

Infectious diseases  
characterized by abortion in  
ruminants

**Brucellosis (Bang's disease,  
Contagious abortion)**

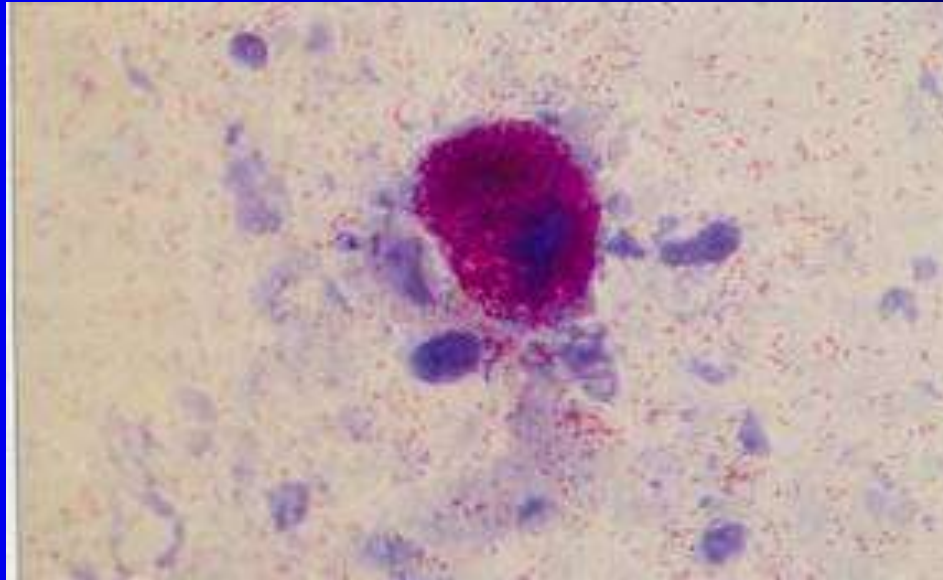
# Definitions

- **Abortion** in dairy cattle a loss of the fetus between the age of 42 days and approximately 260 days.
- **Early embryonic deaths.** Pregnancies lost before 42 days.
- **Stillbirth.** A calf that is born dead between 260 days and full.

- Brucellosis is a highly contagious zoonotic disease of animals characterized by outbreaks of abortion at late stages of pregnancy.



- It is one of the most important zoonotic diseases worldwide, resulting in serious economic losses and public health issues.



# Causative agent:

- Brucellae are Gram-negative, nonmotile, coccobacilli. They are either aerobes or microaerophilic and grow slowly (fastidious) on enriched medias blood or serum agar. In the host, they live as facultative intracellular pathogens.

## Host

- ***B. abortus***; primarily infects cattle but is transmitted to buffaloes, camels, deer, dogs, horses, sheep and man.
- ***B. melitensis***; causes a highly contagious disease in sheep and goats although cattle can be infected. It is the most important species in human infection.
- ***B. suis***; covers a wider host range than most other *Brucella species*. can be transmitted to man.

- ***B. canis***; causes epididymo-orchitis in the male dog and abortion and metritis in the bitch. It has not been reported in other animal species except man.
- ***B. ovis***, is responsible for epididymitis in rams and occasionally abortion in ewes, but does not infect other animals or man. Goats are susceptible to the disease by experimental infection.

# Prevalence of brucellosis

- Brucellosis has been eradicated in most developed countries through animal vaccination and culling of infected animals.
- It persists in many underdeveloped and developing countries.



- Brucellosis is primarily a disease of animals and it affects organs rich in the sugar Erythritol (breast, uterus, epididymis, etc.).
- The organism localizes in these animal organs and cause infertility, sterility, mastitis, abortion or resides as carriage.

- *Brucellosis is found in various regions of the world:*

Mediterranean region, Middle East, Western Asia, Parts of Africa, Indian Subcontinent, Australia, Central and South America, North America.

- The Brucellae are somewhat host-specific but cross-species infections occur, specially with *B. melitensis*.
- In cattle, sheep, goats and swine, susceptibility to brucellosis is greatest in sexually mature animals. Young animals are often resistant, but latent infections can occur and such animals may present a hazard when mature.

- Transmission in animals: For *Brucella abortus*
- \*Ingestion The most frequent route.
- \* Inhalation.
- \*Conjunctiva.
- \* skin.

- \* Genital tract. Transmission via natural breeding does not occur very often,
  - \* Artificial insemination with contaminated semen can transmit the infection (Brucella-contaminated semen is deposited in the uterus but, reportedly, not when deposited in the midcervix).
  - \* Embryo-transfer

- Transmission of *B. melitensis* in sheep and goats is similar to that in cattle but sexual transmission probably plays a greater role.

