

عن أسامة بن زيد: أن النبي صلى الله عليه وسلم ذكر
الطاعون فقال: «بقية رجز أو عذاب أرسل على طائفة من
بني إسرائيل، فإذا وقع بأرض وأنتم بها فلا تخرجوا منها،
وإذا وقع بأرض ولستم بها فلا تهبطوا عليها»

Yersinia pestis

HLS Module

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Dr. Mohammad Odaibat

Mutah university

Faculty of Medicine

General Goal: To know the

- Cause of plague
- Most common modes of transmission
- Major manifestations
- Major complications of this disease

The student should be able to:

1. Identify the cause of this disease (hint: safety pin appearance).
2. Identify what type of pathogen this bacterium is [ex. extracellular, intracellular (what cell does it dwell in)].
3. Tell the risk groups and how to avoid getting infected with this pathogen

History

- There have been three major pandemics of the plague.
 - Mid 6th century, mid 14th century, early 20th century
- The most well known plague pandemic was in the mid 14th century in Europe known as the Black Death
 - The plague came from Asia and spread through Europe.
 - It killed more than half of the population.
 - People didn't understand how the plague worked which allowed it to spread .



The most well known plague pandemic was in the mid 14th century in Europe known as the Black Death

Etiology

- **Plaque is caused by *Yersinia pestis***
- ***Y. pestis* Belongs to the Enterobacteriaceae**
- **Staining pattern:**
 - Gram-negative rods (0.5 - 0.8 x 1- 3 μm)
 - Giemsa stain: Bipolar staining



