Zoonotic Bacteria:

Brucella, Yersinia, Bacillus

Core Course: Medical Microbiology
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What's zoonosis?

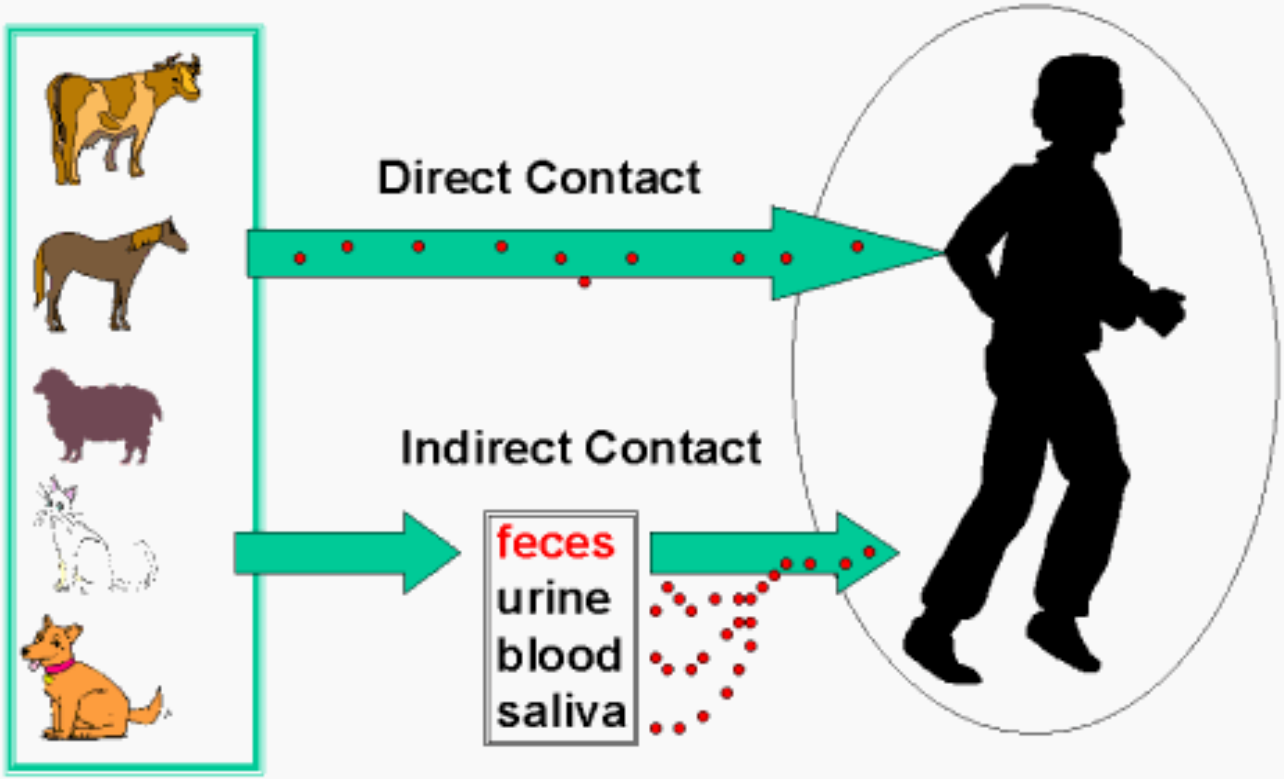
- Zoonosis

  a disease that can be transmitted from animals to humans

- Zoonotic bacteria

  bacteria causing zoonosis

How do human beings become infected ?



What're primary zoonotic bacteria?