- *B. canis* can be a major problem in dog breeding kennels.
- like that in cattle and sheep, sexual transmission is also an important means of spread and males can excrete the organisms in large numbers in their semen.
- Urinary excretion also occurs and is a potential hazard to humans.

## Transmission in humans:

- Cattle, sheep, goats and pigs are the main reservoirs of *Brucella*.
- Transmission to humans occurs through occupational or environmental contact with infected animals or their products.
- Food-borne transmission is a major source of infection, with cheese made from raw milk and unpasteurized milk presenting a high risk.
- Person-to-person transmission is extremely rare.



- Contaminated or infected secretions include blood, urine, feces, and milk of infected animals. Animals that have aborted will shed large amounts of bacteria and contaminate their environment.

- Pathogenesis: 1. Once infection is established the organisms are carried from the point of entry to the **regional lymph nodes**, leading to acute lymphadenitis.
- 2. Bacteria multiply inside phagocytes and disseminate via systemic circulation to **other organs or tissues** such as the spleen, lymph nodes, uterus and the mammary gland. In males, *B. abortus* can be found mostly in the **testicles** where the organisms cause orchitis, and accessory sex glands as well as lymphoid tissue.

- 3. The bacteremia can last for months, and in cases of chronic disease it can be intermittent, recurring mostly around parturition.
- 4. The bacteria localize in the **uterus** during gestation and cause ulceration of the endometrium.
- 5. The initial lesions are seen in the wall of the uterus, but the organism quickly spreads to the **placental cotyledons** and destroys the villi.

- 6. Depending on the severity of the lesions potential sequelae include: abortion, especially in the last trimester, stillbirths, and premature or weak calves.
- 7. Following abortion or parturition the organism is shed by the uterus for weeks, and the animal remains infected for life discharging the bacteria with milk.

# Clinical signs

- **1. Abortions in susceptible, unvaccinated heifers.** Most abortions occur after the fifth month of pregnancy. It is common as 'abortion storms.
- Sequelae to abortions are retained placentas and subsequent metritis.









- **2.Orchitis and epididymitis** are occasionally seen in breeding age bulls. One or both testes may be involved and sterility most commonly results.





- **3. Non-suppurative synovitis** is a less common clinical sign seen in cattle. Hygromas (A carpal hygroma is a synovial swelling over the surface of the carpal joint. It does not cause lameness.) in the carpus are the most common manifestation and *Brucella abortus* is often isolated from these joints. Animals with these lesions are not always seropositive.



## placenta gross

The cotyledons are tan with multifocal hemorrhages and the intercotyledonary portions of the placenta are opaque and edematous.

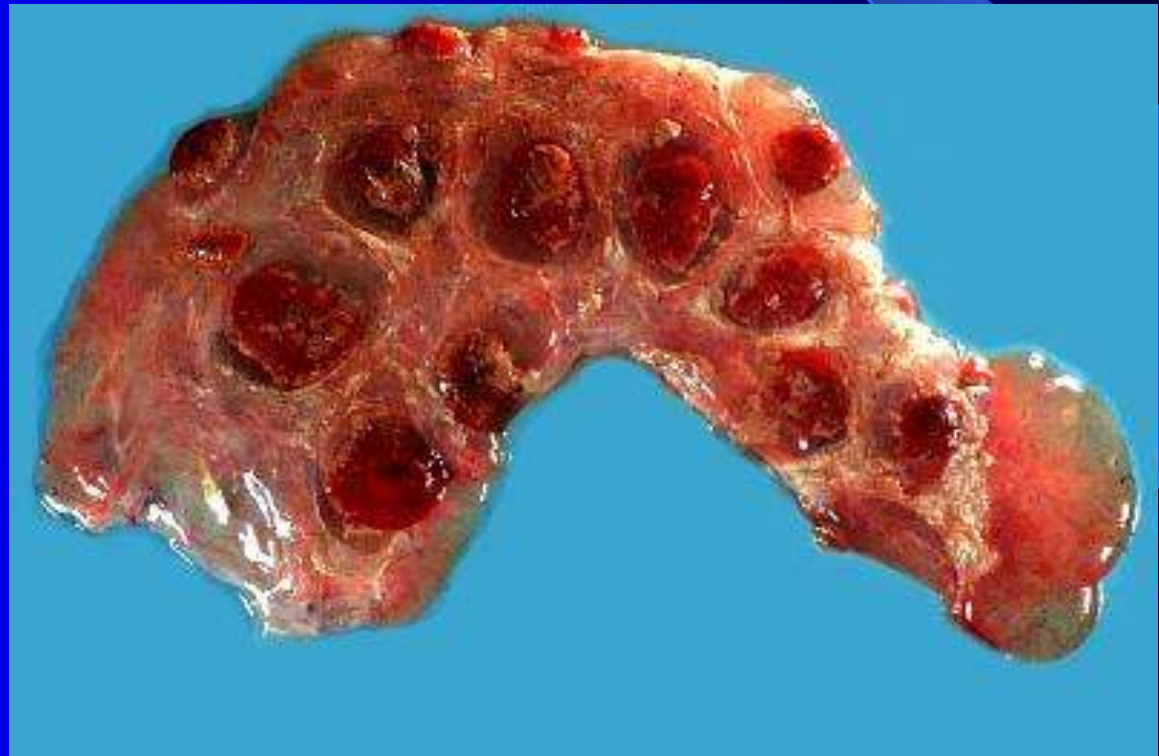




The cotyledons are tan with multifocal hemorrhages and the intercotyledonary portions of the placenta are opaque and edematous.