safety pin

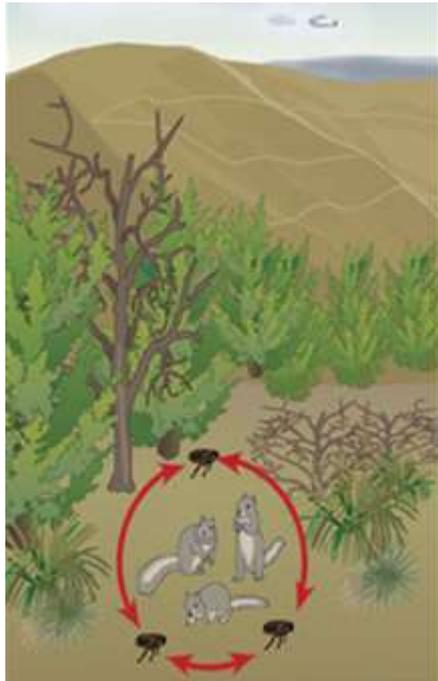
Infection cycle

Sylvatic cycle: means occurring in or affecting wild animals

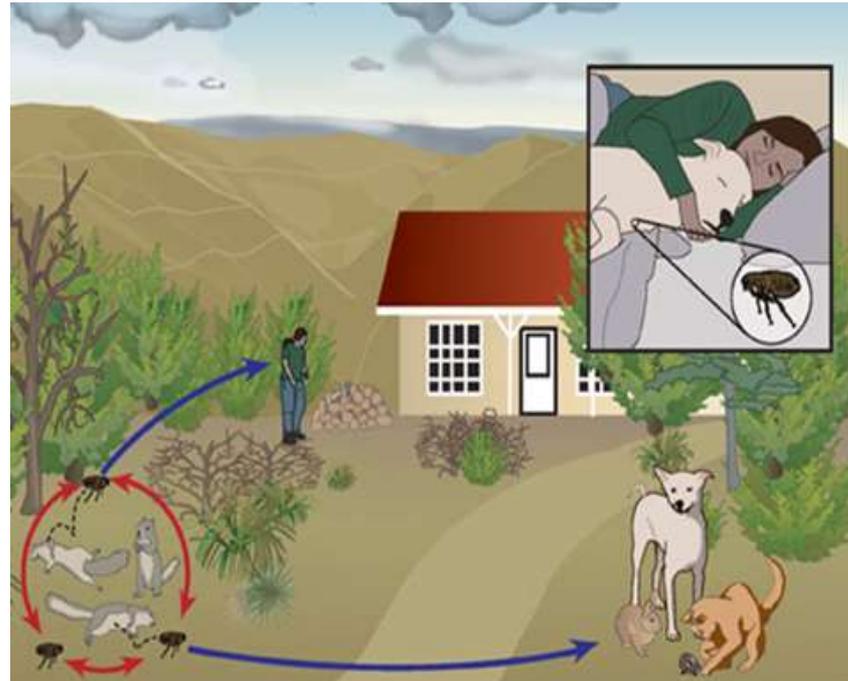
Enzootic: means Endemic in animals

Y. pestis infects animals and human in two cycles

1. The **sylvatic transmission cycle**, also **enzootic**
2. The domestic" or "urban" cycle, in which the pathogen cycles between vectors and non-wild, urban, or domestic animals



