

*Yersinia pestis* and *Borrelia burgdorferi*

Delaney McMahon

*Yersinia pestis*

# *Yersinia pestis* Characteristics

- Gram-negative
- Bacillus shaped
- Optimal growth at 25 - 28 degrees Celsius
- Fried egg appearance on blood agar



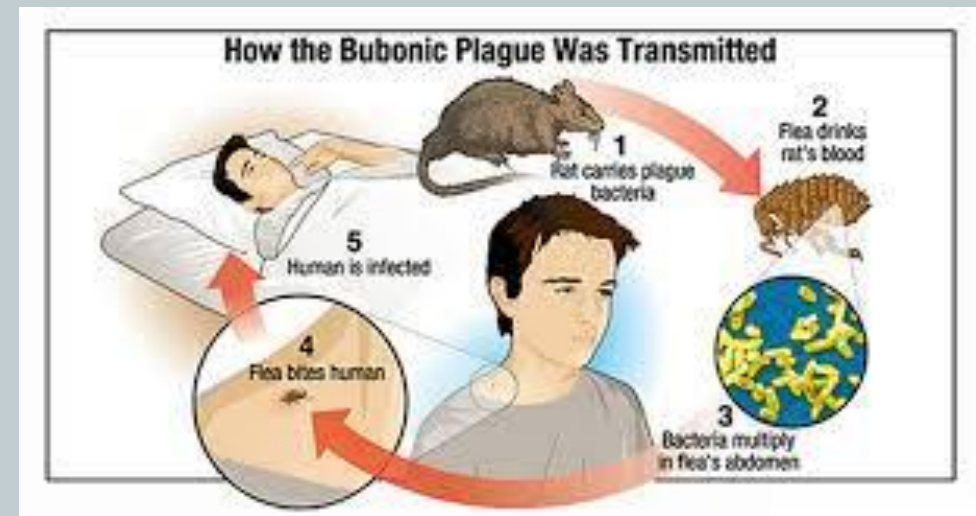
## *Yersinia pestis* and the Plague

- Caused by rodent flea bite carrying the bacterium *Yersinia pestis*
- Killed millions in Europe in the 1300's and 1500's



# Transmission to Humans

- Flea bites
  - Rodents die causing fleas to seek other blood sources (humans)
- Contact with contaminated fluid/ tissue
  - Handling infected tissues or fluids
  - Hunters
- Infectious droplets
  - Cough droplets from pneumonic person



# *Yersinia pestis* Symptoms

- 3 types of Plague: Bubonic, Septicemic, and Pneumonic



Bubonic plague



Septicemic plague



Pneumonic plague

## Bubonic Plague Symptoms

- 2–8-day incubation period
- Fever, headache, chills, weakness, swollen lymph node(s)
- Bacteria multiply in lymph nodes and spread throughout body without treatment



# Systemic Plague Symptoms

- Incubation period of days after exposure
- Fever, chills, extreme weakness, abdominal pain, shock, bleeding in skin and organs
- Skin turns black and dies on fingers, toes, and nose
- Can be caused from untreated bubonic plague





# Pneumonic Plague Symptoms

- Most serious, only form that can be spread from person to person
- Incubation period of 1-3 days
- Caused by inhalation of infection droplets or untreated bubonic or septicemic plague when bacteria spread to lungs
- Fever, headache, weakness, rapidly developing pneumonia
  - Shortness of breath, chest pain, cough, bloody/ watery mucous



Figure 2. Serial frontal chest radiographs from a patient with primary pneumonic plague obtained on three days: 2, 3, and 18.

# Plague Prognosis

- Left untreated
  - 30-60% fatality (bubonic)
  - 30-100% fatality (pneumonic)