Bovine, placenta. The placenta contains numerous hemorrhagic cotyledons.



# *B. abortus* sheep





# Diagnosis:

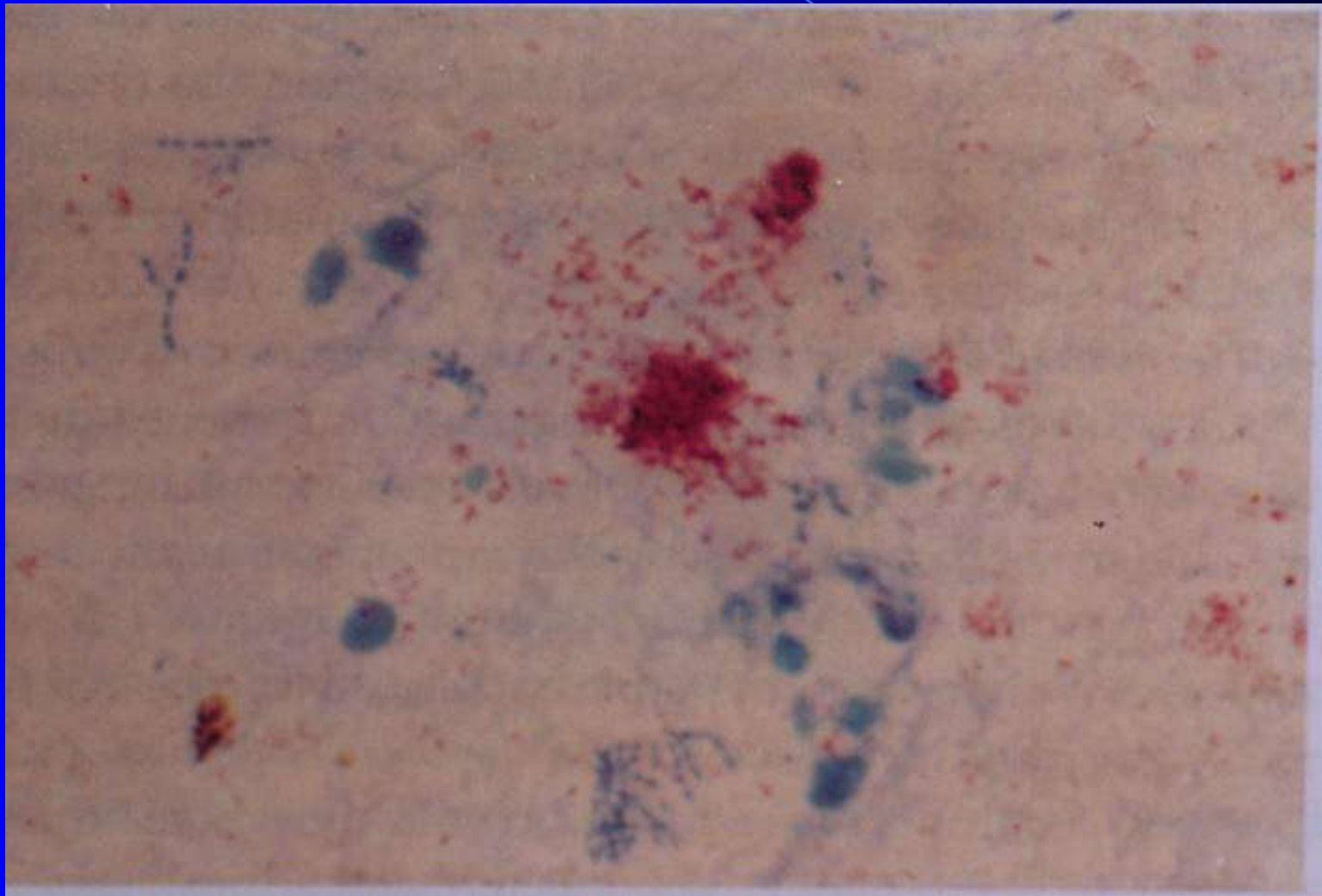
- Clinical signs are not pathognomonic
- Isolation of the bacteria or detection of their antigens or genetic material,
- demonstration of specific antibody or cell-mediated immune responses.