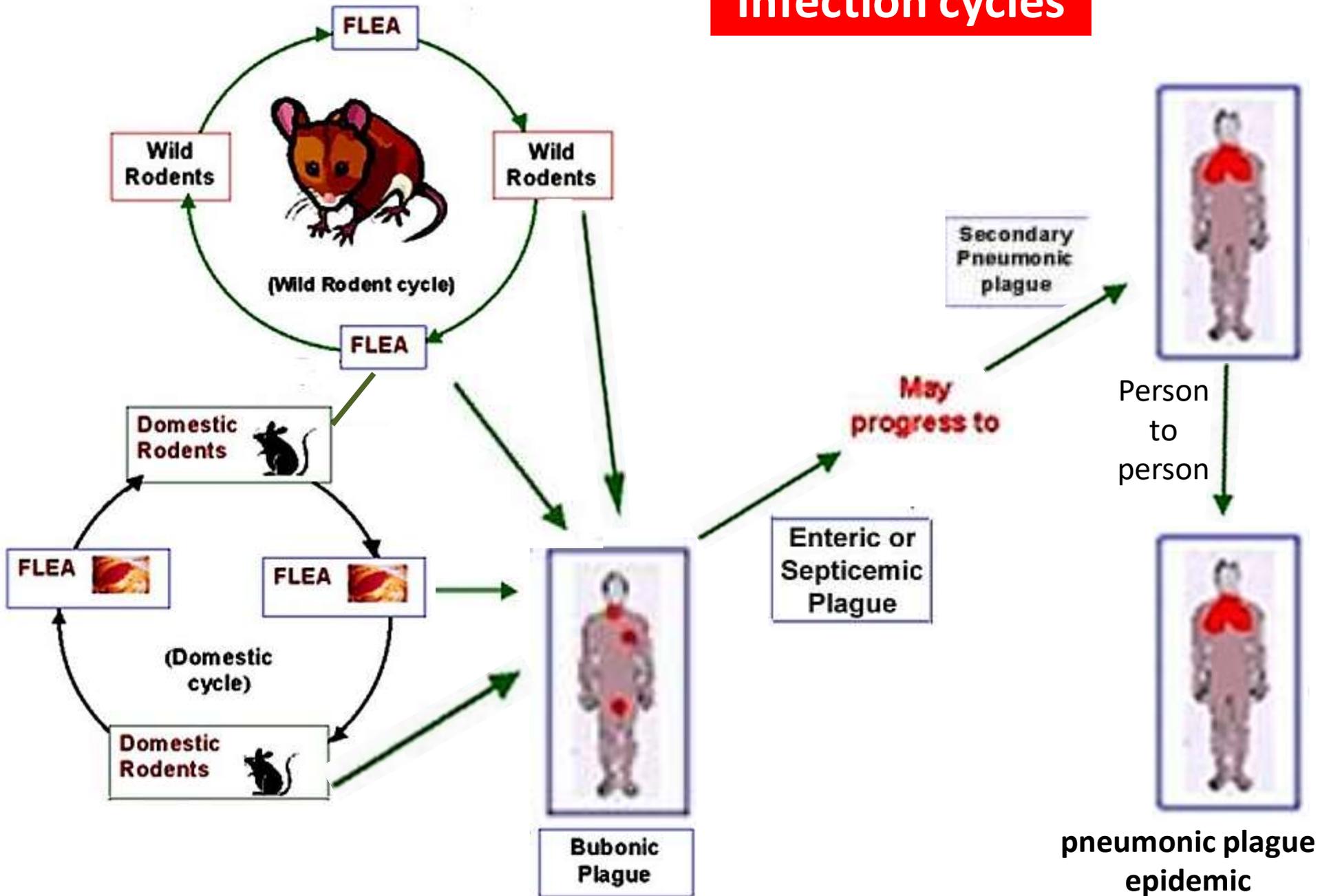
sylvatic transmission



Domestic" or "urban" cycle

sylvatic transmission cycle

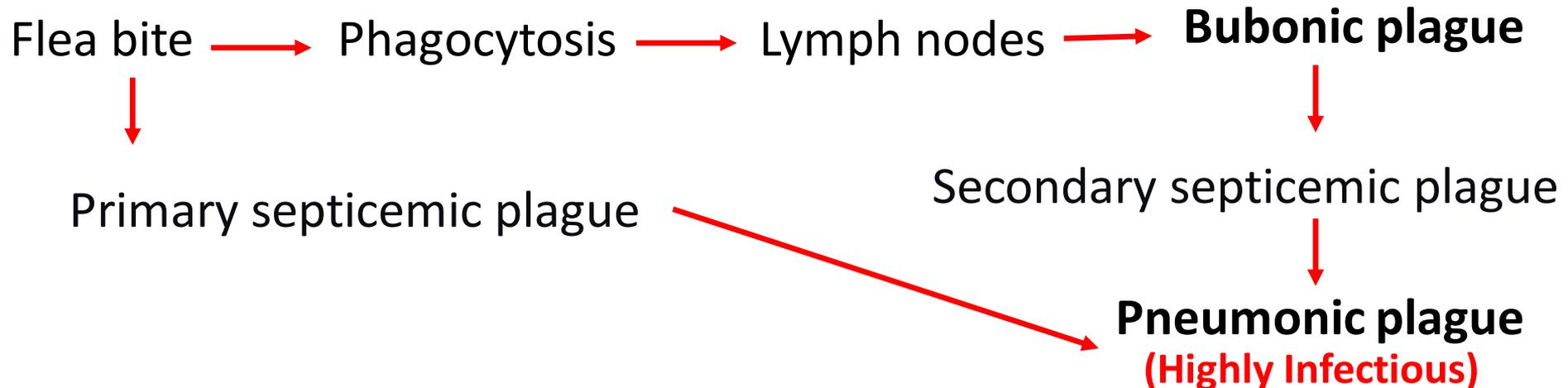
Infection cycles



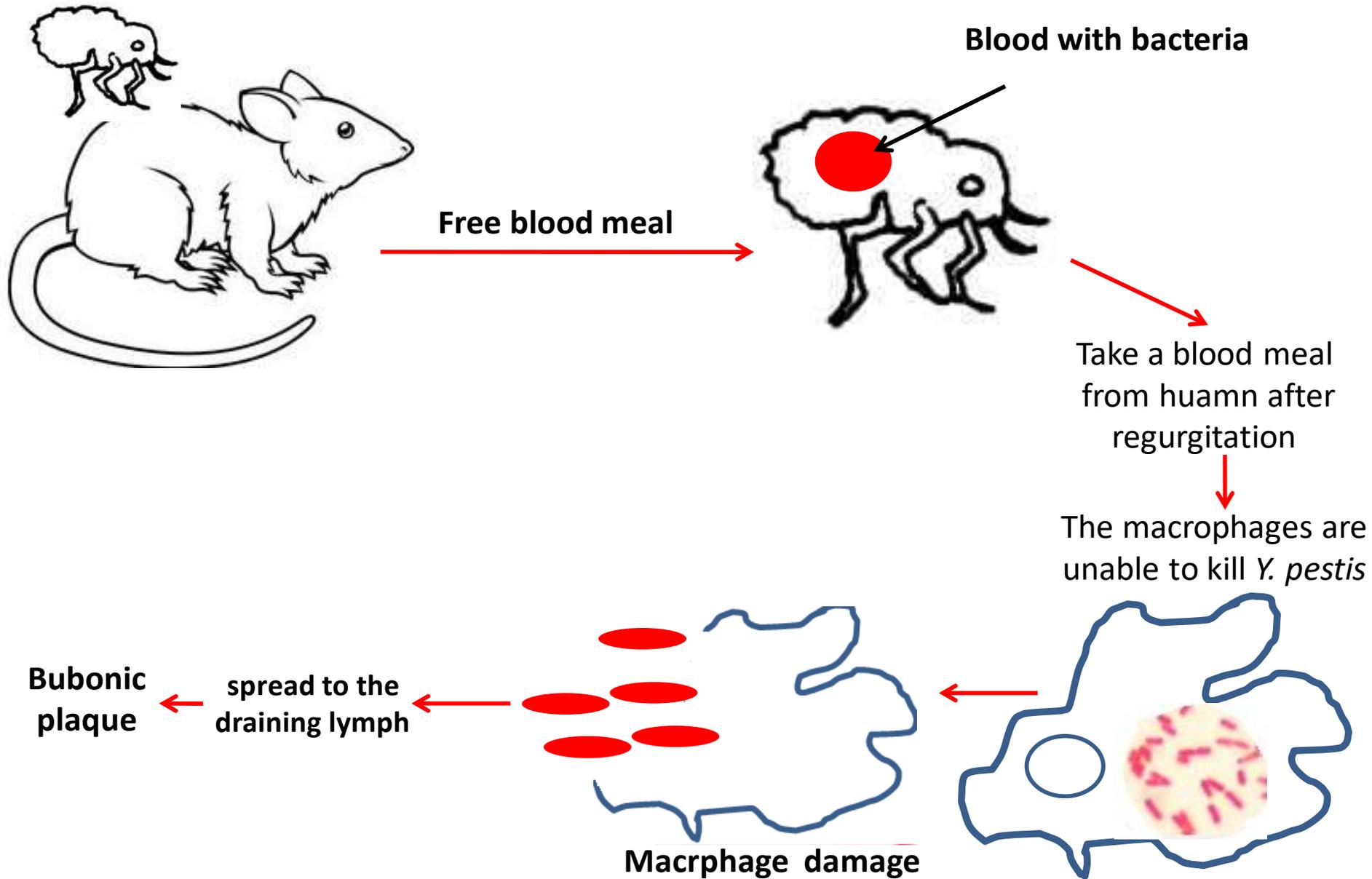
Types of plague

- **Bubonic plague**
- **Septicemic plague**
- **Pneumonic plague**

Summery



Pathogenesis



Pathogenesis

Bubonic plague : the *Y. pestis* quickly spread to the draining lymph nodes, which become hot, swollen, tender, and hemorrhagic. This gives rise to the characteristic black buboes responsible for the name of this disease (Bubonic plaque).

Bubo in pathology means a tender, enlarged, and inflamed lymph node, particularly in the axilla or groin, resulting from absorption of infective material



Bubonic plague



Bubonic plague

Pathogenesis

- Incubation period of 1-3 days (pneumonic) or 2-6 days (bubonic).
- **Complications:** The most common complication of **bubonic and septicemic** plague is disseminated intravascular coagulation (**DIC**), **pneumonia and meningitis**.
- **Mortality rates** for treated individuals range from 1 to 15 % for **bubonic plague** to 40 % for septicemic plague, and 50% for pneumonic plague
- Without treatment, fatality rates: up to 90% for bubonic plague, 100% for septicemic or **pneumonic** plague.

Manifestations

- General malaise
- High fever (hyperpyrexia)
- Pain or tenderness at the regional lymph nodes, which may enlarge (buboes).
- Septicemia
- DIC
- Convulsions
- Shock
- Diffuse, hemorrhagic changes in the skin plus cyanosis from the necrotizing pneumonia produce the dark skin at the extremities giving rise to the term "black death".

Symptomes

1. Bubonic plague

- Patients develop sudden onset of fever, headache, chills, and weakness and one or more swollen, tender and painful lymph nodes (called buboes).
- The bacteria multiply in the lymph node closest to where the bacteria entered the human body.
- If not treated, the bacteria can spread to other parts of the body.

Symptomes

2. Septicemic plague:

- Patients develop fever, chills, extreme weakness, abdominal pain, possibly bleeding into the skin and other organs, and shock.
- Skin and other tissues may turn black and die, especially on fingers, toes, and the nose.

