HEM-210

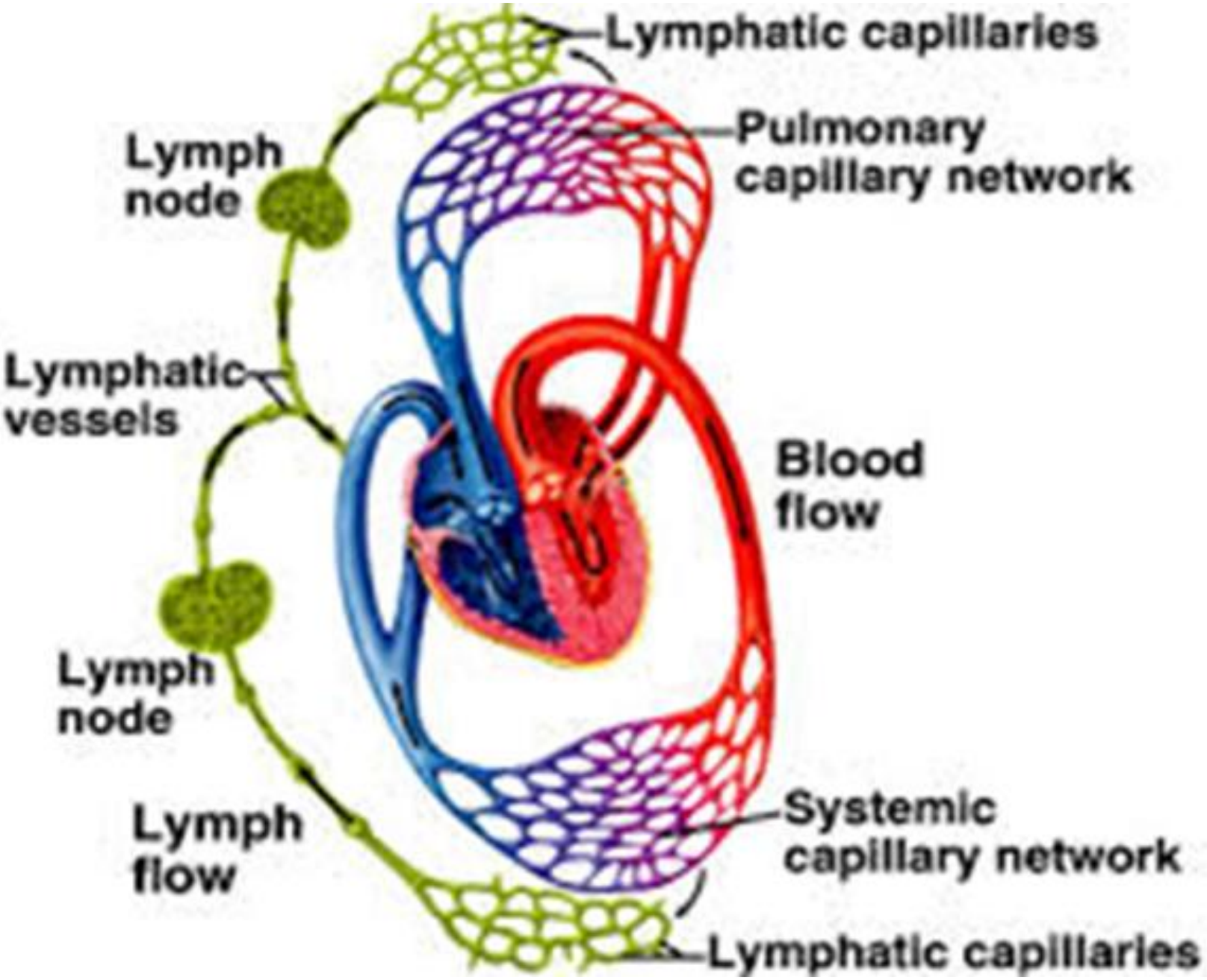
Bacterial lymphadenitis and blood related infections

Microbiology & Immunology department

Objectives

By the end of this lecture, the student will be able to:

- Memorize the general features and major virulence factors of some important bacteria causing lymphadenitis.
- Demonstrate laboratory diagnosis of some important bacteria causing lymphadenitis.
- List etiologies of bacteremia and septicemia.
- Demonstrate laboratory diagnosis of bacteremia and septicemia.
- Memorize infection causes of fever of unknown origin.


Lymphatic capillaries
Pulmonary capillary network
Lymph node
Lymphatic vessels
Blood flow
Lymph node
Lymph flow
Systemic capillary network
Lymphatic capillaries

Important bacteria causing lymphadenitis

- *Staphylococci*
- *Bartonella*
- *Francisella tularensis*
- *Streptococci*
- *Mycobacterium*
- *Yersinia pestis*
- *Brucella*
- *Treponema pallidum*

BRUCELLA

Distinguishing Features

- Small gram-negative rods, aerobic
- Facultative intracellular
- Zoonosis (infection transmissible from vertebrate animals to humans)
- Culture is hazardous
- Potential bioterrorism agent

Reservoir— domestic livestock.

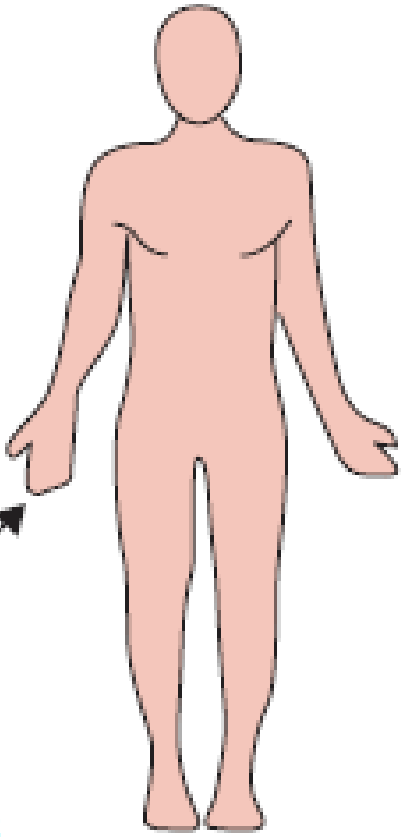
Species of Medical Importance

- *Brucella abortus*: cattle
- *Brucella melitensis:* goats
- *Brucella suis:* pigs
- *Brucella canis*: dogs

