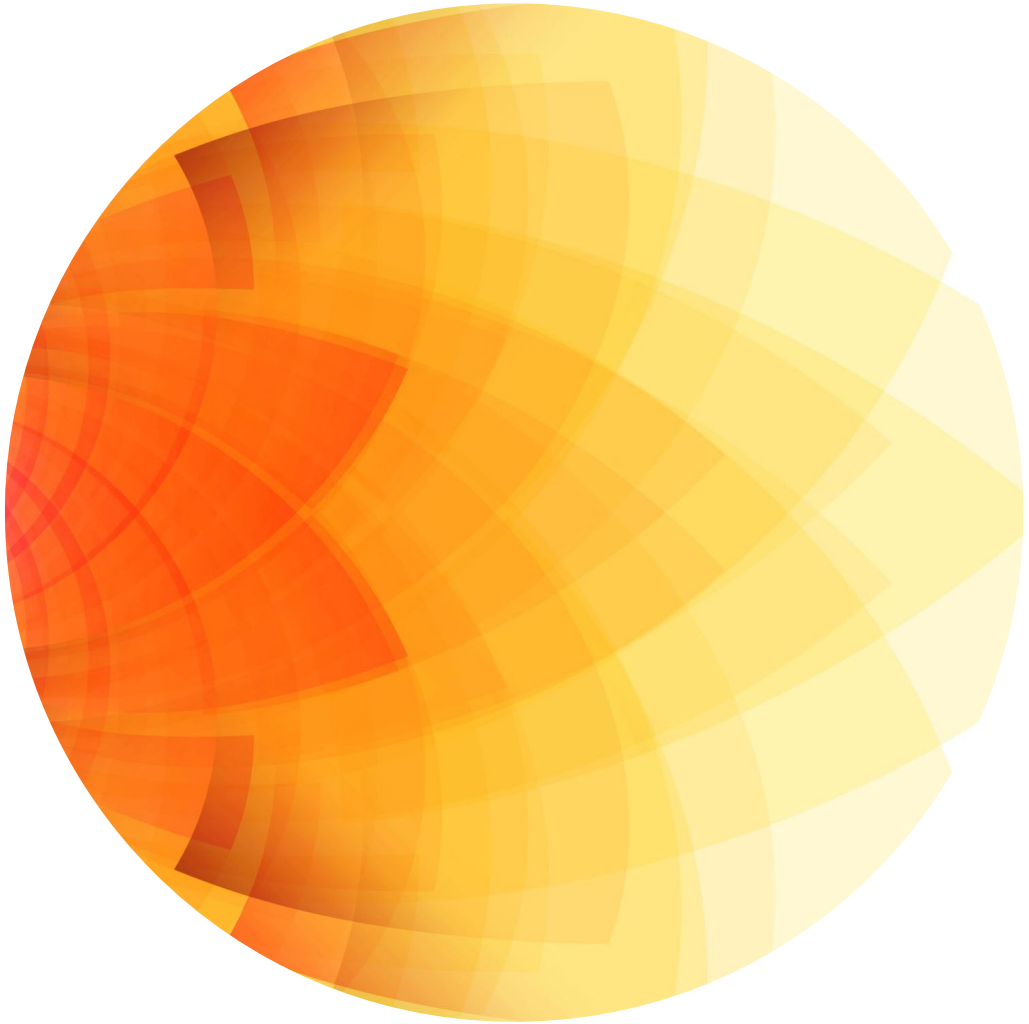
Climate, Critters & Vector-borne Infections

Susan LeLacheur, DrPH, PA-C



Disclosures

- Susan LeLacheur has no relevant disclosures

Objectives

1. Describe the recent changes to the epidemiology of vector borne infections in the United States.
2. Given a patient case, list the vector born infections that should be considered.
3. Compare and contrast the factors in a patient history, physical exam findings and diagnostic study results for vector born infections including anaplasmosis, dengue, erlichiosis, Lyme disease, malaria, Rocky Mountain spotted fever, West Nile virus, and Zika.

Climate & Health

- Precipitation shifts
- Temperature shifts
- Changes to air and water currents
- Sea level rise
- Extreme weather events
- Migration of populations

Impacts

- Direct
  - Respiratory disease with wildfires
  - Changes to food and water supplies
  - Injury from temperature extremes
- Indirect
  - Stress on infrastructure
  - ***Changes in habitat range for disease causing microbes and their hosts***

CDC

JT is a 67-year-old male

- Presents to the ED in early August c/o a two week history of chills & fever to 38.9^{o} C and fatigue.
- Fevers have increased in the past week and he has experienced drenching night sweats X 2.
- Profound generalized weakness and loss of appetite.
- Two episodes of emesis yesterday, no blood or bile noted
- No chest pain, cough, sore throat, headache, neck stiffness, rash, lymphadenopathy, myalgia or arthralgia

JT

- Lives with his wife of 42 years in Vermont where he works as an accountant.
- No known sick contacts, changes to diet or animal contact – they have a dog X 7 years.
- 15 pk/yr smoking hx, quit 17 years ago.
- Hx HTN, on Lisinopril 20 mg daily.
- NKA, NKDA
- Father HTN & T2DM, no family hx hematologic cancer or autoimmune disease

JT

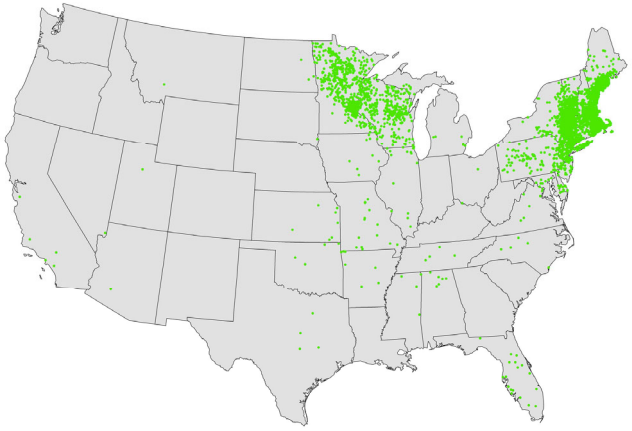
- VS – T 39.2^{o} C, HR 114, BP 122/80, RR 20, O_2 sat 97% RA
- Anxious & pale
- Skin without rashes, lesions or jaundice, no nail changes
- HEENT – pale conjunctive, no icterus bilat eyes, PERRLA, fundi with crisp disc margins, no vascular changes, cup:disc 1:3, CII-XII intact, neck supple, no lymphadenopathy
- CV – regular tachycardia no murmurs or gallops, pulses 2+, no edema
- Lungs – vesicular breath sounds, no adventitious sounds
- Abd – Normoactive bowel sounds, soft, nontender, no hepatosplenomegaly

JT DDx

- ***Anaplasmosis***
- ***Babesiosis***
- Bacterial endocarditis
- ***Erlichiolsis***
- ***Lyme disease***
- Lymphoma
- Primary HIV
- ***Rocky Mountain Spotted Fever (RMSF)***
- Tuberculosis
- ***Tularemia***
- ***West Nile Virus***

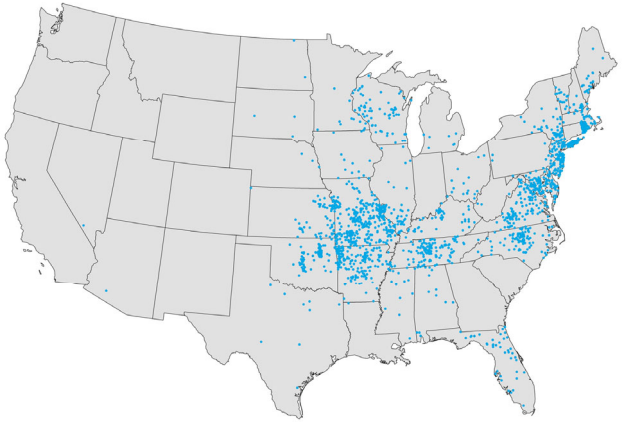
- Consider infectious diseases but also inflammatory autoimmune disease
- Likelihood of various infections depends on potential exposures.
- It is wise to have tuberculosis, primary HIV and endocarditis on your differential even in the absence of an obvious exposure route.