Symptomes

3. Pneumonic plague:

- Patients develop fever, headache, weakness, and a rapidly developing pneumonia with shortness of breath, chest pain, cough, and sometimes bloody or watery mucous, cyanosis, respiratory failure and shock.
- The only form of plague that can be spread from person to person (by infectious droplets).

Plague is a serious illness. If you are experiencing symptoms like those listed here, seek immediate medical attention. Prompt treatment with the correct medications is critical to prevent complications or death

Symptoms



Bubonic plague



Septicemic plague



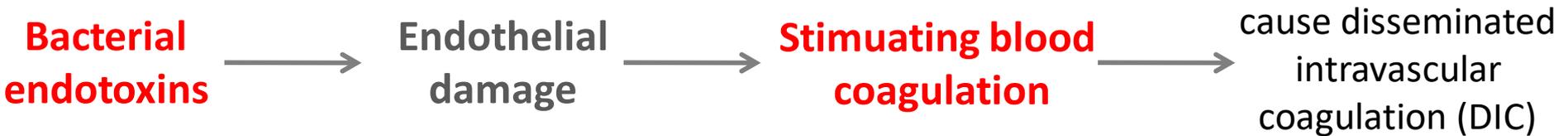
Pneumonic plague



Virulence factors



Why bleeding under skin (black discoloration)?



(DIC), causing

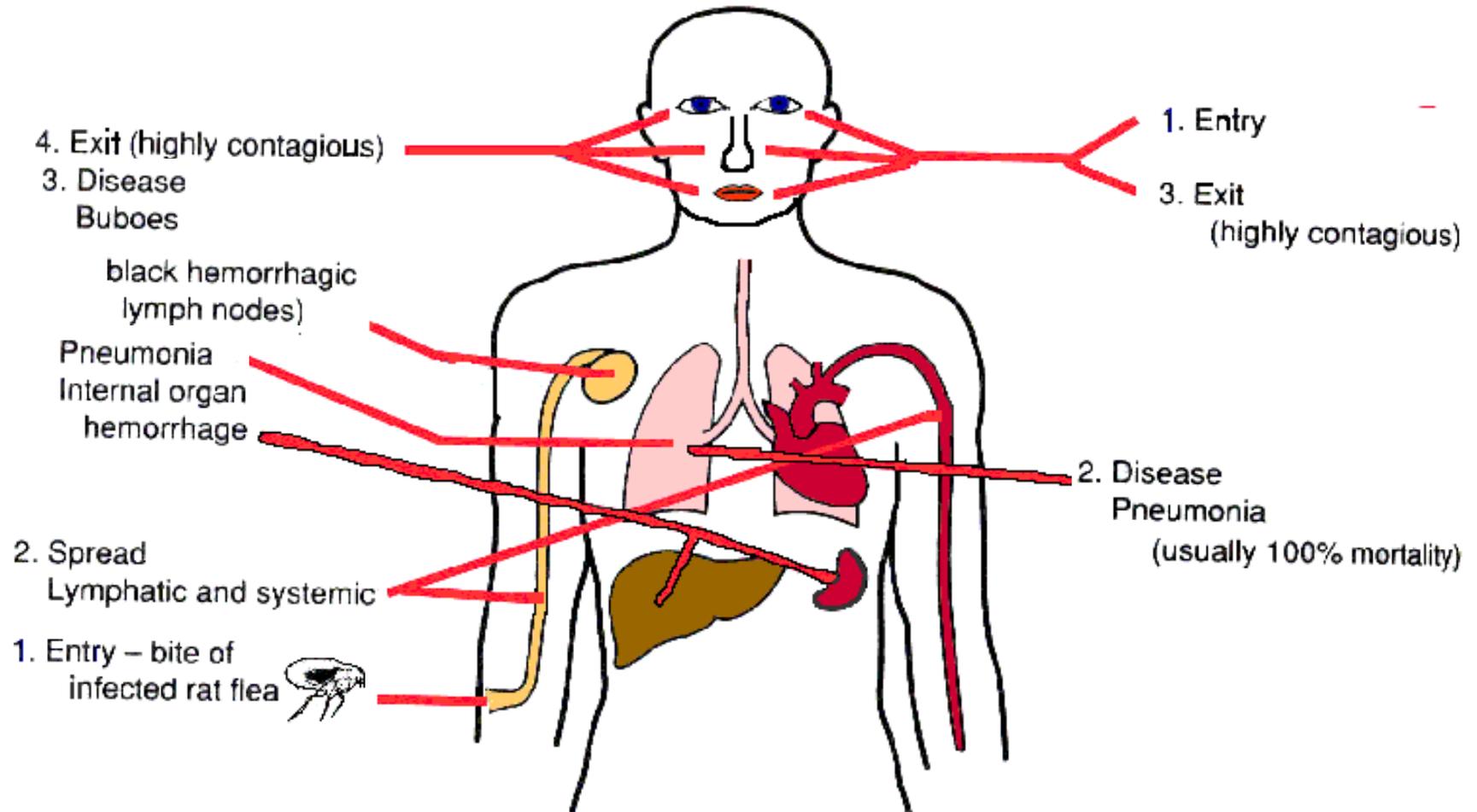
tiny clots throughout the body and possibly ischaemic necrosis (tissue death due to lack of circulation/perfusion to that tissue) from the clots.