- Outline

	Source of human infection	Disease
Brucella	Pigs, cattle, goats, sheep	Brucellosis
Yersinia pestis	Rats	Plague
Bacillus antracis	Cattle, goats, sheep, horses	Anthrax

Brucella

- *B.abortus*: cattle
- *B.melitensis*: goat,sheep
- *B.suis*: swine
- *B.canis*: dog

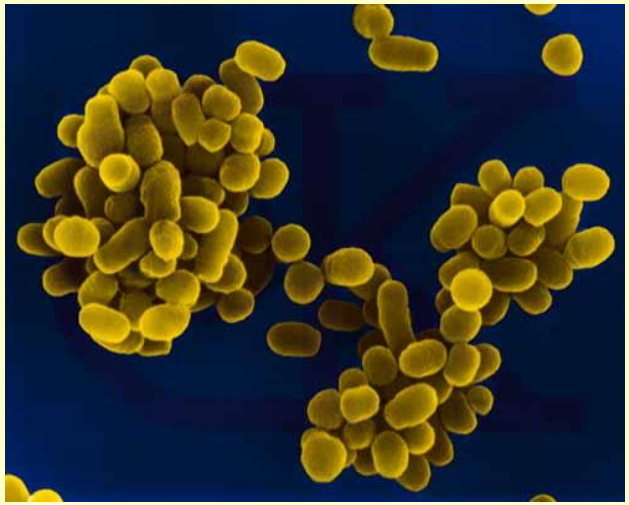
Biological properties

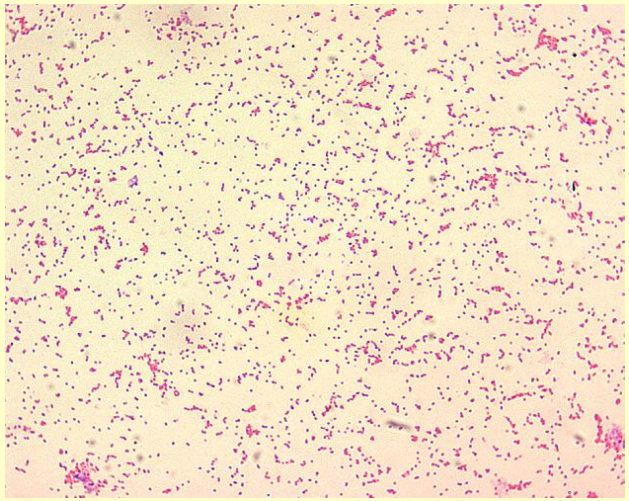
- **Shape and structure**

  Coccobacillus: 0.4-0.8～0.5-1.5μm

  Gram-negative

  Nonmotile, non-spore-forming.





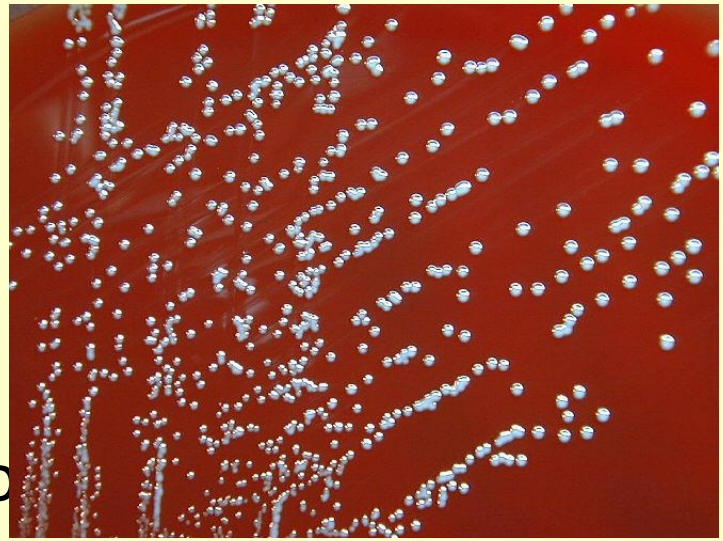
Biological properties

- **Culture**

  Obligate aerobes

  5-10% CO_2 (*B. abortus*)