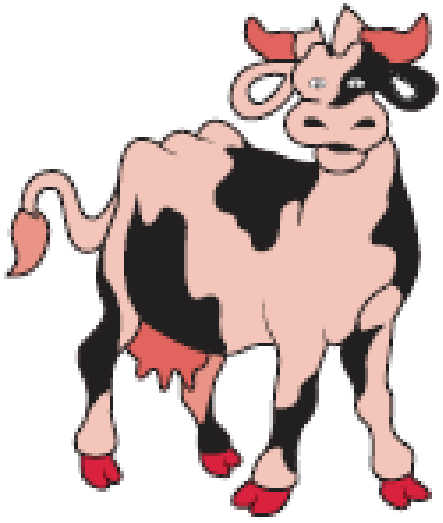
Transmission

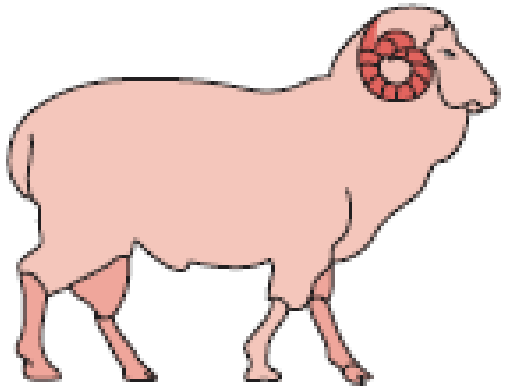
- **Unpasteurized dairy products**
- **Direct contact with the animal e.g.** work in slaughterhouse.

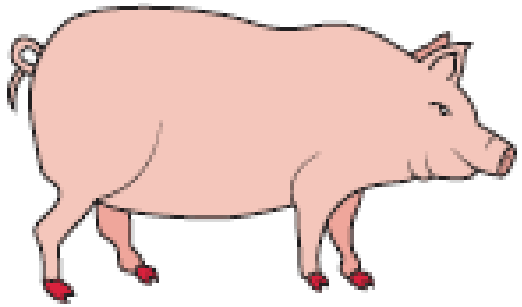
Through ingestion of contaminated milk and milk products



Through handling of animals like cows, pigs, and goats



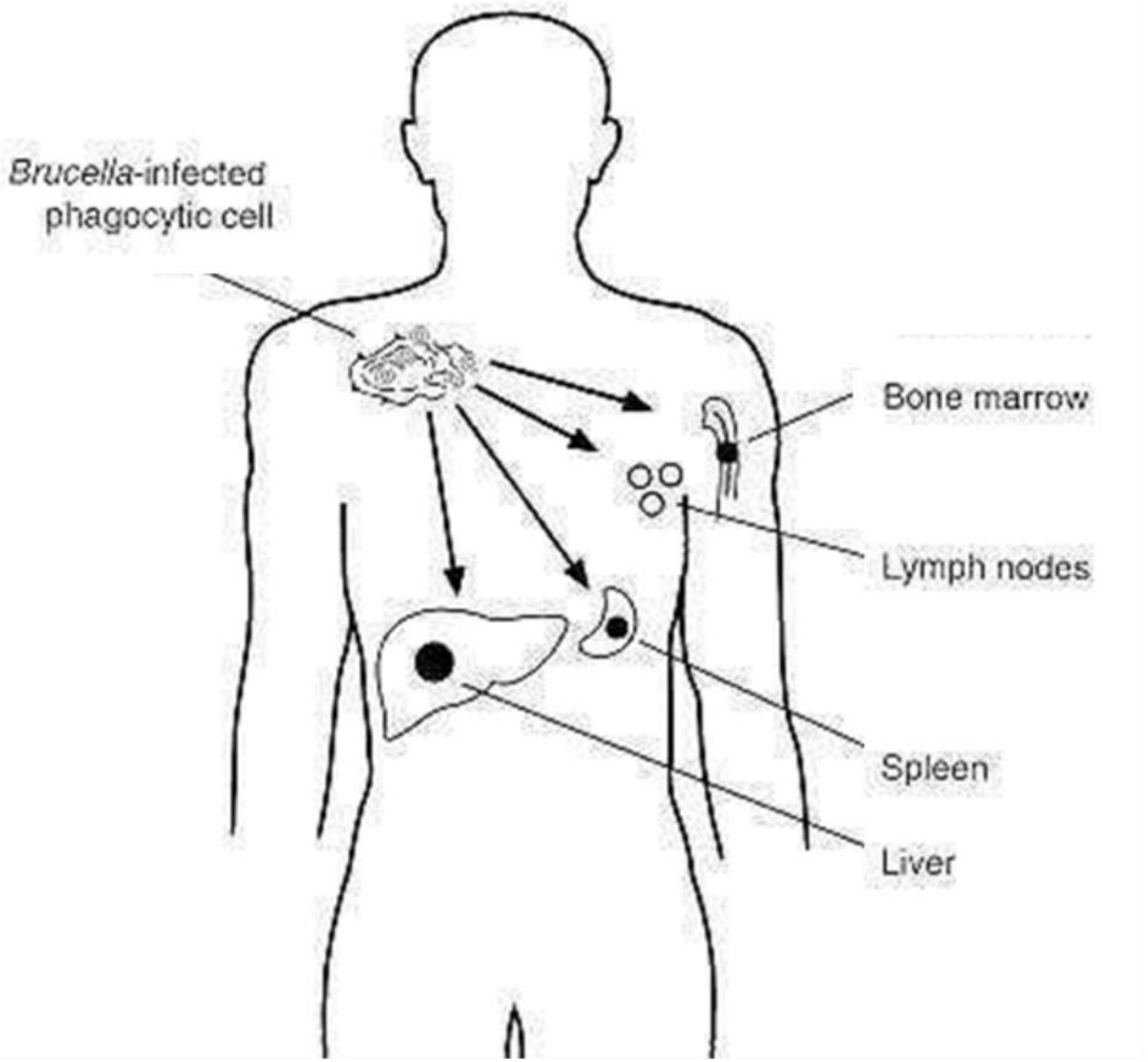




Pathogenesis

- **Endotoxin**
- **Facultative intracellular parasite** → the organism causes **septicemia** then localizes in **macrophages** of the RES, reticuloendothelial system) causing **Granulomatous response** with central necrosis.