Depletion of the body's clotting resources, so that it can no longer control bleeding. Consequently, there is bleeding into the skin and other organs, which can cause red and/or black patchy rash and hemoptysis/hematemesis

Types of plague

Bubonic Plague

Pneumonic Plague



Diagnosis

- It is important to recognize that the **initial symptomatology** is **nonspecific** and commonly seen in **many types of severe bacterial sepsis**, so the **clinician** must have a **high index of suspicion** based on **endemic locations, recent travel**, and close **contact with rodents or domestic** animals that have recently become sick.
- Indeed, **early diagnosis** in the **Emergency Department** for an incident **may be difficult**.
- Most cases will be diagnosed after admission based on culture data (sputum or blood), but if the outbreak is intentional and patients with plague have been identified in the community, all patients presenting with sepsis should be considered to have plague unless an alternate diagnosis is found

Diagnosis

Acceptable Specimen Types .

- Bronchial wash/tracheal aspirate (≥ 1 ml)
- Whole blood
- Aspirate or biopsy of liver, spleen, bone marrow, lung, or bubo.

Diagnosis

- Smears typically show the bacillus to have a **bipolar or "safety pin" appearance** in Giemsa staining.
- fluorescent antibody microscopy.
- *Y. pestis* has longer generation time (1.25 hours) thus require longer incubation times for optimal growth

Case

Pateint

A 45-year-old, previously healthy presented with a 2-day history of increasing fever, myalgia, rigors, headache, and weakness.

History

The patient had a history of camping and sleeping on the ground. The patient had no history of rodent exposure or receipt of insect bites.

Physical examination revealed an acutely ill man with

1. lymphadenopathy, and pneumonia were not present.
2. He had acrocyanosis, severe muscle pain, and a purpuric rash with evolving gangrene of the extremities. In the following days, he had progressive gangrene of the fingers, toes, ears, and nose.
3. Vital sings:

Vital sings	Findings	Norml ranges
Respiratory rate	26 breaths/min	16-20
Heart rate	117 beats/min	50-80
Temperature	38.5 °C	Between 98.0°F (36.6°C) and 98.6°F (37°C)
Blood pressure	85/57 mm Hg	140/60

Diagnosis

- Smears of the patient's peripheral blood sample were sent promptly to the lab where direct fluorescent antibody stains of the organism were found to be positive for *Y. pestis*.
- This finding was subsequently confirmed by the increased Ab to *Y. pestis*

Prevention

- Reduce rodent habitat around your home
- Remove possible rodent food supplies.
- Wear gloves if you are handling or skinning potentially infected animals to prevent contact between your skin and the plague bacteria.
- Use repellent if you think you could be exposed to rodent fleas during activities such as camping, hiking, or working outdoors. Repellent can be applied to the skin as well as clothing .
- Keep fleas off of your pets by applying flea control products. If your pet becomes sick, seek care from a veterinarian as soon as possible.
- Do not allow dogs or cats that travel free in endemic areas to sleep on your bed.

Good Luck