Selected Tickborne Diseases Reported to CDC, U.S., 2018

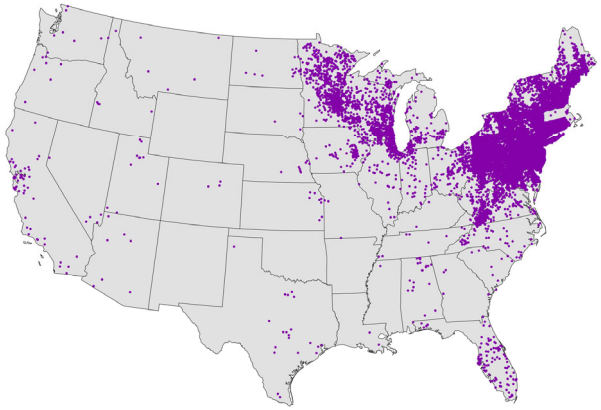


Anaplasmosis

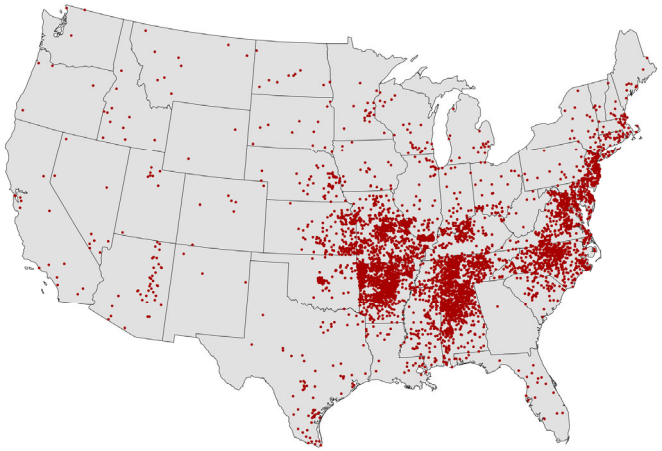
Babesiosis



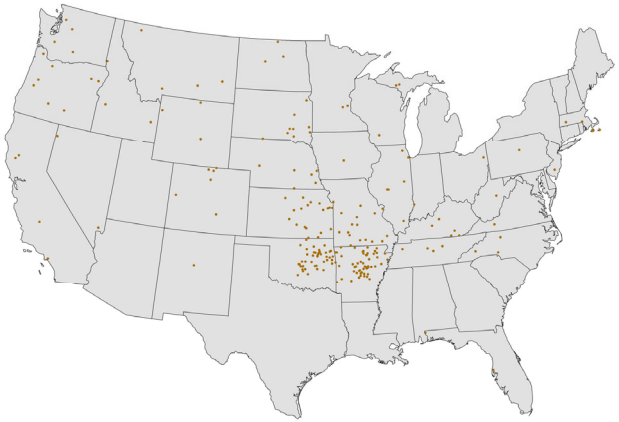
Erlichiosis



Lyme Disease



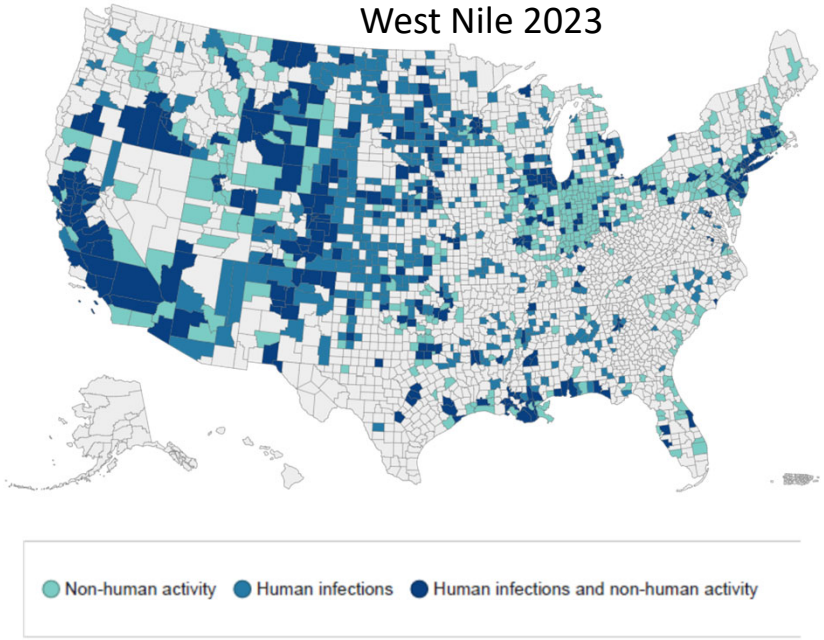
Spotted Fever Rickettsiosis



Tuleremia

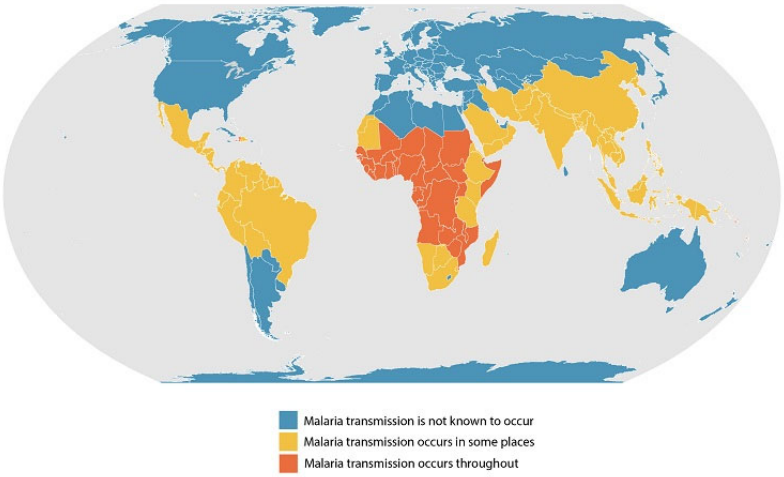
Mosquitos

- Chikungunya
- Dengue
- Malaria
- West Nile →
  - In 2023
    - 2,406 Total Human Disease
    - 1,599 Neuroinvasive Human Disease
- Yellow fever
- Zika →
  - Peaked in 2016 with >40,000 US cases
  - Only 23 cases reported in 2022, all diagnosed with antibody



Malaria

CDC 10/19, 2023 - ***Locally Acquired Cases of Malaria in Florida, Texas, Maryland, and Arkansas***
https://www.cdc.gov/malaria/new_info/2023/malaria_US.htm



https://www.cdc.gov/malaria/about/distribution.html

https://www.cdc.gov/malaria/about/history/elimination_us.html

Mal

CDC 10/19,
Cases of Ma
Maryland, c
https://www.cdc.gc

https://www.cdc.gov/malaria/about/distribution.html

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EMERGING INFECTIOUS DISEASES®

EID Journal > Volume 30 > Early Release > Main Article

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Dispatch

Autochthonous *Plasmodium vivax* Infections, Florida, USA, 2023

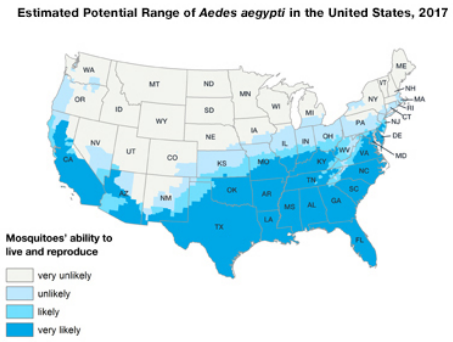
Azhar Muneer[1], Swamy R. Adapa[1], Suzane Silbert, Kelly Scanlan, Harold Vore, Andrew Cannons, Andrea M. Morrison, Danielle Stanek, Carina Blackmore, John H. Adams, Kami Kim[2], Rays H.Y. Jiang[2], and Liwang Cui[2]

