INFECTION & IMMUNITY

Reality - Farm Level

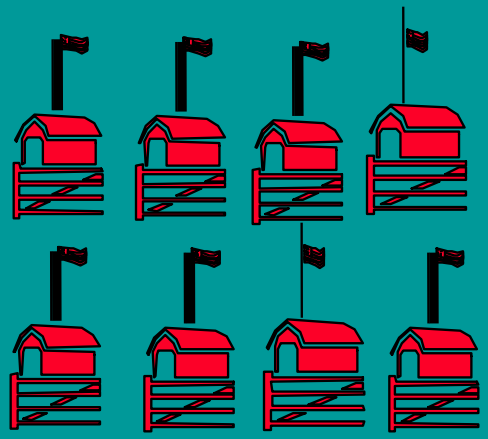
The Most Important Question

Earth, Endemic agent

NON-EXPOSED

EXPOSED

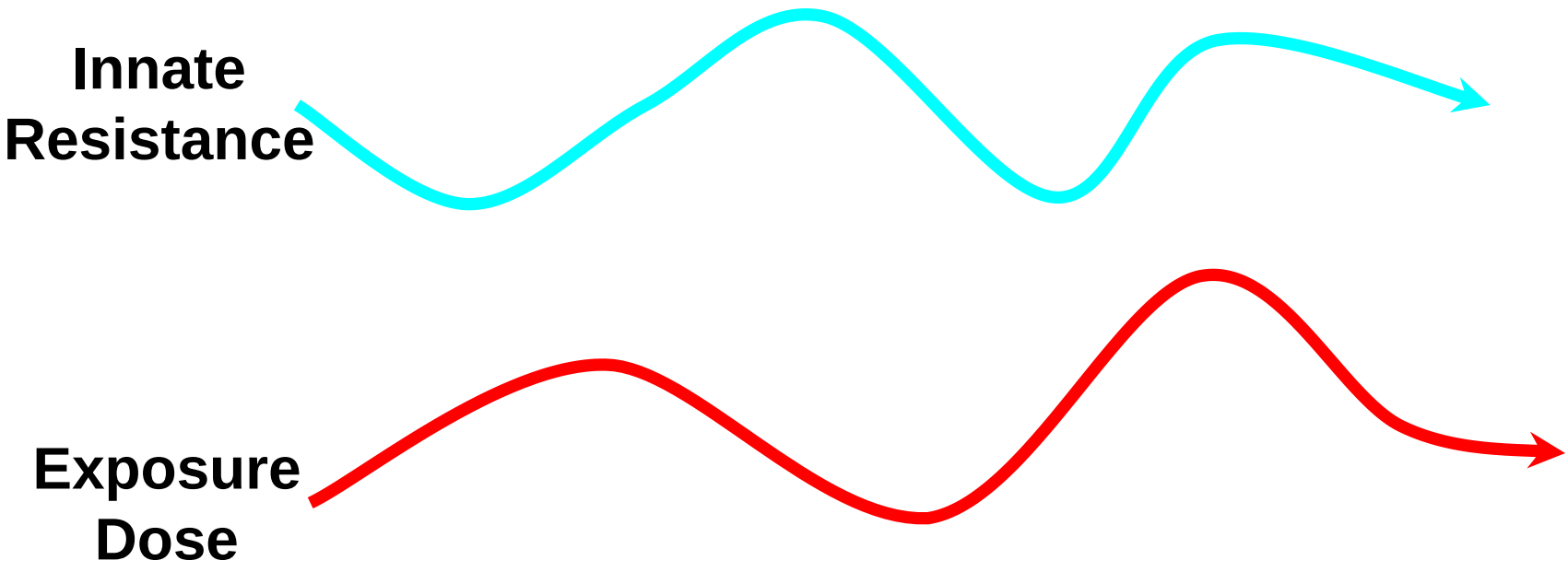
0!