Spread of Brucella in the body

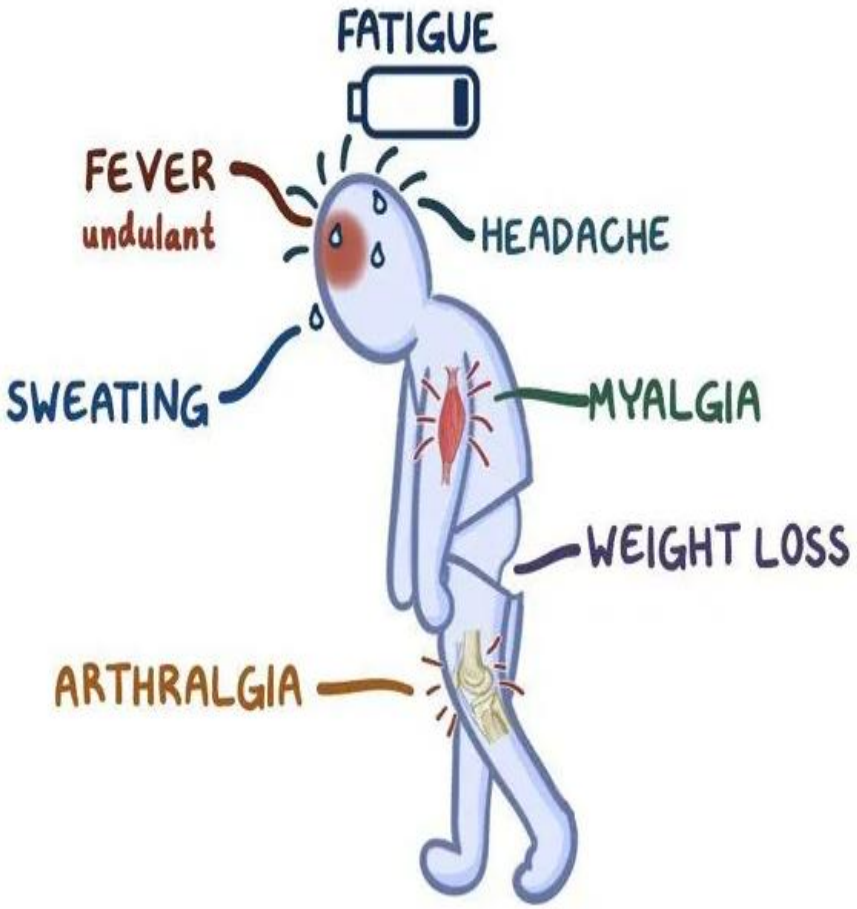


Disease --Brucellosis (undulant fever)

- Acute septicemia.
- Undulant fever (Temperature rises gradually and falls like a wave over days to weeks).
- Influenza-like symptoms, including arthralgia, anorexia, myalgia, back pain.
- Profuse sweating.
- Hepatomegaly, splenomegaly and lymphadenopathy.