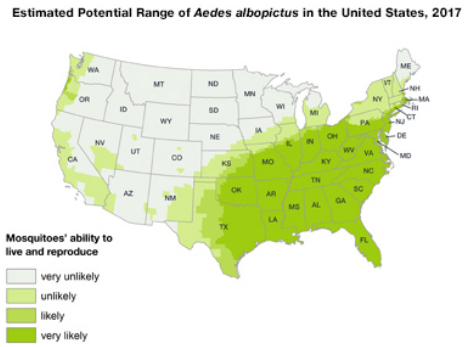
Author affiliations: University of South Florida Morsani College of Medicine, Tampa, Florida, USA (A. Muneer, K. Kim, L. Cui); University of South Florida School of Public Health, Tampa (S.R. Adapa, J.H. Adams, K. Kim, R.H.Y. Jiang); Tampa General Hospital, Tampa (S. Silbert, K. Kim); Sarasota Memorial Hospital, Sarasota, Florida, USA (K. Scanlan, H. Vore); Florida Department of Health Bureau of Public Health Laboratories, Tampa (A. Cannons); Florida Department of Health, Tallahassee, Florida, USA (A.M. Morrison, D. Stanek, C. Blackmore)

https://www.cdc.gov/malaria/about/history/elimination_us.html

Introduction and Spread of Dengue Virus 3, Florida, USA, May 2022–April 2023

Forrest K. Jones,[1] Andrea M. Morrison,[1] Gilberto A. Santiago, Kristyna Rysava, Rebecca A. Zimler, Lea A. Heberlein, Edgar Kopp, Florida Department of Health Bureau of Public Health Laboratory Team,[2] Katharine E. Saunders, Samantha Baudin, Edhelene Rico, Álvaro Mejía-Echeverri, Emma Taylor-Salmon, Verity Hill, Mallery I. Breban, Chantal B.F. Vogels, Nathan D. Grubaugh, Lauren M. Paul, Scott F. Michael, Michael A. Johansson, Laura E. Adams, Jorge Munoz-Jordan, Gabriela Paz-Bailey, Danielle R. Stanek





FDA NEWS RELEASE

FDA Approves First Vaccine to Prevent Disease Caused by Chikungunya Virus

For Immediate Release:

November 09, 2023

Español (https://www.fda.gov/news-events/press-announcements/la-fda-aprueba-la-primera-vacuna-para-prevenir-la-enfermedad-causada-por-el-virus-del-chikungunya)

JT Labs

- EKG & CXR no abnormalities
- HIV neg, COVID neg
- **Na+ 132 mmol/L** (135-142)
- K+ 4.0 mmol/L (3.5-5.0)
- Cl- 102 mmol/L (98-108)
- **CO_2 20 mmol/L** (23-32)
- **BUN 55 mg/dl** (6-23)
- **Creat 2.40 mg/dl** (0.5-1.2)
- **ALT 56 U/L (**10-50)
- **AST 88 U/L** (10-50)
- Alk Phos 63 U/L (35-130)
- **Tot bili 1.8 mg/dl** 0-1.0
- Dir bili 0.3 mg/dl (0-0.3)

- **Hgb 9.0** (13.5-18)
- **WBC 3.04** (4-10,000)
- PMNs 49.4% (48-76)
- Lymphs 31.7% (18-41)
- **Monos 19.0%** (4-11)
- Eos 0.0% (0-1.5)
- Basos 0.8% (0-1.5)
- **Plt/mm^3 23,000** (150,000-450,000)
- MCV 88.0 (80-95)
- RDW 13.1 (11.5-14.5)
- Retic 1.34 (0.5-2.0)
- **ESR 88 mm/hr** (0-12)
- **PTT 15.3 sec** (11.9-14.6)
- **INR 1.2 (**0.9-1.1)

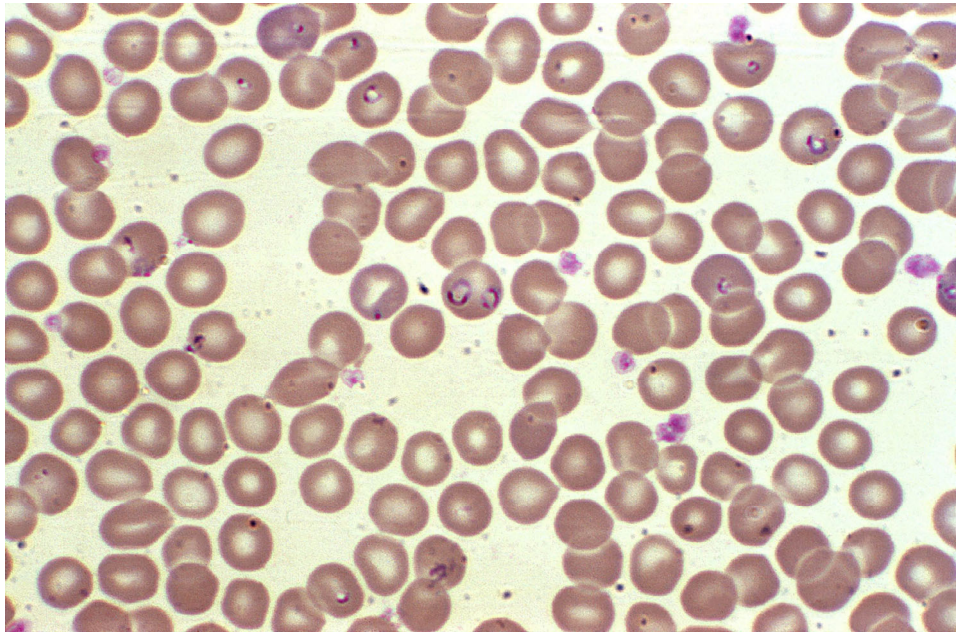
JT DDx

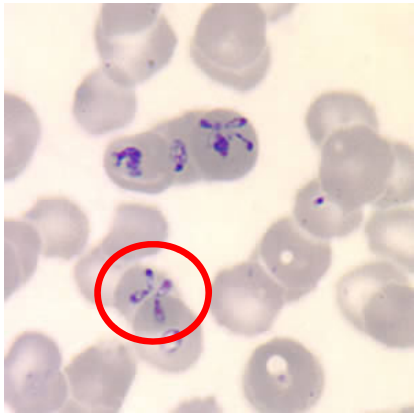
- ***Anaplasmosis***
- ***Babesiosis***
- ~~Bacterial endocarditis~~
- ***Erlichiolsis***
- ***Lyme disease***
- ~~Lymphoma~~
- ~~Primary HIV~~
- ***Rocky Mountain Spotted Fever (RMSF)***
- ~~Tuberculosis~~
- ***Tularemia***

Next steps?

JT DDx

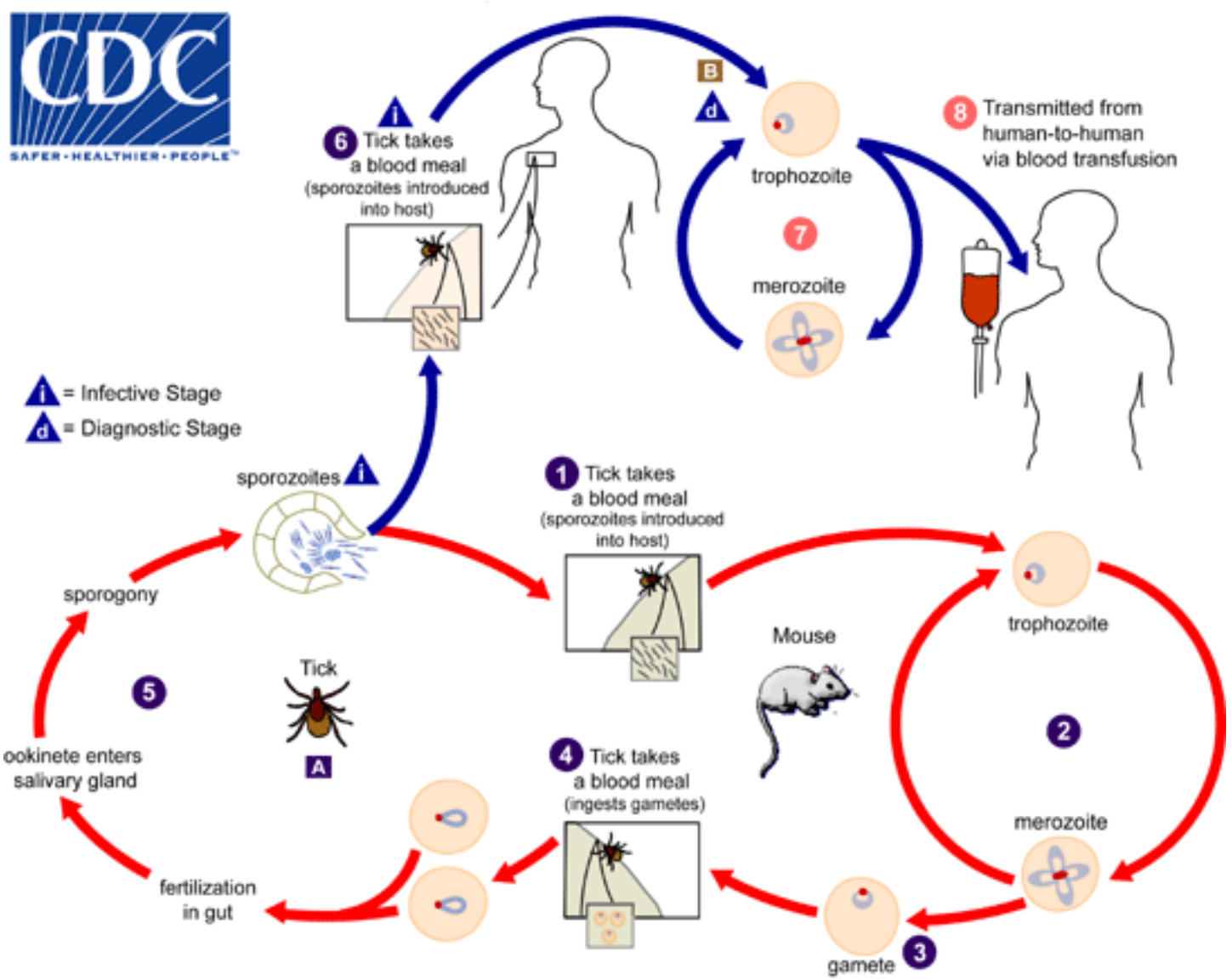
- Basophilic ring forms indicative of parasitic infection with babesia
- Malaria would give a similar picture, but the epidemiology doesn't match for our patient
- Tetrads ("Maltese cross") are rare but pathognomonic