# Plague Treatment

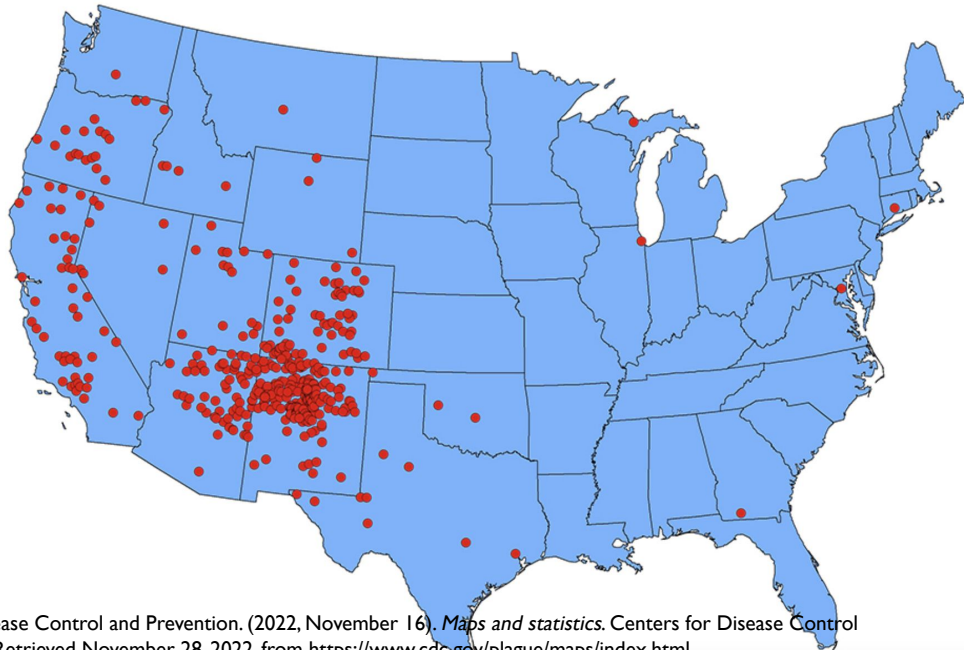
- Antibiotics
  - Gentamicin and fluoroquinolones
  - 10–14-day treatment
  - Intramuscular injection of antibiotics until patient improves, then oral medication
- Prognosis with Treatment
  - Full recovery