# Detection of bacteria by direct smear and culture:

## Specimens for bacterial isolation;

- 1. Aborted foetus. 2. Placenta and foetal membranes. 3. Vaginal mucus. 4. Uterine discharge. 5. Milk from lactating animals 2-3 weeks after abortion. 6. Semen of bulls.

# Acid fast stain



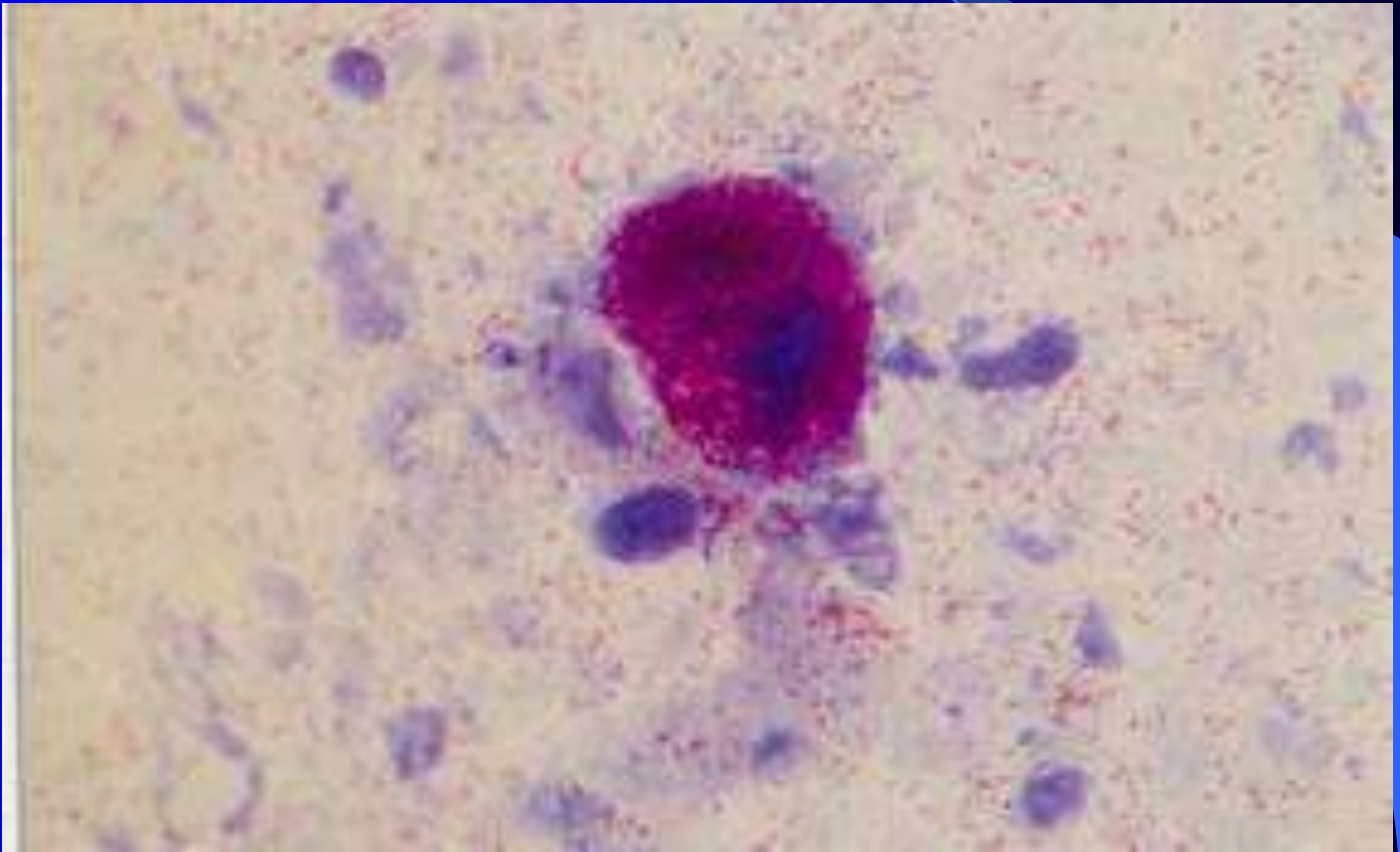


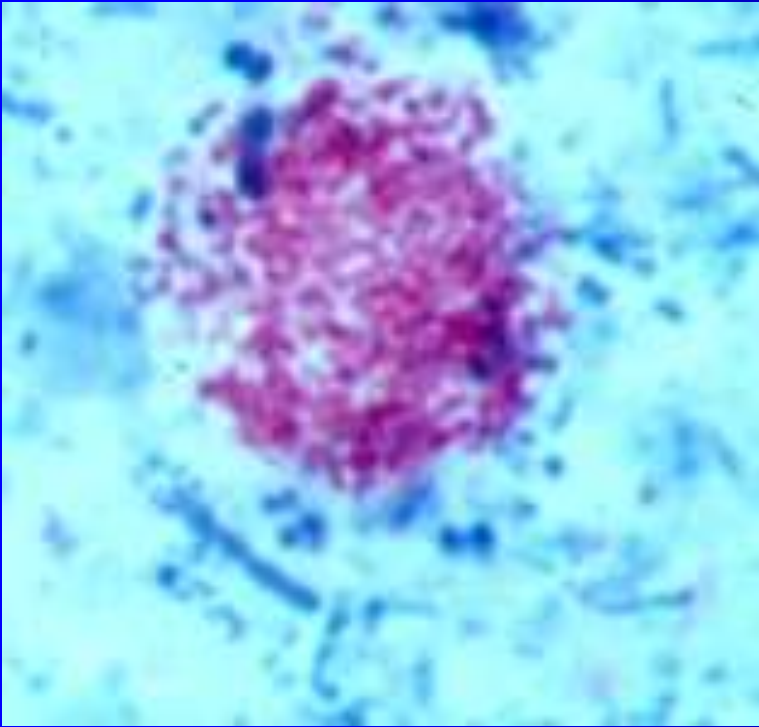
- *B. canis*



# Direct Stained smears

- Smears of placental cotyledon, vaginal discharge or fetal stomach contents
- stained using modified Ziehl-Neelsen (Stamp) or Koster's methods.
- The presence of large aggregates of intracellular, weakly acid-fast organisms
- with *Brucella* morphology is presumptive evidence of brucellosis.
- other infectious agents such as *Coxiella burnetii* or *Chlamydia* may superficially resemble *Brucella*.