Babesiosis

- Ixodus scapularis (Black-legged Tick)
  - Same tick as Lyme & anaplasmosis
  - Reservoir white-footed mouse
- Has been endemic to southern NE, Wisconsin & Minnesota now moving north
- 4 species, most U.S. cases *B. microti*


CDC
SAFER·HEALTHIER·PEOPLE™
i = Infective Stage
d = Diagnostic Stage
1 Tick takes a blood meal (sporozoites introduced into host)
2
3 gamete
4 Tick takes a blood meal (ingests gametes)
5
6 Tick takes a blood meal (sporozoites introduced into host)
7
8 Transmitted from human-to-human via blood transfusion
A
B
Tick
Mouse
sporozoites
sporogony
ookinete enters salivary gland
fertilization in gut
trophozoite
merozoite
trophozoite
merozoite

Babesiosis Clinical Presentation

- Incubation period 1-4 weeks after tick bite
- Symptoms related to inflammatory response
- Asymptomatic in >25% (especially children)
- Flu-like illness: fever, chills, night sweats, headache, myalgia, arthralgia GIl symptoms
- Less common: dry cough, sore throat, photophobia, conjunctival injection
- Mild splenomegaly, mild hepatomegaly, or jaundice may occur

- Complications (elderly, asplenic, immunocompromised): Disseminated intravascular coagulation, hemodynamic instability, ARDS, renal failure, hepatic compromise, altered mental status, and death.

Babesiosis Diagnosis

- Suspect if the epidemiology symptomology matches and you see:
  - Anemia
  - Thrombocytopenia
  - Elevated liver enzymes ↓
  - ↑Evidence of intravascular hemolysis (LDH, total and indirect bili, haptoglobin)
- Microscopic exam of the blood
  - Giemsa or Wright stain
- PCR
- Serology – must be confirmed with PCR or blood smear
- R/O coinfection with Lyme, anaplasmosis

Babesiosis DDx

- *Borrelia burgdorferi*, Lyme disease
- *Anaplasma phagocytophilum*, Anaplasmosis

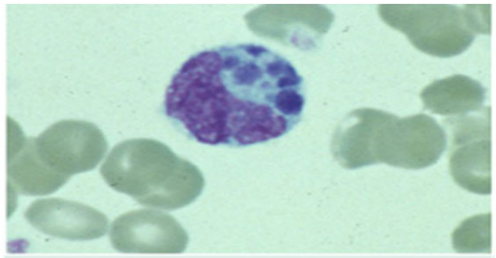
  Coinfection with either or both
- *Ehrlichia* spp., Erlichiosis

Babesiosis Tx

- Atovaquone 750 mg PO Q 12 h (with a fatty meal) plus azithromycin 500 mg PO day one then 250 mg Q 24h, both for 7-10 days
- For hospitalized patients use atovaquone 750 mg PO Q 12 h plus azithromycin at 500 mg IV Q 24h until symptoms abate then 250-500 mg PO, total 7-10 days

Anaplasmosis (Human Granulocytic Anaplasmosis HGA)

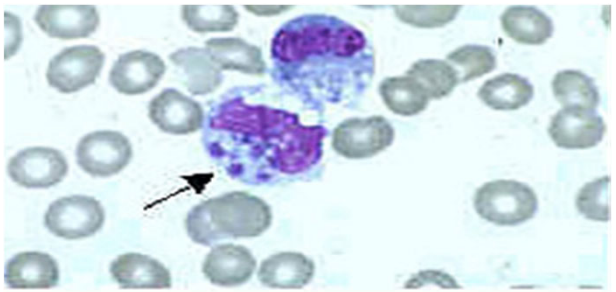
- Intracellular Bacteria (Anaplasma phagocytophilia)
- Incubation 10-14d
- Presentation
  - Flu-like sxs
  - Leukopenia + Thrombocytopenia + Elevated Transaminases
  - Complications: Septic Shock, ARDS; Neuro (peripheral neuropathies, facial palsy, demyelinating polyneuropathy, brachial plexopathy)
- Morulae in GRANULOCYTES
- PCR (acute) & IFA (IgG 4x)



A granulocyte on a peripheral blood smear.

Ehrlichiosis (Human Monocytic Erlichiosis HME)

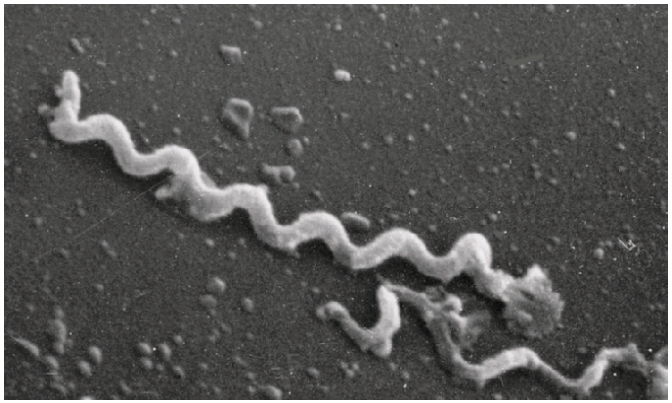
- Intracellular bacteria (E. chaggeensis, ewingii, canis)
- Lone Star Tick incubation 7-10d
- Presentation
  - Flu-like sxs + maculopapular rash*
  - Leukopenia + Thrombocytopenia + Elevated Transaminases
  - Complications: Septic Shock, Coagulopathies, ARDS; <u>Neuro</u> (meningoencephalitis, seizures, coma, peripheral neuropathies, primary cranial neuritis)
    - MORE COMPLICATIONS & FATALITIES
- Morulae in MONOCYTES



E. chaffeensis morulae in the cytoplasm of a human monocyte. Photograph courtesy of the Centers for Disease Control.

Lyme Disease

- Clinical manifestations:
  - stage 1: localized erythema migrans (EM)
  - stage 2: follows stage 1 by days or weeks: disseminated infection
  - stage 3: persistent infection months to years after initial infection, can follow long period of latent infection



Lyme Disease – Systemic symptoms

- Musculoskeletal manifestations - 80% of patients
- Early neurologic manifestations - symptoms of meningeal irritation concomitant with ECM
- Late neurologic manifestations - 15% of cases affected
  - Meningitis, encephalitis, chorea, cranial, motor/sensory radiculitis, myelitis
- Cardiac manifestations - affects 5% of untreated patients
  - AV block (1st degree, Wenckebach, complete heart block),
  - may present with EKG changes, myopericarditis, LV dysfunction

Lyme Disease Dx

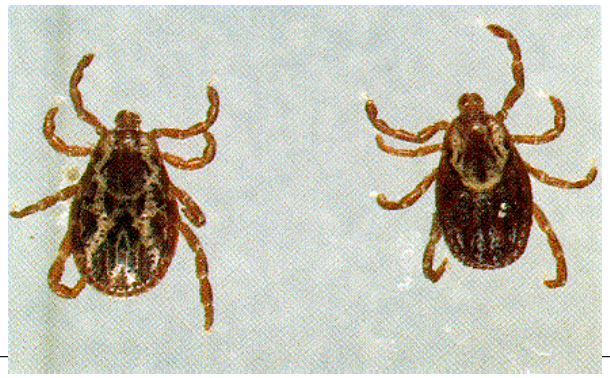
- Clinical - EM
- After 4-6 weeks 90% have elevated IgG
  - after antibiotic treatment, titers fall slowly, however, those with later manifestations remain seropositive for years
  - PCR testing is available for serum, CSF, synovial fluid
  - C6 antibody (ELISA): highly sensitive and specific