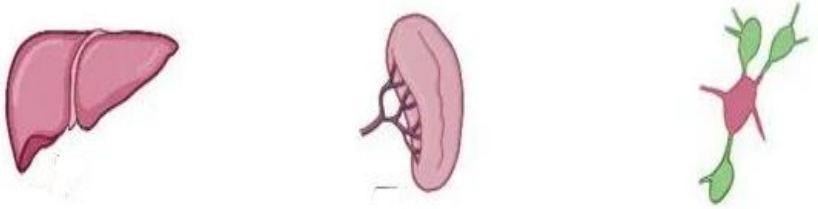
SYMPTOMS

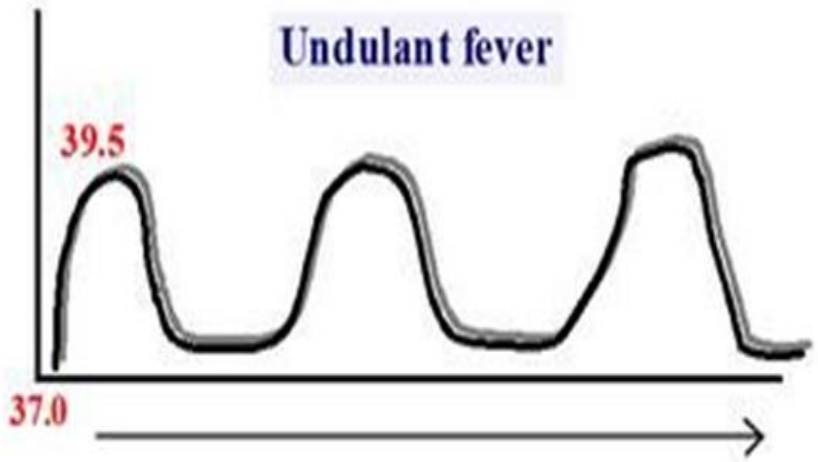
* NON-SPECIFIC & INFLUENZA-LIKE



* PHYSICAL EXAM

HEPATOMEGALY SPLENOMEGALY LYMPHADENOPATHY



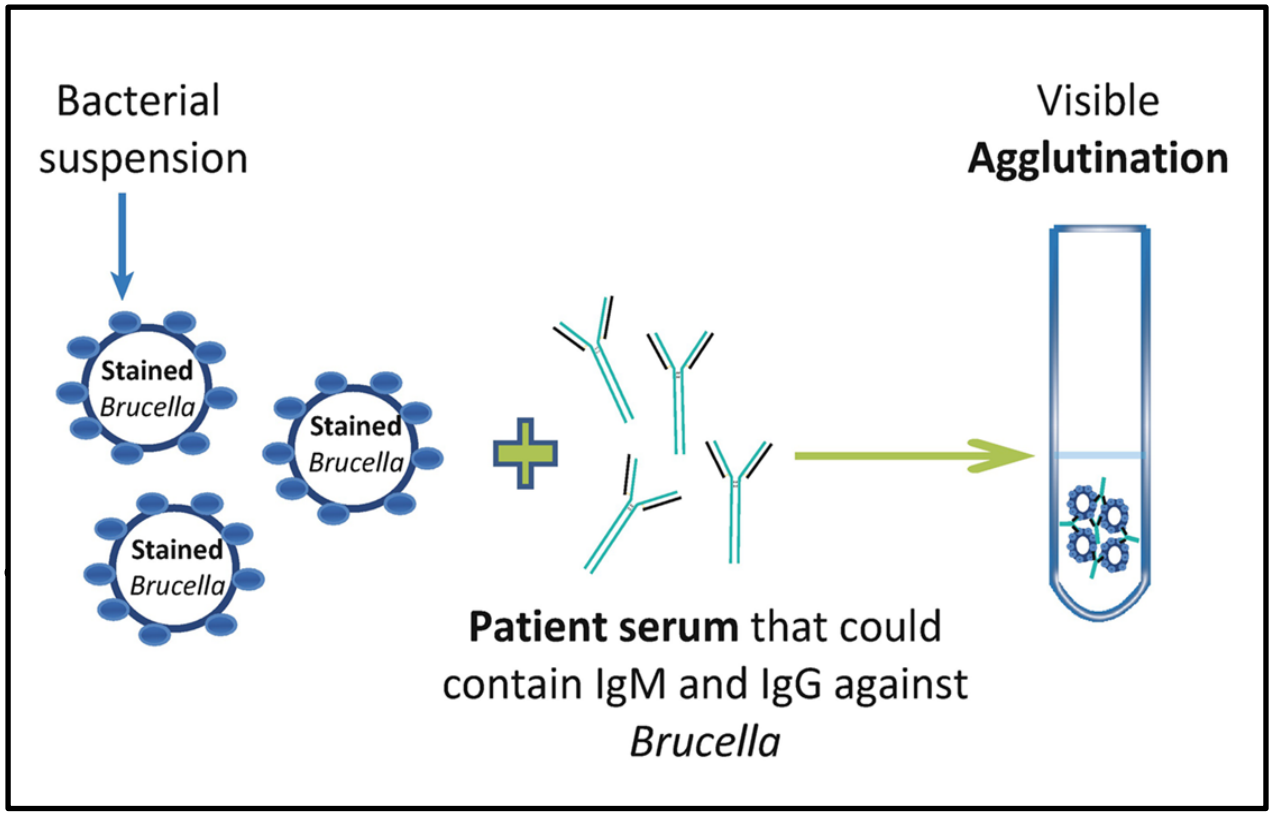


Diagnosis:

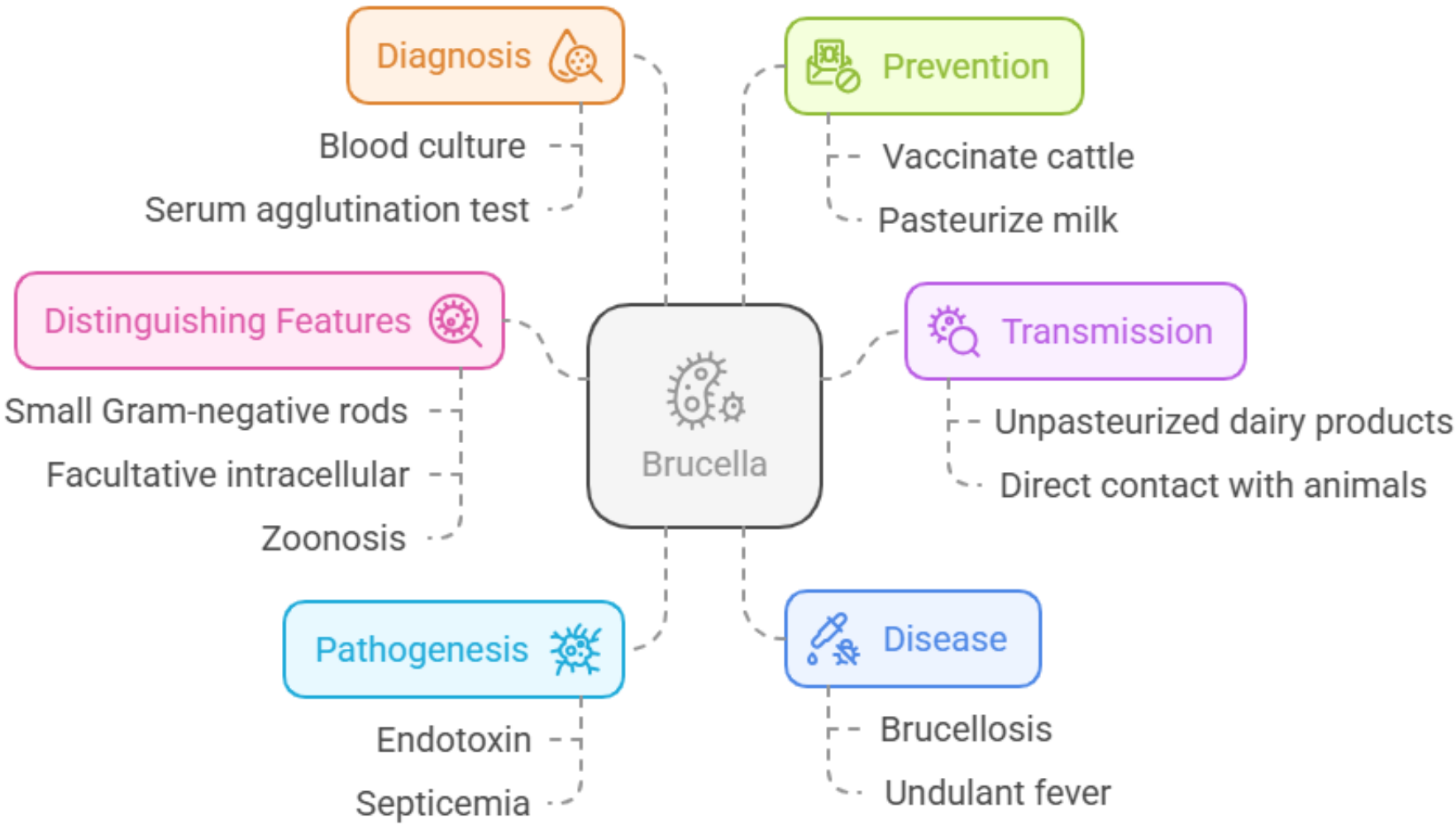
- **Blood culture is diagnostic but hazardous.**
- **Serum agglutination test**→ fourfold increase in titer of antibodies against *Brucella* >1:160 is considered positive

Prevention

- Vaccinate cattle.
- Pasteurize milk, especially goat milk.