  fastidious
- Small ,smooth, convex colonies



- Facultative intracellular patho

Biological properties

- **Antigenic types**

  LPS, endotoxin

  two major serological determinants: A and M

  A---abortus antigen

  M---melitensis antigen

Pathogenicity

- Virulence factor

  endotoxin (main)

  capsule

Pathogenicity

- Transmission

  intestinal tract: infected milk

  respiratory tract: aerosols containing the bacteria

  direct contact

Pathogenicity

- Disease: brucellosis

  animals: infections of genital systems

  abortion (erythritol)

  inapparent infections (source)

  humans: undulant fever

organism (as a facultative intracellular parasite)
→ lymphatic system → blood （bacteremia）

undulant fever

liver, spleen, bone marrow, lymph nodes

Diagnosis :

- Culture :

  Brucella agar

- Serological tests:

  Agglutination test

Control

- Prevention
  - pasteurization of milk before drinking
  - animals: slaughter
    immunization
  - humans: vaccination for persons at high risk
- Treatment

  tetracycline, ampicillin

  prolonged treatment

Yersinia

Species	Transmission	Disease
Y Pestis.	Flea bite Respiratory tract	Plague
Y. Enterocolitica	Digestive tract Contact	Enterocolitis
Y. Pseudotuberculosis	Digestive tract	Enterocolitis

Y. Pestis

- During 14th century over a 5-year period
  - 25 million deaths
- The most recent pandemic in Asia in 1904
  - a million deaths

Biological properties

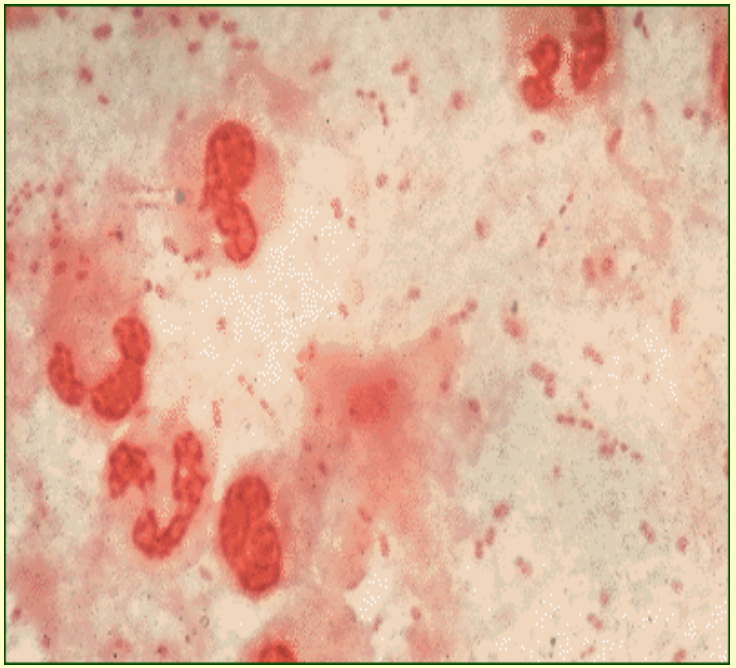
- **Shape and structure**

  Coccobacillus

  Gram-negative,Capsule

  nonmotile, non-spore-forming

  bacteria.



Biological properties

- **Cultivation**

  facultative anaerobes

  slow growth

  colony--irregular and rough

  optimum temperature: 27～30℃

Biological properties

- **Antigenic structure**
  - F1 antigen (fraction Ⅰ): capsular antigen
  - V-W antigen: protein-lipoprotein
  - Yop (Yersinia outer membrane proteins)
  - murine toxin (MT): exotoxin
    released only when cells are lysed.
  - endotoxin: LPS

Pathogenicity

- **Virulence factor**

  F1 antigen - anti phagocytic properties.

  V-W antigen-encoded on plasmids(72 kb plasmid).