Lyme Disease Tx

- Doxycycline 100 mg PO daily X 10 days

Rickettsia rickettsia – Rocky Mountain Spotted Fever

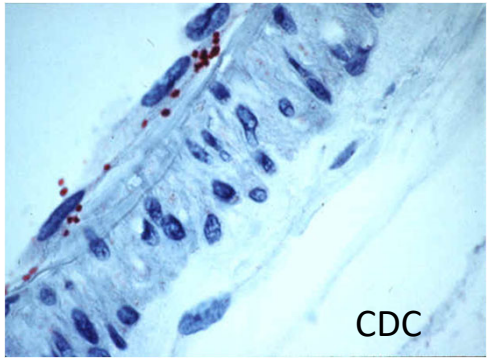
- **Tick-borne:** mostly *Dermacentor spp*.
  - Dog tick
  - Adult stage only
  - Tick bites often undetected
- Endemic in US, Canada, Mexico, Central America, Brazil and Columbia



CDC

RMSF: Pathogenesis

- Direct vascular injury, increased vascular permeability:
  - Edema, hemorrhage, hypotension
- Infection of endothelium results in expression of membrane surface proteins such as platelet binding substances:
  - Activation of coagulation system
  - Consumption of platelets:
    - Thrombocytopenia in up to 50%



RMSF: Clinical Features

- Incubation: 2-14 days
- **Classic triad: fever, headache & rash**
- History of tick bite in <50%
- **Early**: headache, intense myalgias, anorexia & fever

- **Rash** (~90%) 3-5 days after onset
  - "*Textbook case*": begins on ankles/wrists and spreads centrally
  - Maculopapular, evolves into petechial rash
  - Palms/soles in 40-80%
  - *Severe cases*: hemorrhage, necrosis & gangrene of digits
  - Usually NO eschar

RMSF: Early Maculopapular Rash

CDC

CDC

RMSF: Late Petechial Rash

RMSF:DIAGNOSIS & TREATMENT

- **Diagnosis** is usually clinical
  - Typical presentation & epidemiologic clues (i.e., TICK BITE) → start doxycycline
- Serology to confirm diagnosis – IgG IFA acute & convalescent
  - Antibodies appear 10-14 days after infection
  - Cross-reactive with other bacteria of spotted fever group
- Immunohistochemical stains (skin, tissue)
- PCR (skin, blood and ticks)

- **Treatment** doxycycline 100 mg PO q 12 hr X 5-7 days

Tularemia – *Francisella tularensis*

- Transmitted by tick or deerfly bite or handling dead animals
- ***Rare***
- Fever, chills, malaise, headache, anorexia, myalgia, GI
- Localized symptoms and signs depend on entry point:
  - Skin – lymphadenopathy +/- ulcer
  - Eye – preauricular lymphadenopathy + eye inflammation
  - Mouth/throat – pharyngitis, oral ulcers tonsillitis, cervical lymphadenopathy
  - Lungs – cough, chest pain, dyspnea – can be deadly
- **Dx** – alert lab for safe handling and special cultures, serology acute and convalescent
- **Tx** – supportive plus IV gentamicin, ciprofloxacin or doxycycline

Alpha gal Syndrome

- Lone star tick, generally occurs after multiple bites (hunting, dog owning)
- IgE-mediated hypersensitivity to galactose-alpha-1,3-galactose (alpha-gal), found in all nonprimate mammalian tissues
- Recurrent episodes of severe allergic reactions with no apparent cause – urticarial, pruritis, angioedema, GI symptoms, anaphylaxis
- Symptoms appear 3-6 hours after consumption of meat products
- Elevation of CRP & total IgE; skin prick tests; serologic testing for IgE to alpha-gal or mammalian meat

CDC

JT Management & Outcome

- Blood and urine cultures were negative.
- Serologic testing (ELISA X 2 = modified 2 tier testing) for Lyme disease was positive.

- Treated inpatient with atovaquone 750 mg PO Q 12 h plus azithromycin at 500 mg IV Q 24h for two days at which point serial blood smears revealed a reduction in overall parasitemia from 1.8% to 1.4% to 1.1%. His fevers resolved, and hepatic and renal function normalized.
- Doxycycline 100 mg PO daily was started at the same time.
- All meds were continued for 10 days with a switch to PO azithromycin, 500 mg.
- At six week FU the patient's CBC was near normal and no parasites were seen on blood smear.

RS is a 28-year-old male

- Presented to the ED in Washington DC in mid-April with fevers and shaking chills.
- Daily fevers X 1 week, with temperatures as high as 39.4ºC.
- Associated shaking chills, nausea, and severe headaches.
- Headaches are throbbing and feel like a squeezing around the head.
- No improvement with ibuprofen.
- No night sweats, weight loss, lymphadenopathy, myalgias, arthralgias, morning stiffness, cough, sore throat, vomiting, diarrhea, rash, or urethral discharge.
- The fevers typically occur in the evening and resolve by morning when he feels well enough to go to work during the day. All symptoms resolve with the fevers.
- Three weeks before presentation, he and his wife had visited Martha's Vineyard for a week with family then the eastern shore of Maryland by themselves for a second week. The unseasonably warm weather this spring allowed them to spend a great deal of time outdoors in both locations.
- The patients wife reports no noticeable changes in his mental status.
- Works as a lawyer in a downtown firm
- Traveled to México (Yucatan area but with some travel within southern Mexico) with his wife for their honeymoon three years ago.

RS

- VS – T 36.8^{o} C, HR 86, BP 118/60, RR 16, O_2 sat 98% RA
- Fatigued, NAD
- Skin scattered petecchiae anterior shins and feet, no other lesions or jaundice, no nail changes
- HEENT – no pallor or icterus bilat eyes, PERRLA, fundi with crisp disc margins, no vascular changes, cup:disc 1:3, CII-XII intact, neck supple, no lymphadenopathy or nuchal rigidity
- CV – normal sinus rhythm, no murmurs or gallops, pulses 2+, 1+ pitting edema to ankles bilaterally
- Lungs – vesicular breath sounds, no adventitious sounds
- Abd – normoactive bowel sounds, soft, nontender, no hepatomegaly, spleen tip palpable at the left costal margin, nontender

RS DDx

- ***Anaplasmosis***
- ***Babesiosis***
- ***Erlichiolsis***
- ***Lyme disease***
- Lymphoma
- **Malaria**
- Primary HIV
- ***Rocky Mountain Spotted Fever (RMSF)***
- Tuberculosis
- ***Tularemia***
- ***West Nile Virus***

- Consider infectious diseases but also inflammatory autoimmune disease
- Likelihood of various infections depends on potential exposures.
- **Chikungunya & dengue** would also be on the list if travel to Mexico was recent.
- It is wise to have tuberculosis and primary HIV on your differential even in the absence of an obvious exposure route.