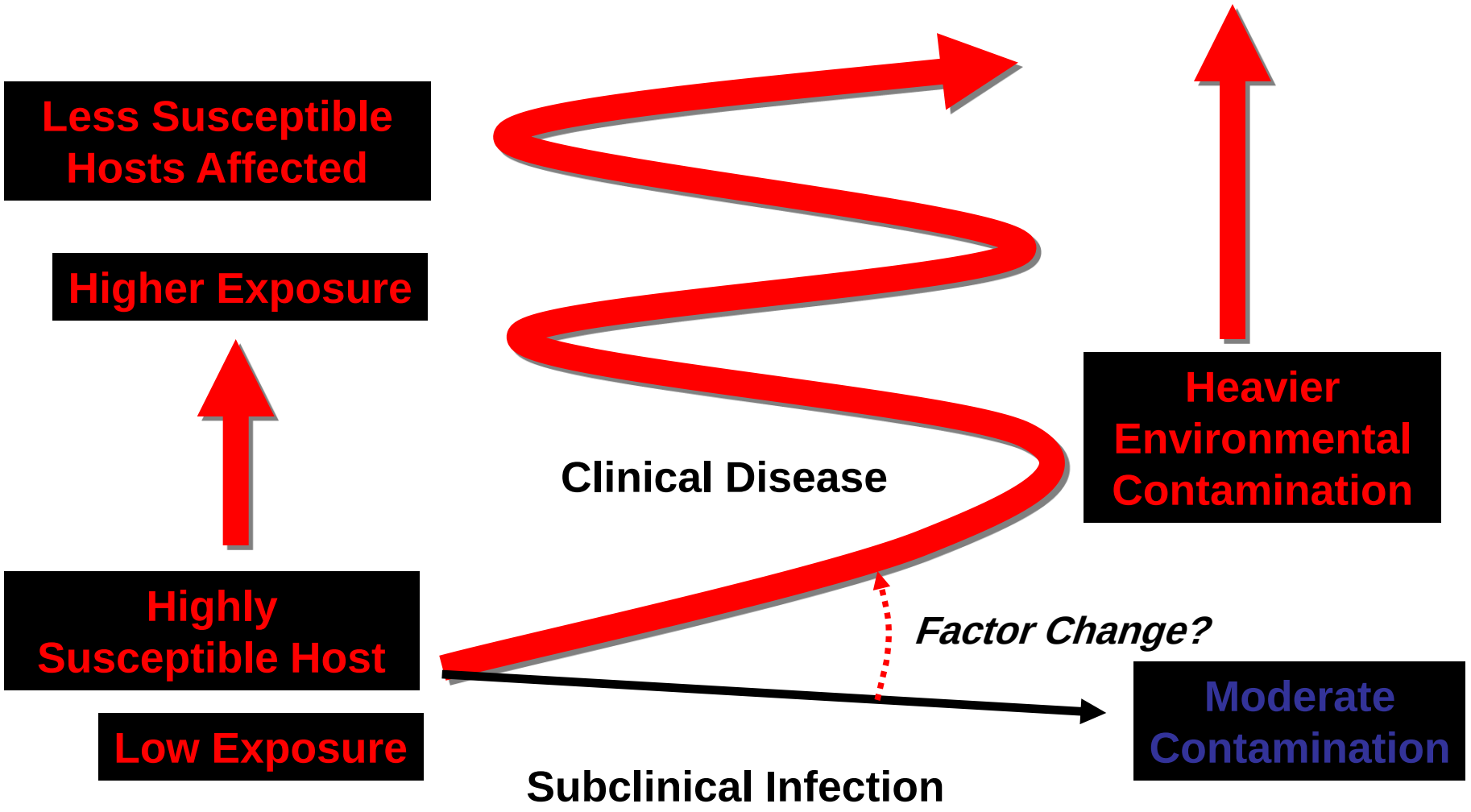
All infected
Some sick, some well

*If almost **all** farms have the infectious agents, why do **few** farms have **sick** calves?*