Brucella: Characteristics, Transmission, and Prevention



Yersinia pestis

Features

- Small gram-negative rods with bipolar staining.
- Facultative intracellular parasite.
- Coagulase positive.

Reservoir

- **Zoonosis**
- **rodents** (e.g., rats, chipmunks, squirrels)
- **Potential bio warfare agent**

Transmission

- Wild rodents, **flea bite** (rat to man) → sylvatic plague
- Human-to-human transmission by **respiratory droplets.**

Pathogenesis

- **Coagulase** via contaminated mouth parts of flea.
- **Endotoxin** and **exotoxin** production.
- **Envelope antigen (F-1) inhibits phagocytosis.**
- Suppression of cytokine production and resistance to phagocytic killing.

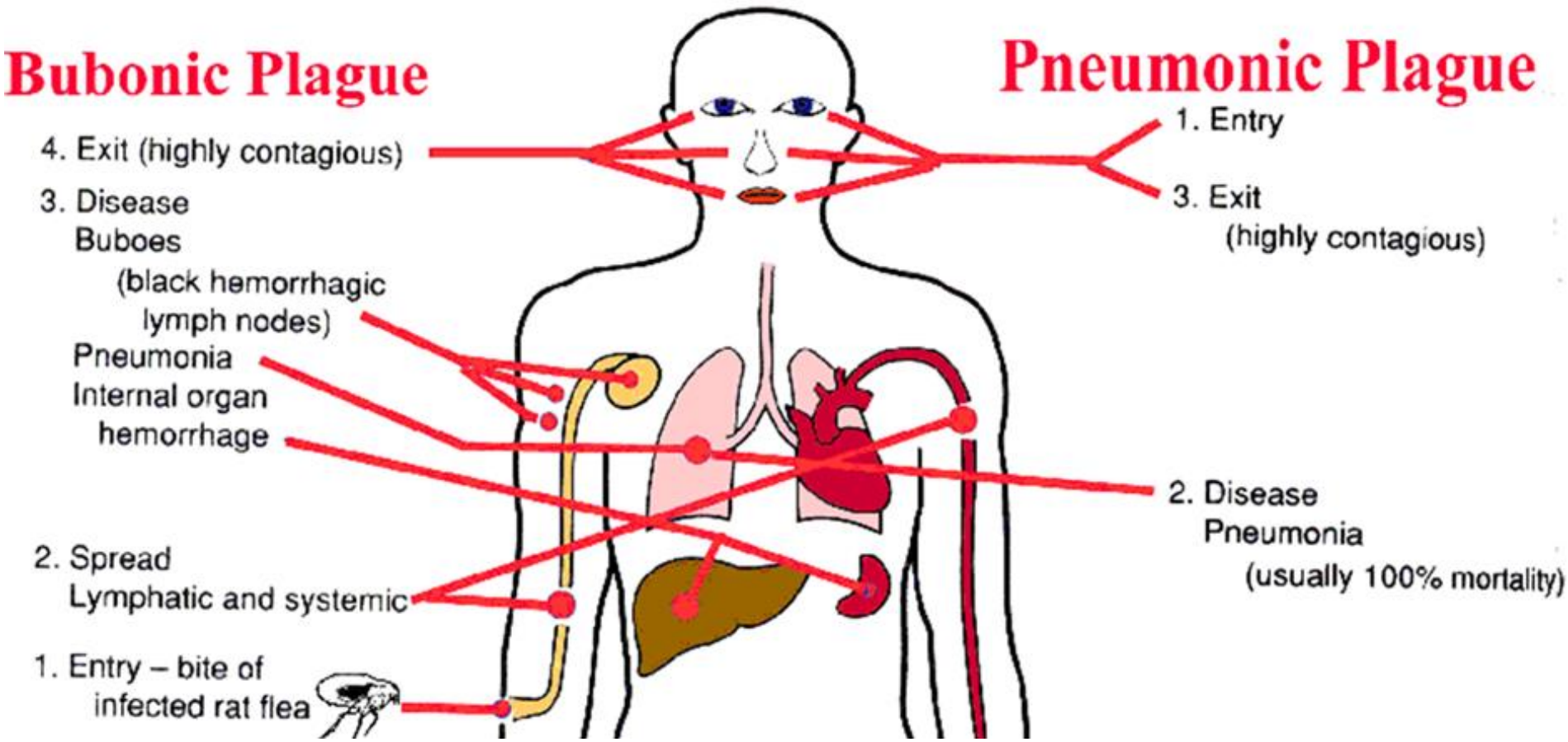
Disease(s)

Bubonic plague

- Flea bites an infected animal and then bites a human
- Symptoms
  - Rapidly increasing **fever**
  - **Regional buboes** (swollen inflamed lymph nodes)
  - Leads to **septicemia** and death if untreated