  Yop

  endotoxin

  MT

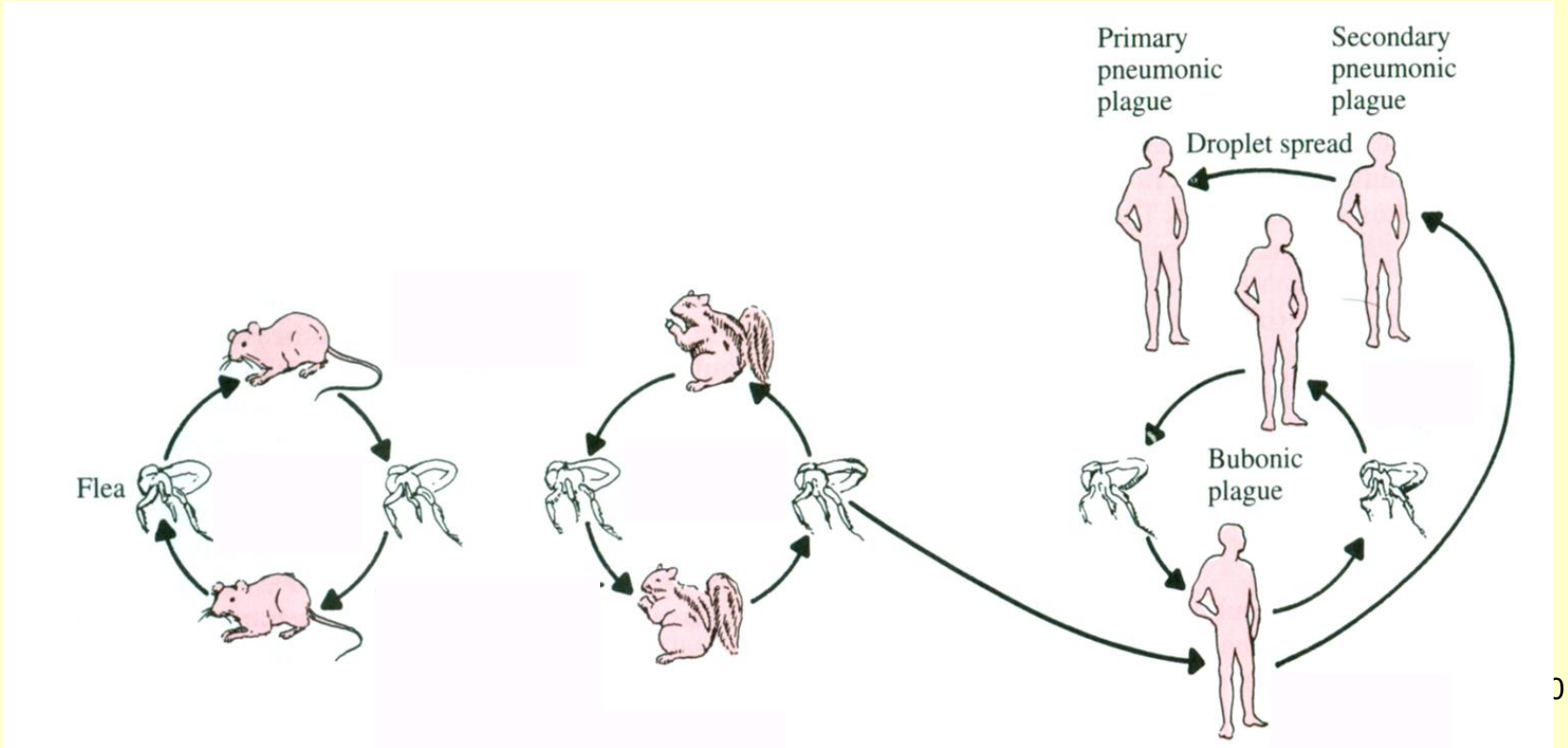
Pathogenicity

- Transmission

rat ←→ rat (by direct contact or biting of rat fleas)

↓by rat fleas

person ←→ person (by human fleas or respiratory route)