RS Labs

- HIV neg, COVID neg, TB gold neg
- Na+ 139 mmol/L (135-142)
- K+ 4.0 mmol/L (3.5-5.0)
- Cl- 106 mmol/L (98-108)
- CO_2 23 mmol/L (23-32)
- BUN 18 mg/dl (6-23)
- Creat 0.8 mg/dl (0.5-1.2)
- ALT 36 U/L (10-50)
- AST 28 U/L (10-50)
- Alk Phos 63 U/L (35-130)
- Tot bili 0.9 mg/dl 0-1.0
- Dir bili 0.3 mg/dl (0-0.3)
- **LDH 283 U/L** (135-225)

- **Hgb 11.9** (13.5-18)
- WBC 5.4 (4-10,000)
- **PMNs 80.2%** (48-76)
- **Lymphs 7.7%** (18-41)
- Monos 5.0% (4-11)
- Eos 0.0% (0-1.5)
- Basos 0.8% (0-1.5)
- **Plt/mm^3 51,000** (150,000-450,000)
- MCV 88.0 (80-95)
- **PT 16.2**(12.2-14.6)
- PTT 34.7 sec (11.9-14.6)
- **INR 1.2 (**0.9-1.1)
- **Haptoglobin <8** (30-200)

RS DDx

- ***Anaplasmosis***
- ***Babesiosis***
- ~~***Erlichiolsis***~~
- ***Lyme disease***
- ~~Lymphoma~~
- **Malaria**
- ~~Primary HIV~~
- ~~***Rocky Mountain Spotted Fever (RMSF)***~~
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- ~~***Tularemia***~~
- ~~***West Nile Virus***~~

Clinically Important Arboviruses

	Epidemic vector	**Reservoir host(s)**	**Human Disease Syndrome**
West Nile	*Culex pipens*	Birds	+/-Febrile illness Encephalitis
Dengue	*Aedes aegypti*	Macaques (humans)	Febrile illness Hemorrhagic syndrome
Zika	*Aedes aegypti*	Primates	+/-Febrile illness Birth defects
Yellow Fever	*Aedes aegypti*	Primates	Hepatitis Hemorrhagic syndrome
Chikungunya	*Aedes spp.*	Humans	Febrile illness Polyarthralgias

West Nile Virus: Clinical Manifestations

- Incubation: 2-14 days

- 70-80% ***No symptoms***
- 20-30% of infections: West Nile Fever (WNF)
  - Abrupt onset fever, headache, myalgia, arthralgia, nausea, vomiting, diarrhea, rash
  - Most recover 3-5 days with some remaining fatigue
- <1%: West Nile Neuroinvasive Disease (WNND)
  - Encephalitis
  - Meningitis
  - Polio-like flaccid paralysis
  - Recovery may be weeks to months and 1 in 10 will die

WNV: Diagnosis

- Serology:
  - IgM in CSF or blood detectable 3-8 days after illness onset
  - WNND (neuroinvasive Disease): **CSF IgM** most sensitive (doesn't cross BBB)
    - Usually detectable by onset of CNS symptoms
    - May be detectable for up to 1 year post-infection
  - WNF (fever): serum IgM may appear only 8 days after onset
  - Paired acute/convalescent IgG: 4-fold rise
- PCR: serum or CSF
  - Poor sensitivity (low level of viremia)

Dengue

- Most important arboviral human pathogen
- Endemic in Puerto Rico, moving up to Florida
- Each of 4 serotype provides ***specific lifetime immunity***, and short-term cross-immunity to other serotypes
- All serotypes can cause severe and fatal disease
- Genetic variation within serotypes:
  - Some genetic variants within each serotype appear to be more virulent or have greater epidemic potential
- There is a vaccine given ***after*** first infection – discontinued by manufacturer. Additional vaccines coming soon?

Dengue: Clinical Manifestations

- **Symptoms:**
  - Incubation 4-7 days
  - high fever (40°C/104°F), severe headache, pain behind the eyes, myalgia, arthralgia, nausea, vomiting, lymphadenopathy, rash

- **Dengue** (1 in 4 infected people) = a combination of ≥2 clinical findings in a febrile person who traveled to or lives in a dengue-endemic area.

- **Severe dengue** = dengue with any of the following:
  - severe plasma leakage leading to shock or fluid accumulation with respiratory distress
  - severe bleeding
  - severe organ impairment such as elevated transaminases ≥1,000 IU/L, impaired consciousness, or heart impairment.

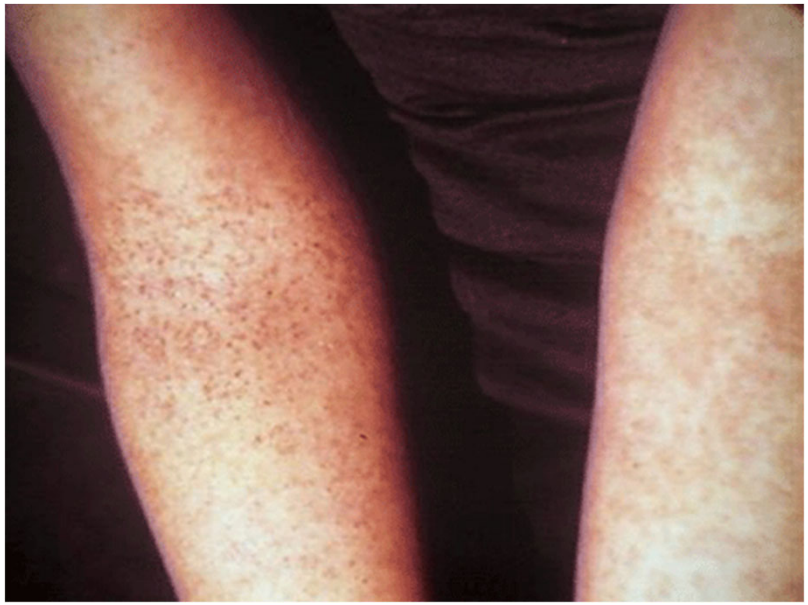
WHO definitions 2009

Dengue Hemolytic Fever: 3 Phases

1. **Febrile phase:**
   - Similar to regular DF; may develop hepatosplenomegaly
2. **Critical (plasma leak) phase:**
   - Upon defervescence or shortly after
   - Develop warning signs of plasma leak
   - Usually remain alert & lucid
   - Lasts 24-36 hours
3. **Convalescent (reabsorption) phase:**
   - End of plasma leakage
   - Stabilization of vital signs, hematocrit, increased urine output
   - **Rash**: confluent pruritic rash with small islands of unaffected skin
   - **Fluid overload** if don't decrease fluid resuscitation

Dengue: Dx & Tx

- Clinical: tourniquet test
- Acute phase: virus detection
  - Blood, CSF, tissue
  - 0-5 days post-onset of symptoms
  - **RT-PCR**
  - Antigen detection (NS1 protein)
- Serology:
  - IgM (>5 days post-onset)
  - IgG: paired acute/convalescent (4-fold rise in titer)
- **Tx Supportive**
  - Early recognition of severe dengue and anticipatory treatment
    - Volume replacement is key
    - Blood & blood product transfusion as necessary



CDC

- Inflate BP cuff between systolic & diastolic
- Leave inflated for 5 minutes
- **Positive**: > 20 petecchiae/in^2

Chikungunya Virus

- Infection may be asymptomatic
- Incubation: 2-4 days
- 2-stage disease:
  - **Acute**: fever, headache, back pain, myalgia & intense arthralgias
    - Rash in ~50%: maculopapular, diffuse hyperemia, **edema** of face & extremities
    - Resolves in ~ 3 days
  - **Chronic**: debilitating **polyarthralgias**
    - Can last months to >1 year
    - Less common in children
    - Usually peripheral joints; also spinal pain
    - Associated with **tenosynovitis** & Raynaud's syndrome
- **Diagnosis**:
  - Serology: IgM (detectable after 2 days of symptoms) or IgG (convalescent)
  - RT-PCR: initial viremic phase
- **Treatment**: symptomatic

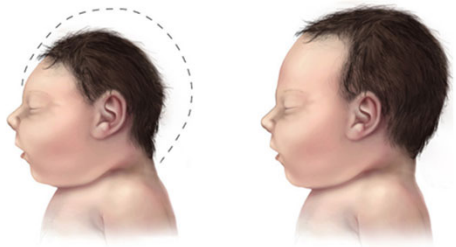
Chikungunya Virus

- **Outcome**: eventual recovery
  - Death rare but if occurs, due to multi-organ failure

- **Diagnosis**:
  - Serology: IgM (detectable after 2 days of symptoms) or IgG (convalescent)
  - RT-PCR: initial viremic phase