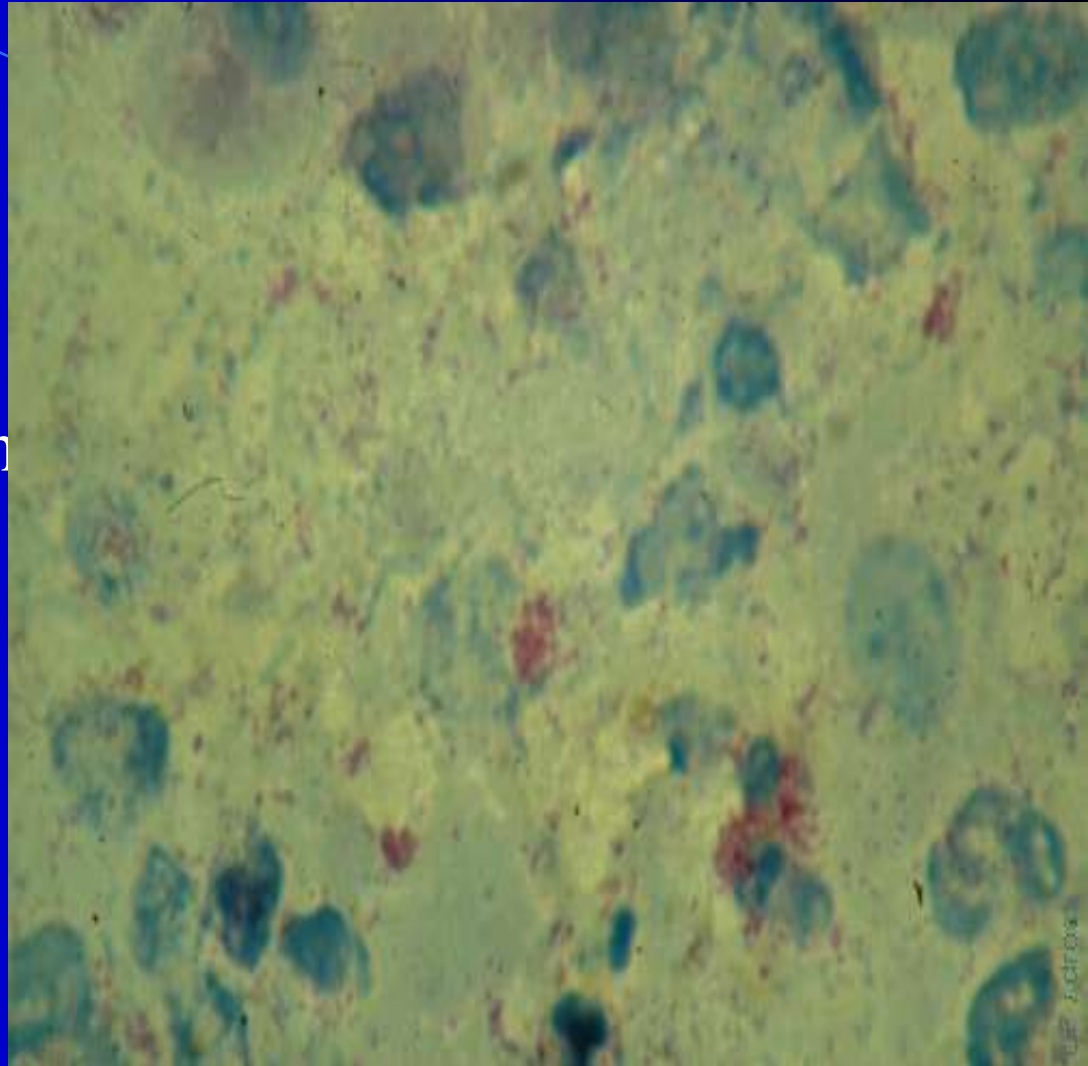


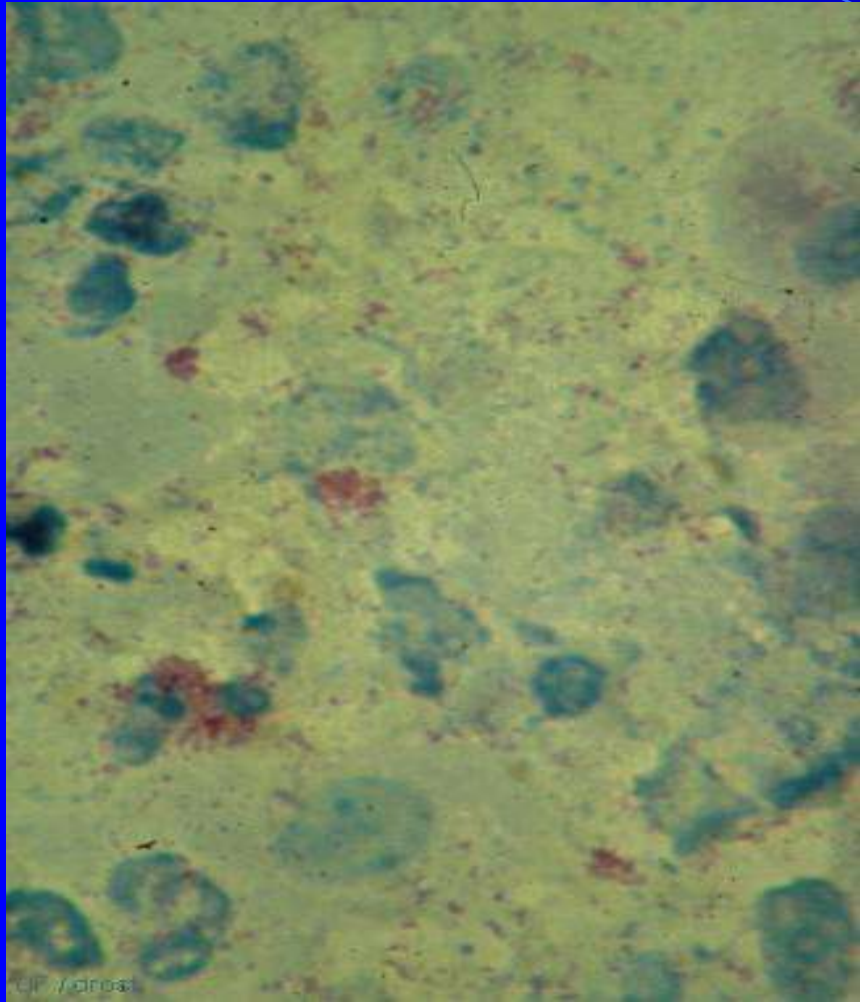




## ● Chlamydia.

Stained placental smear showing intracellular acid-fast bacteria as coccoid elementary bodies. Chlamydiosis is characterized by abortion during the last month of gestation. The disease is also called Enzootic Abortion of Ewes (EAE) and is caused by *Chlamydophila abortus*, previously known as *Chlamydia psittaci*





© J. J. Dorland



## b. Blood for serology:

- The serological diagnosis is considered unreliable when performed during the period of 2 to 3 weeks before and after abortion or calving.
- Blood is collected 3-4 weeks after abortion or calving. Serological test may be carried also on, milk, whey, vaginal mucus and seminal plasma.