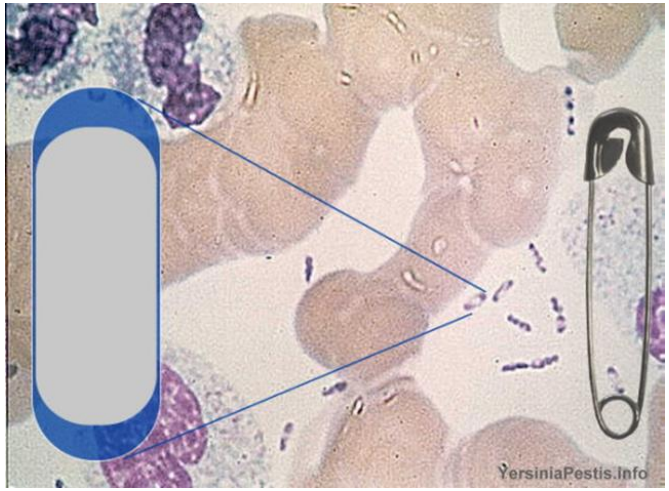
Pneumonic plague

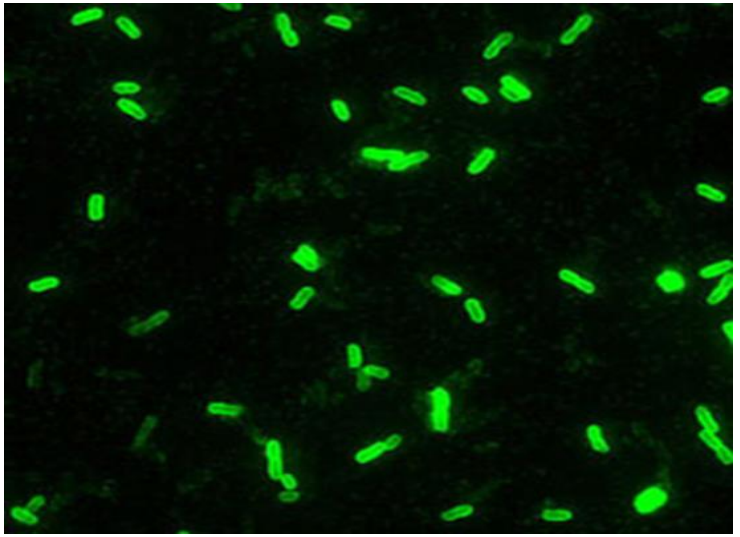
- Rapidly progressing pneumonia
- Arises from septic pulmonary emboli in bubonic plague or inhalation of organisms from infected individual
- Highly contagious.


Bubonic Plague
4. Exit (highly contagious)
3. Disease
Buboes
(black hemorrhagic lymph nodes)
Pneumonia
Internal organ hemorrhage
2. Spread
Lymphatic and systemic
1. Entry – bite of infected rat flea
Pneumonic Plague
1. Entry
3. Exit
(highly contagious)
2. Disease
Pneumonia
(usually 100% mortality)

Diagnosis

- Clinical specimens (lymph node aspirate, sputum or blood) and **cultures** (blood agar or MacConkey) **are hazardous.**
- **Serodiagnosis** or direct **immunofluorescence**
- • **Bipolar staining of bacteria (appearance of —closed safety pin)**

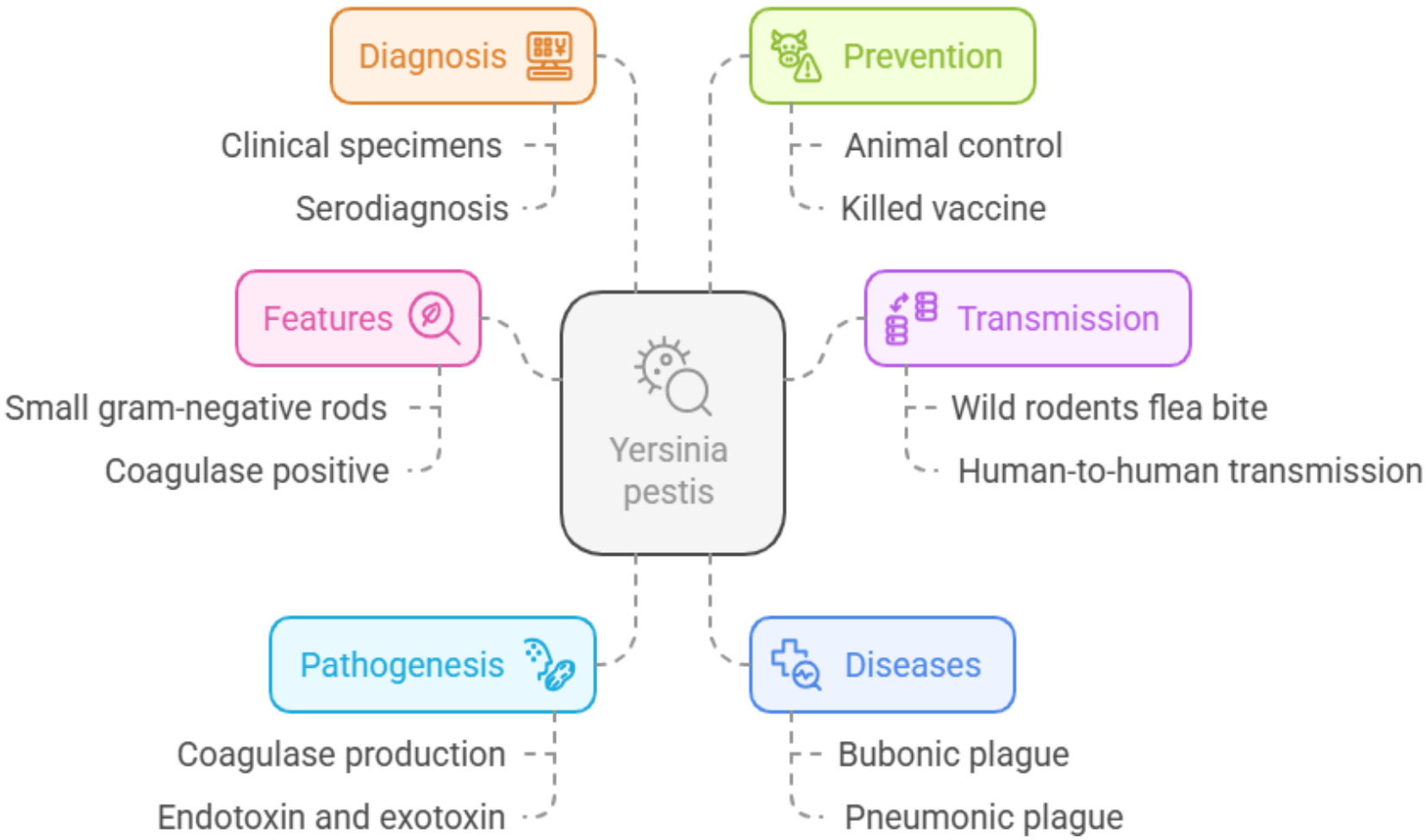




Prevention

- Animal control; avoid sick and dead animals.
- **Killed vaccine** (military)