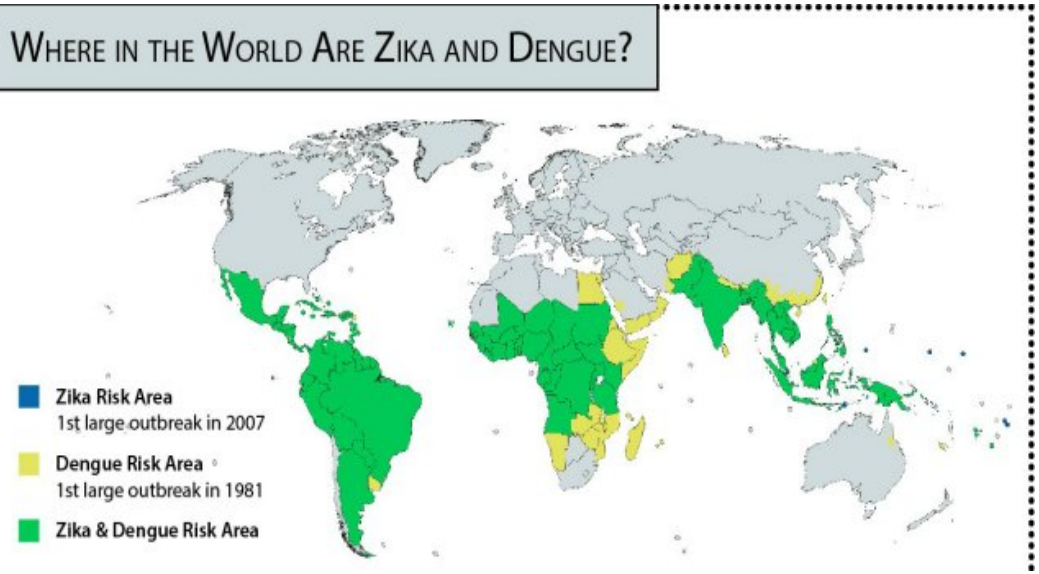
- **Treatment**: symptomatic

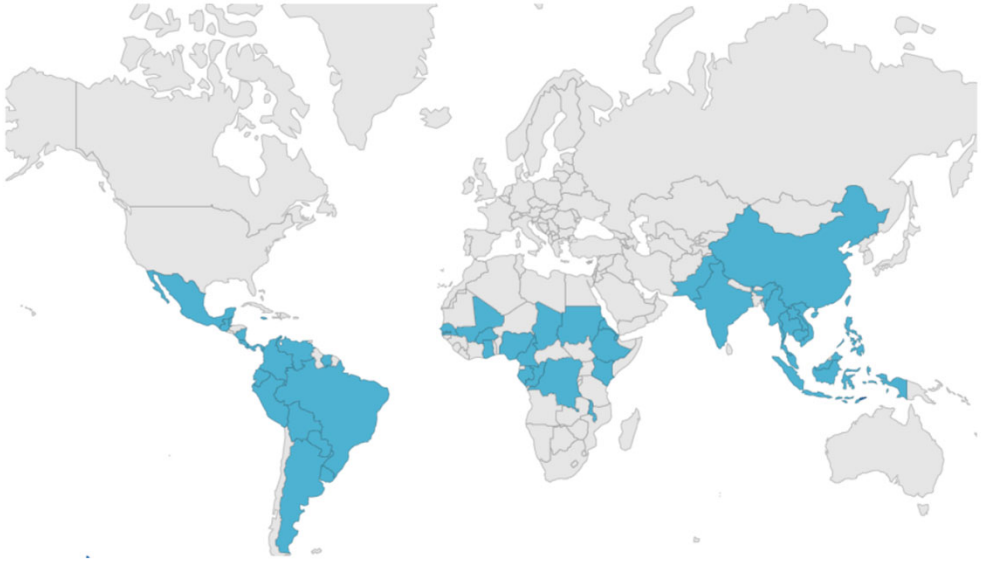
Zika



- Transmission via mosquito or sexual
- Most asymptomatic or very mild
- Acute onset of fever with maculopapular rash, arthralgia, or conjunctivitis, myalgia and headache lasting 1 week
- Guillain-Barré syndrome reported in patients following suspected Zika virus infection
- Infection during pregnancy is a cause of **microcephaly**

- **Dx** -Testing ***NOT*** routinely recommended, see CDC recommendations for testing pregnant people
- **Tx** - Supportive