# Quick serological tests(Screening tests):

## Rapid plate test (RPT):

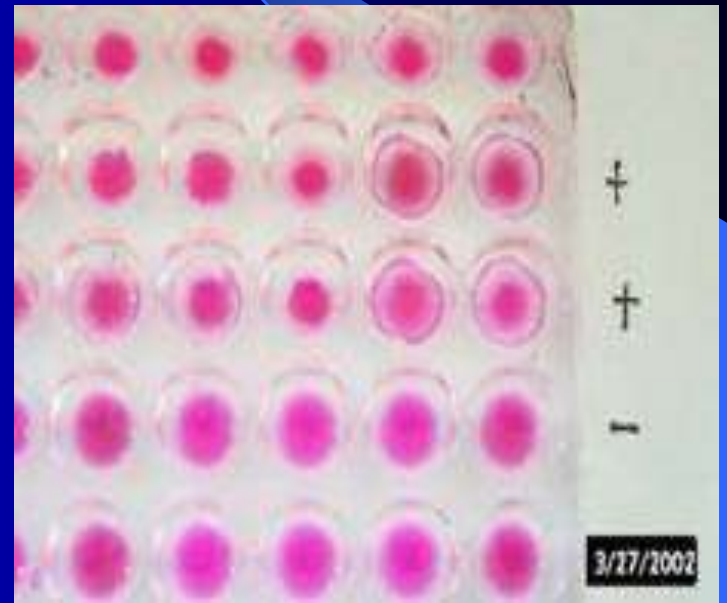
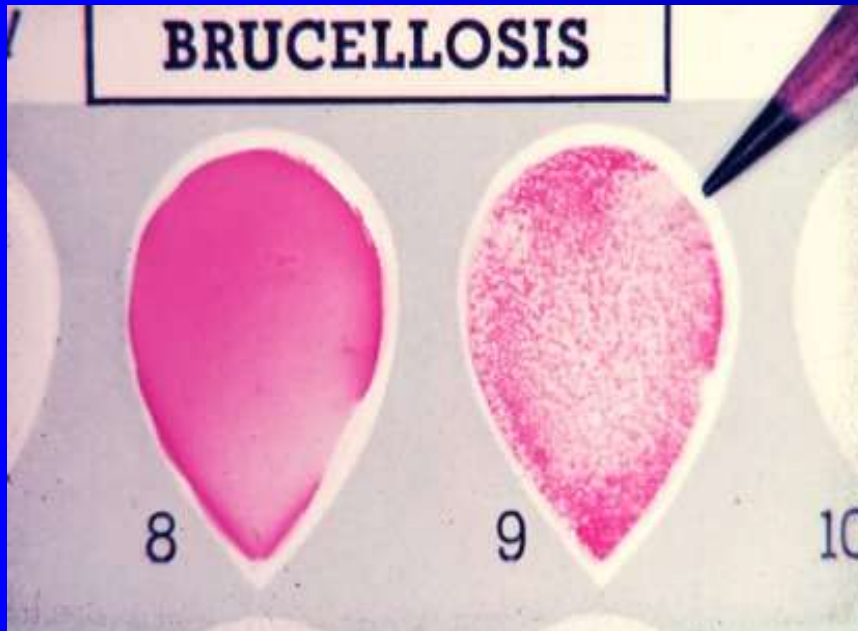
- Drop serum 0.08, 0.04, 0.02 and 0.01 ml dilutions on a glass plate and drop antigen 0.03 ml to each dilution then mix and rotate for 5-8 minutes. Observe for agglutination (any visible reaction is considered to be positive in each dilution).