Yersinia pestis: Features, Transmission, and Disease Impact



Bartonella henselae

Characteristics

Gram-negative rods

Reservoir/Transmission

Cats and dogs/ bites, scratches, fleas

Disease

- **Cat scratch fever**; lymphadenopathy with stellate microabscesses
- **Bacillary angiomatosis** in AIDS patients (red-purple papules that bleed easily)


Cat bite or scratch.
Development of skin lesion in about 50% of patients.
Lymph nodes are enlarged.
DAY 1
1 WEEK
1 - 2 WEEKS

Francisella tularensis

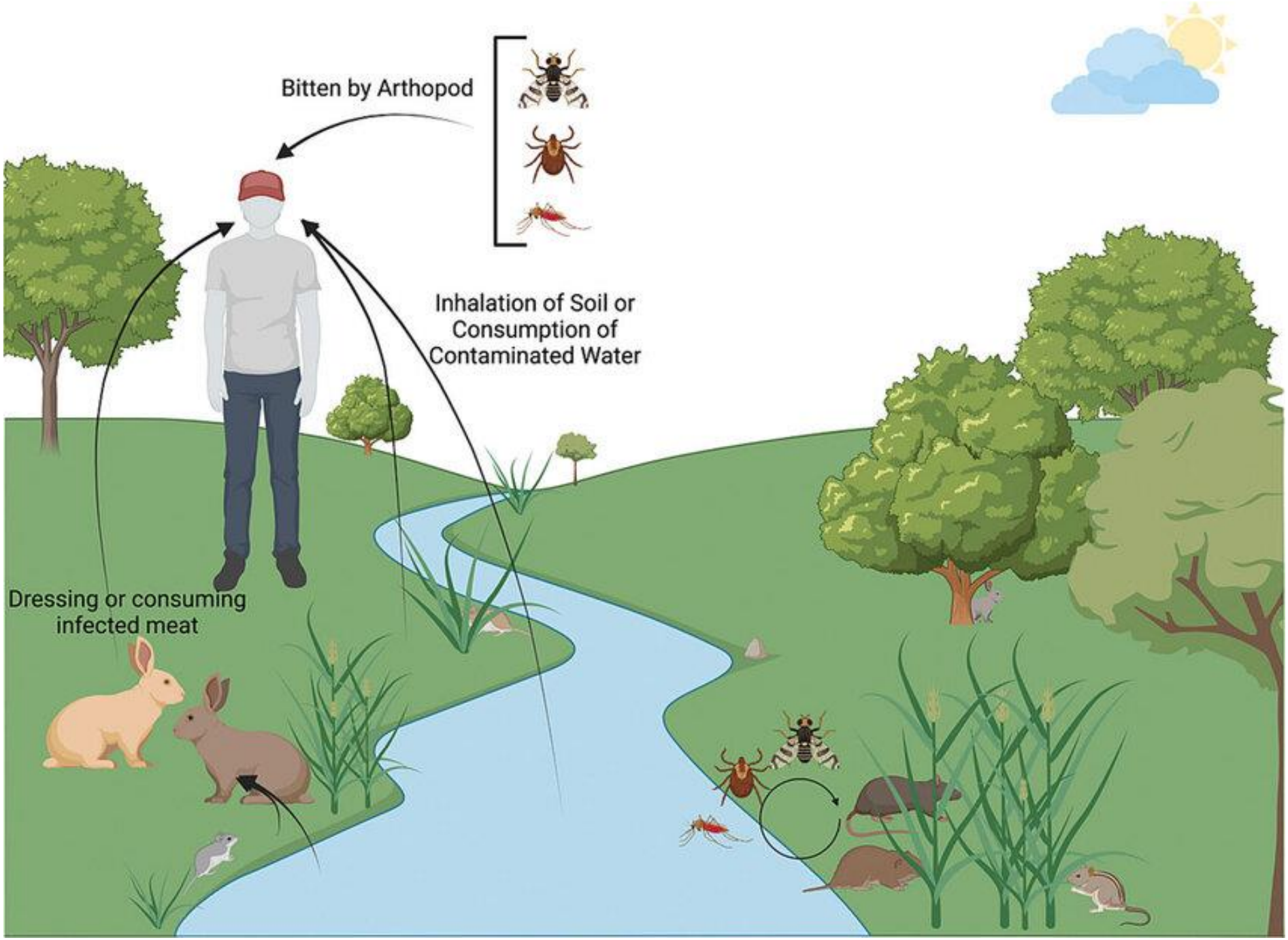
Distinguishing Features

- Small gram-negative rod
- **Facultative intracellular pathogen**
- **Potential bio warfare agent**
- **Zoonosis**

Reservoir—many species of wild **animals**, especially rabbits, deer, and rodents

Transmission and diseases:

- **Tick bite** → **ulceroglandular** disease, characterized by **fever**, ulcer at bite site, and regional lymph node enlargement and necrosis
- **Traumatic implantation** while skinning rabbits → ulceroglandular disease
- **Aerosols** (skinning rabbits) → pneumonia
- **Ingestion** (of undercooked, infected meat or contaminated water) produces typhoidal tularemia (hepatosplenomegaly).


