Europe

Mexico

Central America

South America

### FEATURED TESTING



**LEIS** | Leishmaniasis (Visceral) Antibody, Serum

**!** **Test is NOT appropriate for diagnosing cutaneous leishmaniasis.**

## Parasite Identification (Arthropods)

### SYMPTOMS

Arthropods serve as disease vectors and cause disease by tissue damage and blood loss.

### VECTOR

Ticks  
Fleas  
Mites  
Lice  
Reduviid bugs

### DISTRIBUTION

Varies with arthropod

### FEATURED TESTING



**PARID** | Parasite Identification, Varies

**!** *Tick identification can be used to guide prophylaxis for Lyme disease<sup>11</sup> and predict the risk for other tick-borne diseases. The report includes tick genus, species, gender, life cycle stage, degree of engorgement, and presence—or absence—of mouthparts.*

## *Trypanosoma cruzi* Infection (Chagas Disease)

### SYMPTOMS

#### Acute phase:

Often asymptomatic. Mild signs include swelling at the infection site, fever, fatigue, rash, body aches, eyelid swelling, headache, loss of appetite, nausea, diarrhea, vomiting, swollen glands, and enlargement of the liver or spleen.

#### Chronic phase:

Irregular heartbeat, congestive heart failure, sudden cardiac arrest, difficulty swallowing due to enlarged esophagus, abdominal pain, and constipation due to enlarged colon.

**!** *If left untreated, the infection persists and advances to the chronic phase. Symptoms may occur 10–20 years after initial infection and may be life threatening.<sup>3</sup>*

### PATHOGEN

#### Protozoan hemoflagellate:

*Trypanosoma cruzi*

### VECTOR

Reduviid (“kissing bugs”) *Triatoma*

### DISTRIBUTION

Rural regions of Mexico  
Central America  
South America

### FEATURED TESTING



**CHAG** | *Trypanosoma cruzi* IgG Antibody ELISA, Serum

**!** *Test is preferred for diagnosis of chronic Chagas disease.*

# THE MAYO CLINIC DIFFERENCE

Our clinicians and laboratorians focus on maintaining high-quality, cost-effective, and efficient care by using algorithmic, evidence-based approaches that lead to correct diagnoses and treatment, while minimizing unnecessary testing.

More importantly, physicians and scientists manage our laboratories with expert knowledge regarding the clinical implications of each test result and how it impacts patient care.

For more information about our vector-borne disease testing and algorithms, visit **[mayocliniclabs.com/vectorborne](https://www.mayocliniclabs.com/vectorborne)**.

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