Pathogenicity

- Disease--- plague
  - Bubonic plague
  - Pneumonic plague
  - Septicemic plague

Pathogenicity

- Bubonic plague

  the most common

  enlarged and inflamed lymph

  mortality rate: 30-75%

Pathogenicity

- Pneumonic plague

  the second most common

  mortality rate: 90-95%

Pathogenicity

- Septicemic plague

  the most rare

  mortality rate: close to 100%

DIAGNOSIS:

- Smears:
  - Giemsa stain
  - Immuno flouroscent stains
- Culture:
  - Blood agar
  - Macconkey agar

Control

- Prevention

  elimination of rats and fleas

  vaccine

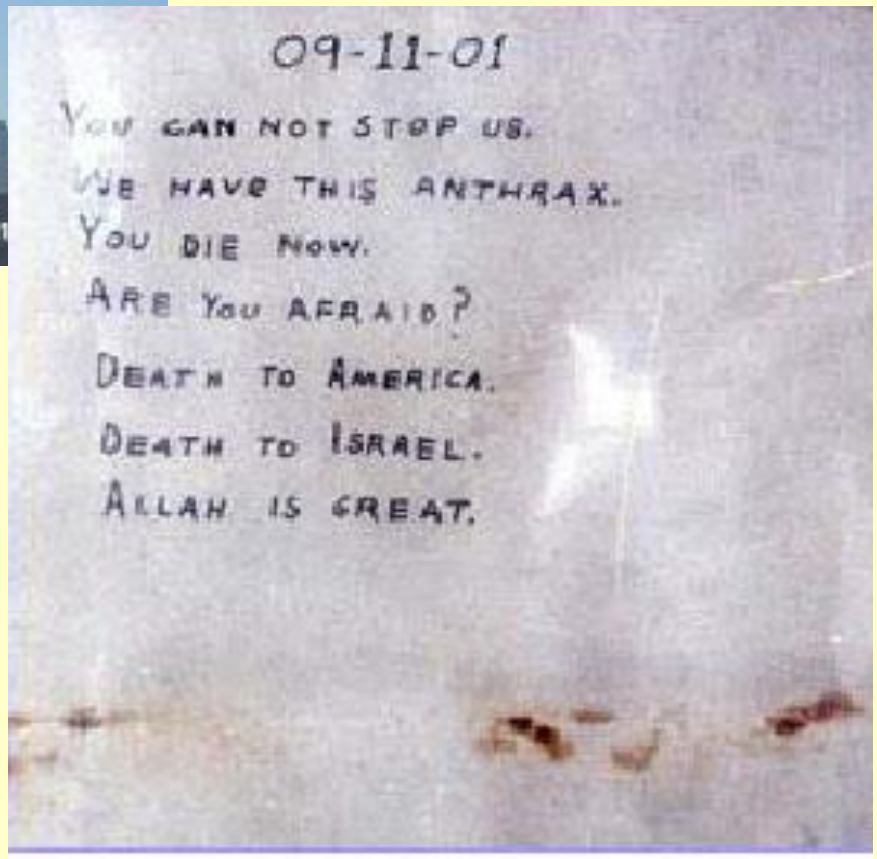
- Treatment

  streptomycin, sulfanilamide

  rapid treatment

Bacillus

- *B.anthracis:* anthrax
- *B.cereus*: food poisoning


09-11-01
YOU CAN NOT STOP US.
WE HAVE THIS ANTHRAX.
YOU DIE NOW.
ARE YOU AFRAID?
DEATH TO AMERICA.
DEATH TO ISRAEL.
ALLAH IS GREAT.