Bitten by Arthopod
Inhalation of Soil or
Consumption of
Contaminated Water
Dressing or consuming
infected meat

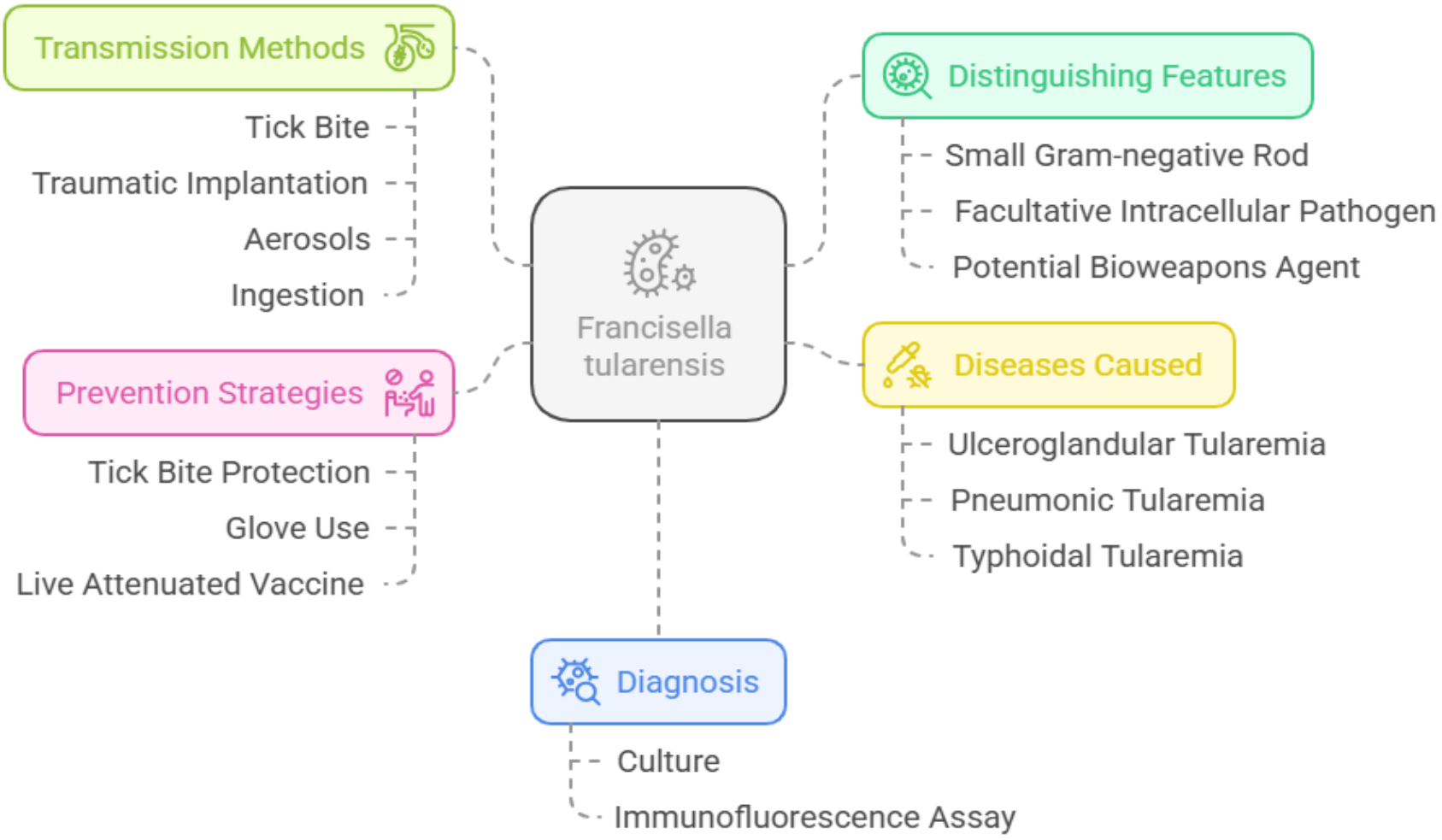
Diagnosis:

- Culture is diagnostic but hazardous
- Immunofluorescence assay for Francisella antibodies.

Prevention:

- Protection against tick bites.
- Glove use while butchering rabbits.
- Live, attenuated vaccine (for those at high risk).

Francisella tularensis: Characteristics and Management



Bloodstream infection (BSI)

Bacteremia, septicemia, fungemia or viremia.

Bacteremia:

- it is simple presence of bacteria in bloodstream with no symptoms or with mild fever.

Septicemia:

- It is the presence and multiplication of bacteria in bloodstream with clinical symptoms
- It is a life-threatening condition.

General risk factors for BSI

- Factors impairing the immune system including malignancies, chronic diseases as diabetes mellitus…etc.
- Factors facilitating pathogen entry as catheters, prosthetic implants and IV drug use

- **Risk factors for common BSI pathogens**

Pathogen	Risk factors
Staphylococcus aureus	• Skin & soft tissue infections • Osteomyelitis
Coagulase negative *Staphylococci*	• Prosthetic implants • Central venous catheters
Enterobacteriaceae (commonly *E. coli)*	• Urinary tract infection • Intra-abdominal pathology
Pseudomonas aeruginosa	• Prolonged hospitalization
Enterococci	• Colorectal cancer • Urinary tract infections

Blood borne pathogens

Definition: A pathogen that is carried in the bloodstream and spread through contact with blood or other body fluids.

Examples:

Pathogens of primary concern	Others
• HIV • Hepatitis viruses B and C	· CMV · EBV · Human T cell lymphotropic retrovirus (HTLV) · *Treponema pallidum*

Infections causing fever of unknown origin

Definition: temperature of >38.3°C recorded on multiple occasions that lasts for >3 weeks with no clear etiology despite investigations.

Common infections causing of fever of unknown origin:

1. Tuberculosis
2. Brucellosis
3. Q fever
4. Sub-acute bacterial endocarditis
5. Complicated urinary tract infection
6. Abscess

Questions

Case (1)

A 57-year-old woman comes to the physician 6 weeks after returning from a trip to Greece. She had fever of 38.8° C that rises during the day and decreases at night. She said that she feels tired and has lost weight. She mentioned she enjoyed her vacation and trying local specialties, including fresh goat cheese. Her physical examination is notable for hepatosplenomegaly and generalized lymphadenopathy.

Which of the following organisms is most likely responsible for this patient's symptoms?

(A) Bartonella henselae

(B) Brucella melitensis

(C) Pasteurella multocida

(D) Francisella tularensis

Case (2)

A 3-year-old girl is brought to the emergency department because she is feeling sick and has had a temperature of 38.9° C for 3 days. The intern notices a shallow, healing laceration on the girl's right calf with an erythematous papule in the same area. On questioning, her brother states that a cat may have scratched the toddler because he "saw her playing with a stray."

Which of the following organisms is the most likely cause of this illness?

(A) Bartonella henselae

(B) Borrelia burgdorferi

(C) Eikenella corrodens

(D) Pasteurella multocida


THANK
YOU