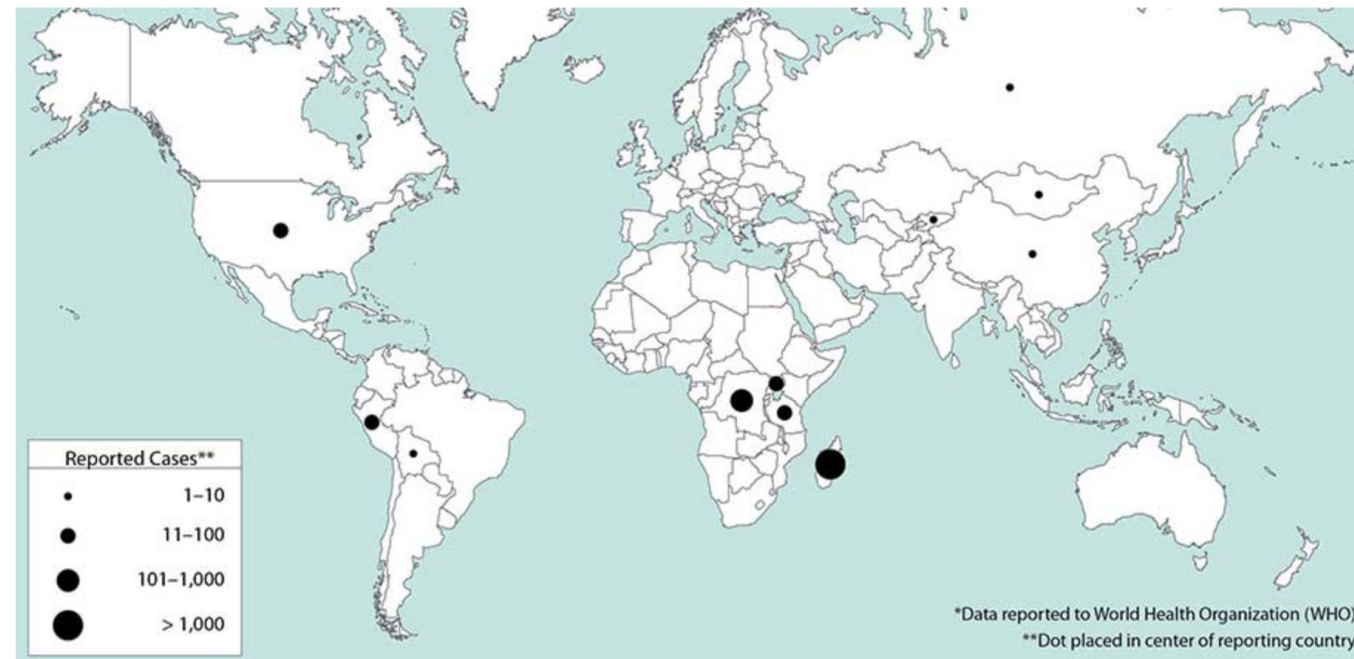
# Plague Current Importance

- Human plague infections occur in rural areas of western United States
- More cases are found in parts of Africa and Asia
- The last epidemic in the US was in 1924-1925
- Only 496 cases have been reported since 1970

Reported Cases of Human Plague - United States, 1970-2020



Reported\* Plague Cases by Country, 2013-2018



*Borrelia burgdorferi*

## *Borrelia burgdorferi* Characteristics

- Gram-negative
- Spiral shaped
- Irregularly coiled
- 10-20  $\mu\text{m}$  length and 0.2-0.5  $\mu\text{m}$  in width



# *Borrelia burgdorferi* Disease

- Lyme Disease
  - Most common vector borne disease in the United States
  - Transmitted through infected ticks



# Immediate Lyme Disease Symptoms

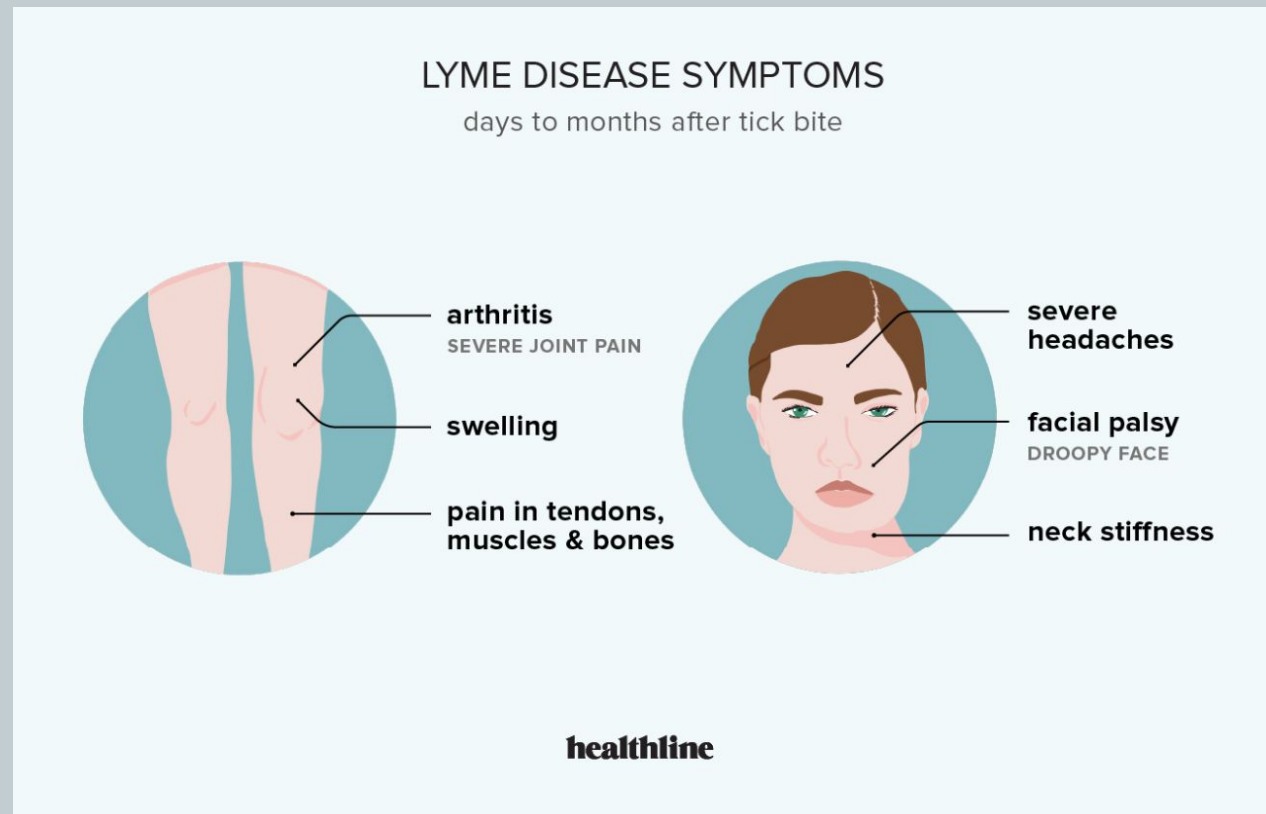
- Fever, headache, fatigue, and skin rash (Erythema migrans)
  - Erythema migrans: 70-80% of infected people
  - Site of tick bite after 3-30 days (7 average)
  - Warm to touch, not itchy
  - Bullseye shape