B.anthracis

Biological properties

- **Shape and structure**

  1-3～5-10μm

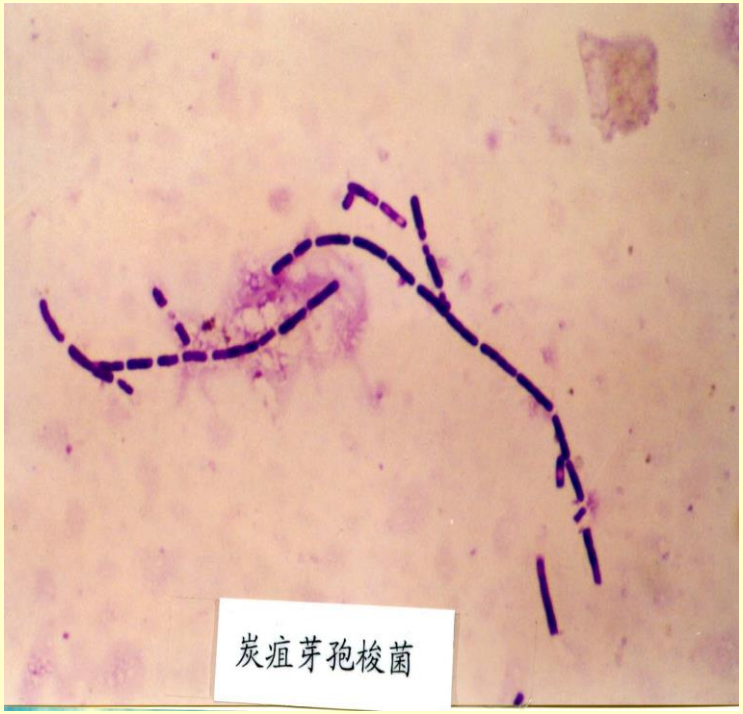
  Gram positive

  rod with square ends in long chains (bamboo)

  central spore

  capsule (D-glutamate)

  nonmotile



Biological properties

- **Culture**

  aerobic or facultative anaerobic

  colony: irregular margins

  non-hemolytic

Biological properties

- **Resistance**

  strong resistance: dry heat
  desiccation
  disinfectant

  sensitivity: oxidant
  autoclaving

Pathogenicity

- **Virulence factors**

  capsule: Poly-D-glutamate polypeptide

  anthrax toxin: protective antigen (PA): proteolytic activation

  lethal factor (LF)

  edema factor (EF)

  PA+EF=edema toxin

  PA+LF=lethal toxin → responsible for shock and death

Pathogenicity

- Disease - anthrax

source: herbivorous animals

transmission:

direct contact

digestive tract

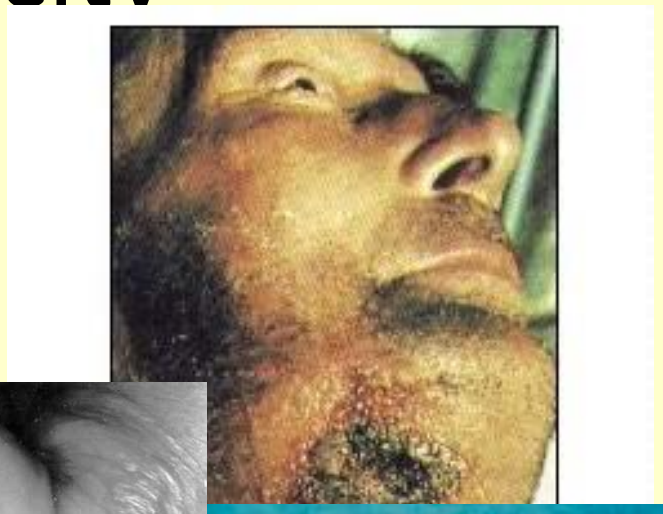
respiratory tract

clinical types:

cutaneous anthrax (95%)

intestinal anthrax (5%)

pulmonary anthrax (5%)



Diagnosis:

- Culture:

  Blood agar – non hemolytic colonies.
- Staining:

  immunoflouroscence stains
- Serological tests:

  ELISA

Control

- Prevention
  - animals: burn or deep bury

    vaccination
  - humans: vaccination
- Treatment
  - Penicillin, tetracycline, erythromycin