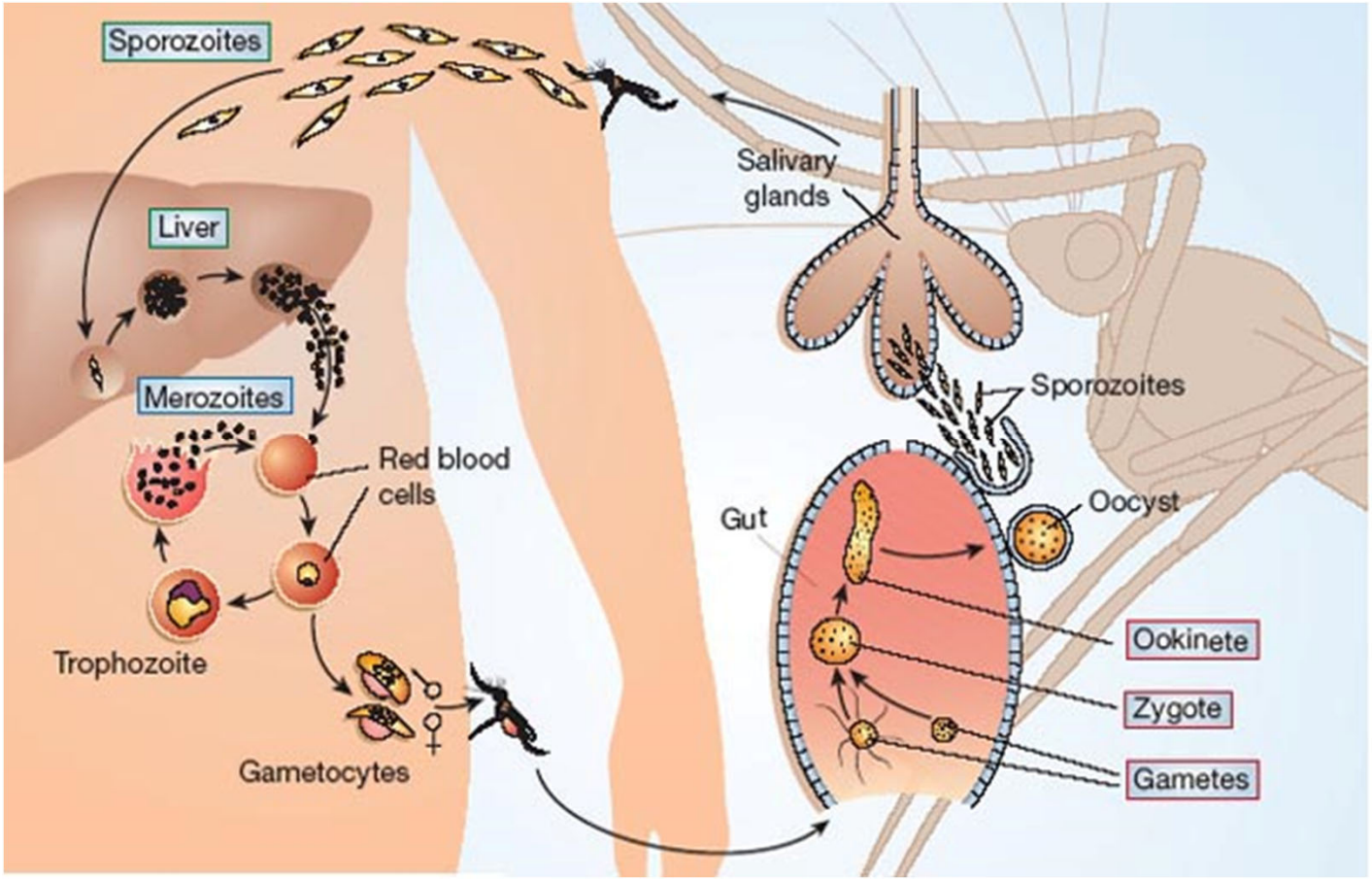
Chikungunya

CDC

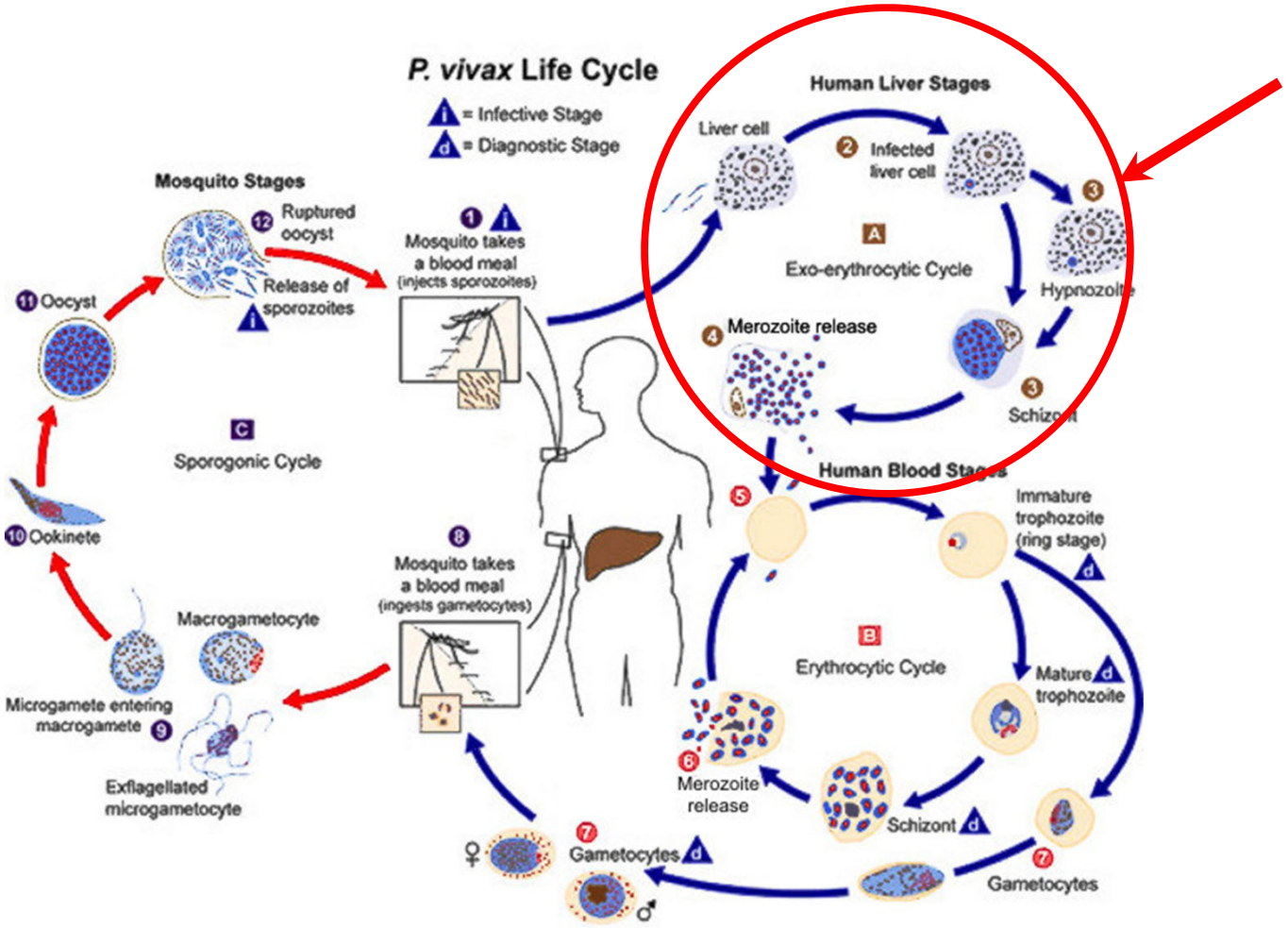
Malaria

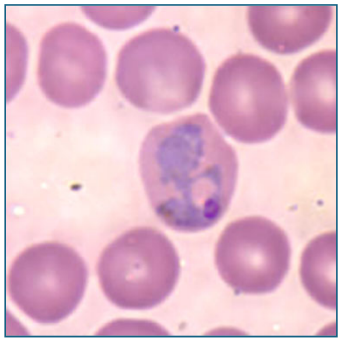
- Two main types in Central and South America:
  - *Plasmodium vivax* (75%) – uncomplicated malaria but can sequester in the liver. Periodic fevers are common
  - *Plasmodium falciparum* (25%) – more likely to lead to severe disease but does not sequester in the liver. Fevers are not predictable
- Fever paroxysms:
  - Chills → Fever → Sweats
  - Fever can be high (41^{o}C)
  - Also: headache, nausea, vomiting
  - Symptoms coincide with rupturing of RBCs

Plasmodium Life Cycle

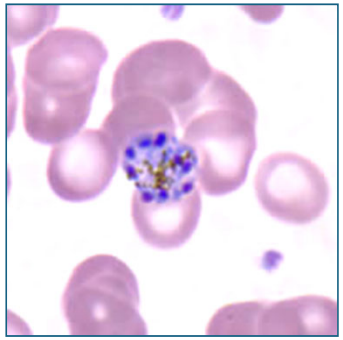


P. ovale & *P. vivax* – Hypnozoite Formation in Liver

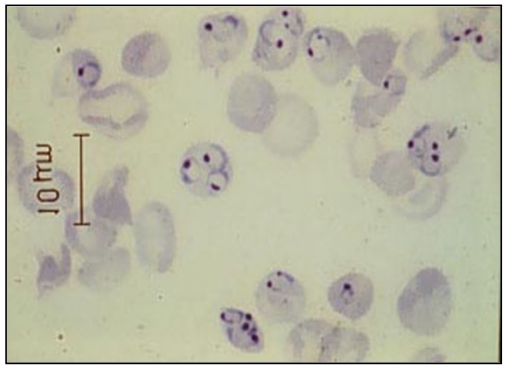


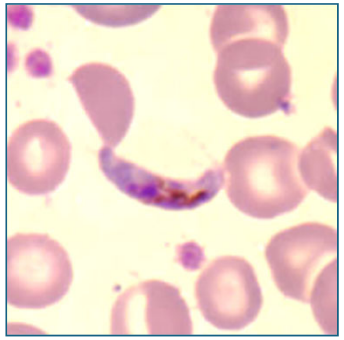


P. vivax



P. malariae





P. falciparum


MEXICO
Boundary representation is not necessarily authoritative.
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Chihuahua
COAHUILA
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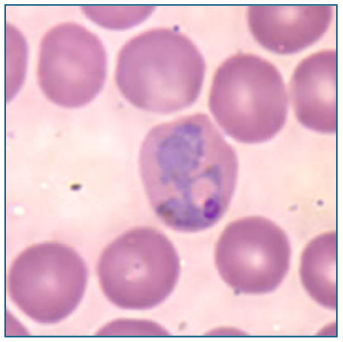
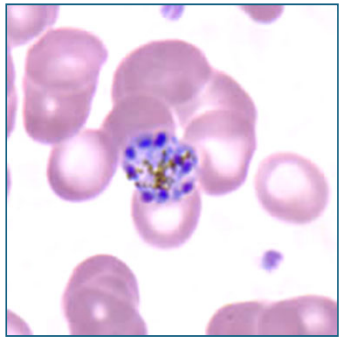
MORELOS
PUEBLA
VERACRUZ
TABASCO
BELIZE
GUERRERO
Ixtapa
CHIAPAS
OAXACA
Acapulco
GUATEMALA
HONDURAS
Chemoprophylaxis recommended
Mosquito avoidance only
No known risk for malaria transmission

CDC

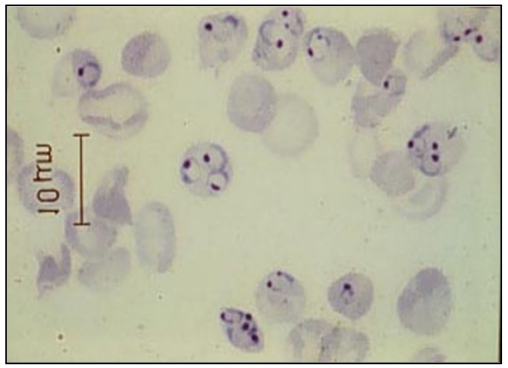


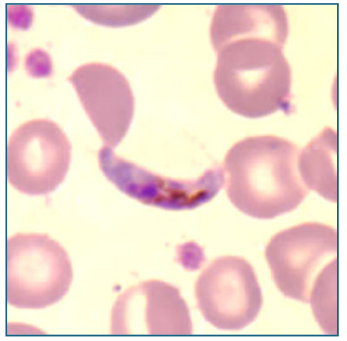
P. vivax

JT's blood smear



P. malariae





P. falciparum

JT

- Intraerythrocytic parasites on peripheral smear with few ring forms, more mature ameboid trophozoites, and pigment-containing gametocytes consistent with *P. vivax*
- Babesia & malaria are hard to differentiate on smear without a clinical history or classic findings. In the patient's smear.
  - The absence of LFT abnormalities or low blood-cell counts plus the clinical history support malaria.
- Treatment - chloroquine phosphate 600 mg base (1,000 mg salt) orally immediately, then 300 mg base (500 mg salt) orally at 6, 24, and 48 hours (total dose 1,500 mg base [2,000 mg salt]) **plus** primaquine phosphate 30 mg/day base orally for 14 days.
  - ***Check for G6PD deficiency***
- JT recovered without complications