# Long-Term Immediate Lyme Disease Symptoms

- Swollen knee, facial palsy (loss of muscle tone/ droop on face)
- Severe headaches
- Arthritis
- Inflammation of brain or spinal cord
- Shooting pains in hands or feet



# Lyme Disease Prognosis

- Most cases can be cured in 2-4 weeks of oral medication returning to their normal state of health
  - Post treatment: short term memory, fatigue, and cognitive problems
- When diagnosis/ treatment is delayed, prognosis worsens
  - 20% or higher report neurological symptoms
  - Memory loss, focus and concentration issues finding words, decrease in visual clarity
  - No cure for persistent symptoms of Lyme disease

# Lyme Disease Treatment

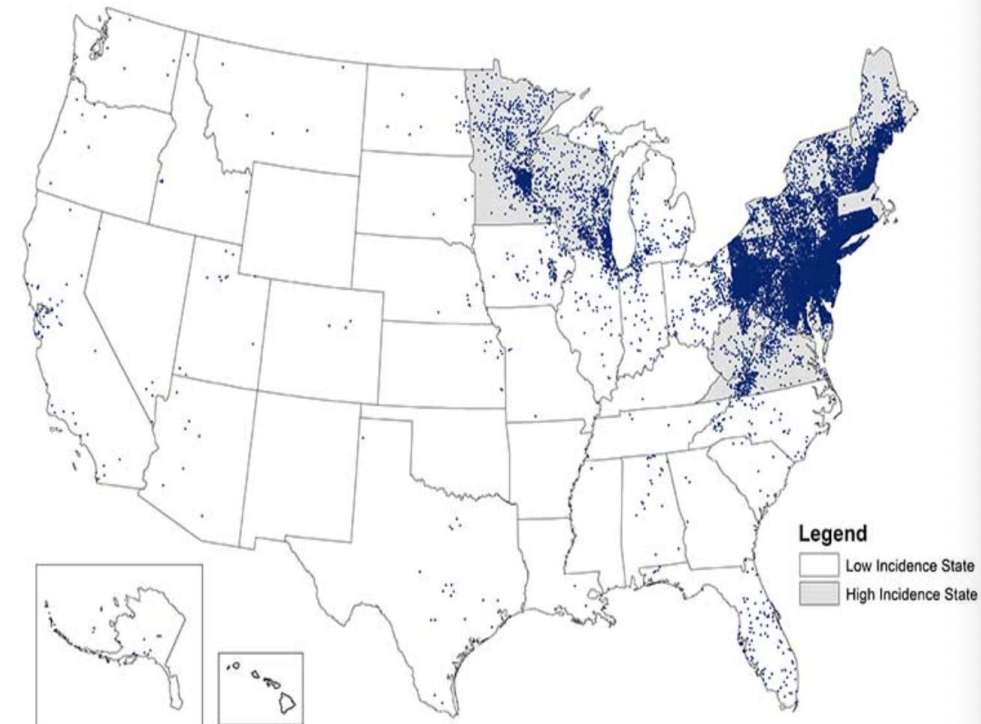
- Antibiotics: doxycycline and amoxicillin
  - Mainly oral, but when disease is more progressed, intravenous is required
  - Stop growth of bacteria or disrupt cell wall and kill them



# Lyme Disease Current Importance

- Most common vector-borne disease in the United States
- Approximately 476,000 Americans are diagnosed and treated each year

Reported Cases of Lyme Disease — United States, 2018\*



# QUESTIONS