## Rose Bengal test (RBPT):

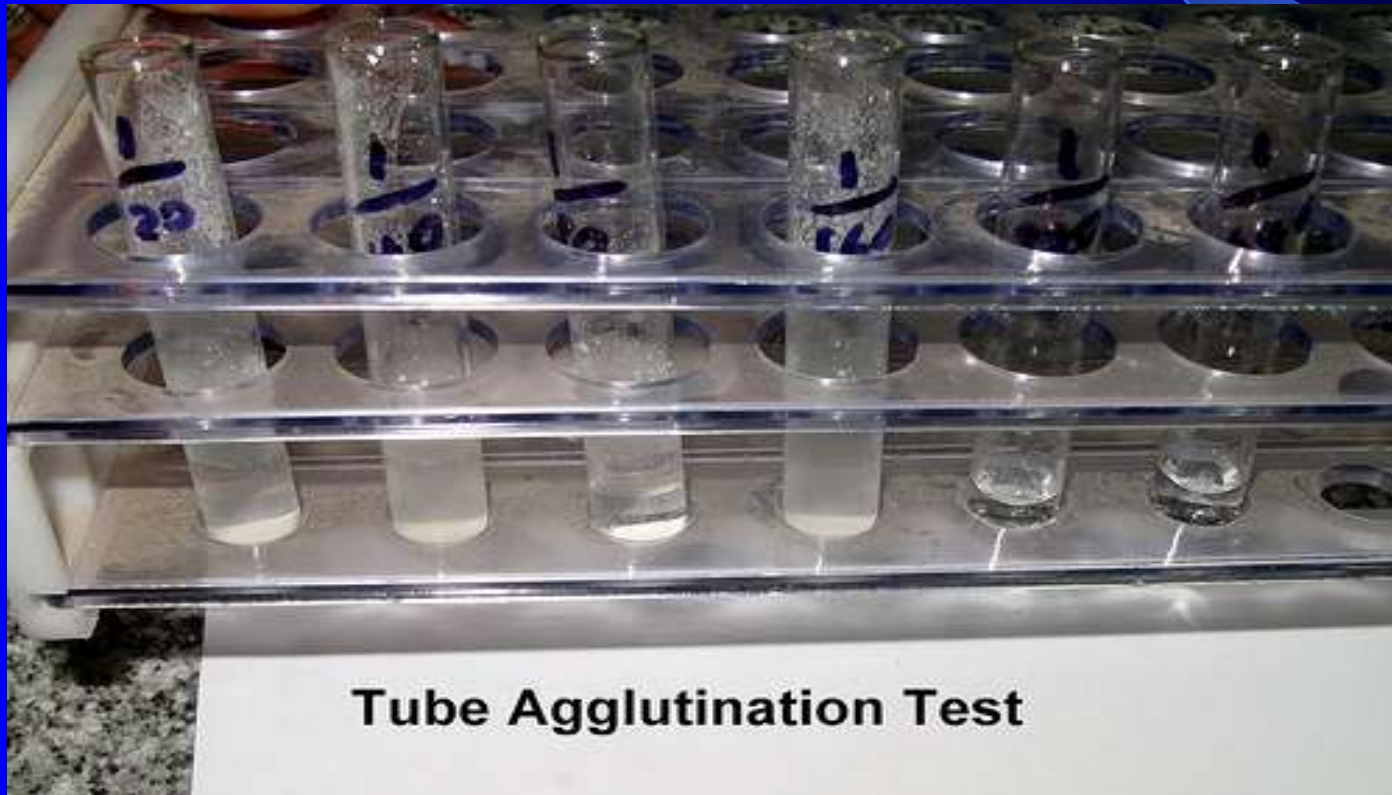
- Buffered *Brucella* antigen tests which rely on the principle that the ability of nonspecific IgM antibodies to bind to antigen is markedly reduced at a low pH (pH 3.6).
- Antigen 0.03 ml + serum 0.03 ml mix and rock for 4 minutes and observe the agglutination.
- Any visible reaction is considered to be positive. This is a rapid and simple screening test that is useful for detecting early infections.

# RBT



- Confirmatory serological tests:
- Serum agglutination test(SAT): using heat/phenol-killed whole S-cells, detect antibodies to the S-LPS.
- Screening test involving an agglutination reaction. it lacks sensitivity and specificity ; it should only be used in the absence of alternative techniques.

- The serum agglutination test will detect non-specific antibodies as well as those that are specific for *Brucella abortus* infection and vaccination.



- Complement Fixation Test (CFT): This test has good specificity and is the most definitive test at this point in time aside for bacterial isolation.

- Milk Ring Test-MRT (antibody detection in milk): This test is a satisfactory and inexpensive test used for surveillance of dairy herds for brucellosis.
- 1ml milk+ drop of haematoxylin-stained antigen (0.1ml) + mixing and incubation for hours. Positive reaction is detected by formation of a stained fat ring; negative reaction the ring is white while the milk column remained colored.



- If specific antibody is present in the milk it will bind to the antigen and rise with the cream to form a blue ring at the top of the column of milk.



- ELISA (Enzyme Linked Immunosorbent Assay): This test has been useful during eradication programs after vaccination has ceased and is used for screening or as a supplemental test to the complement fixation test. The ELISA test has superior sensitivity and reliably detects true negative results.

# Control

1. Detection and elimination, because no practical treatment is available.
2. Eventual eradication depends on testing and eliminating reactors. The disease has been eradicated from many individual herds and areas by this method.
3. Herds must be tested at regular intervals until two or three successive tests are negative.

6. Noninfected herds must be protected. The greatest danger is from replacement animals. Additions should be vaccinated calves or nonpregnant heifers. If pregnant or fresh cows are added, they should originate from brucellosis-free areas or herds and be seronegative.

Replacements should be isolated for ~30 days and retested before being added to the herd.

**7. Vaccination:** There is general agreement that the most successful method for prevention and control of brucellosis in animals is through vaccination.

The attenuated strains of *B. melitensis* strain Rev.1 for sheep and goats and *B. abortus* strain 19 have proven to be superior to all others.

The non-agglutinogenic *B. abortus* strain RB51 has been used in the USA and some Latin American countries, with encouraging results.



- Heifers should be vaccinated between 4 and 12 months of age Positive titres are seen up to 18 months of age.
- Vaccination of cows older than 12 months of age should only be considered in the face of abortion storms.

- Heifers are the only animals vaccinated. The vaccine does not protect bulls and they will often develop subsequent orchitis.

# Treatment

- It is unsuccessful because of intracellular sequestration of the organism in lymph nodes, mammary gland and reproductive organs