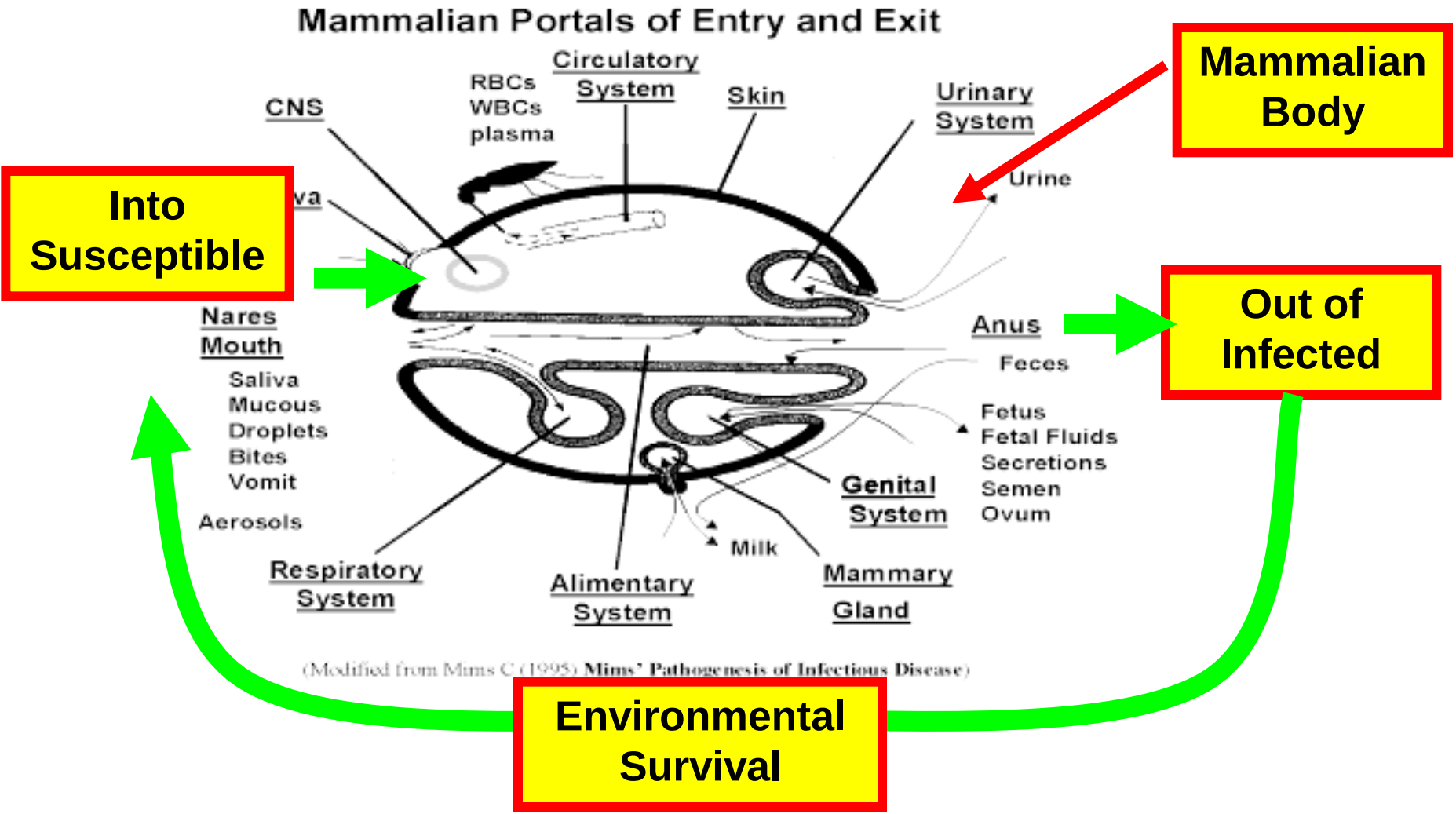
When doesn’t clinical disease occur?



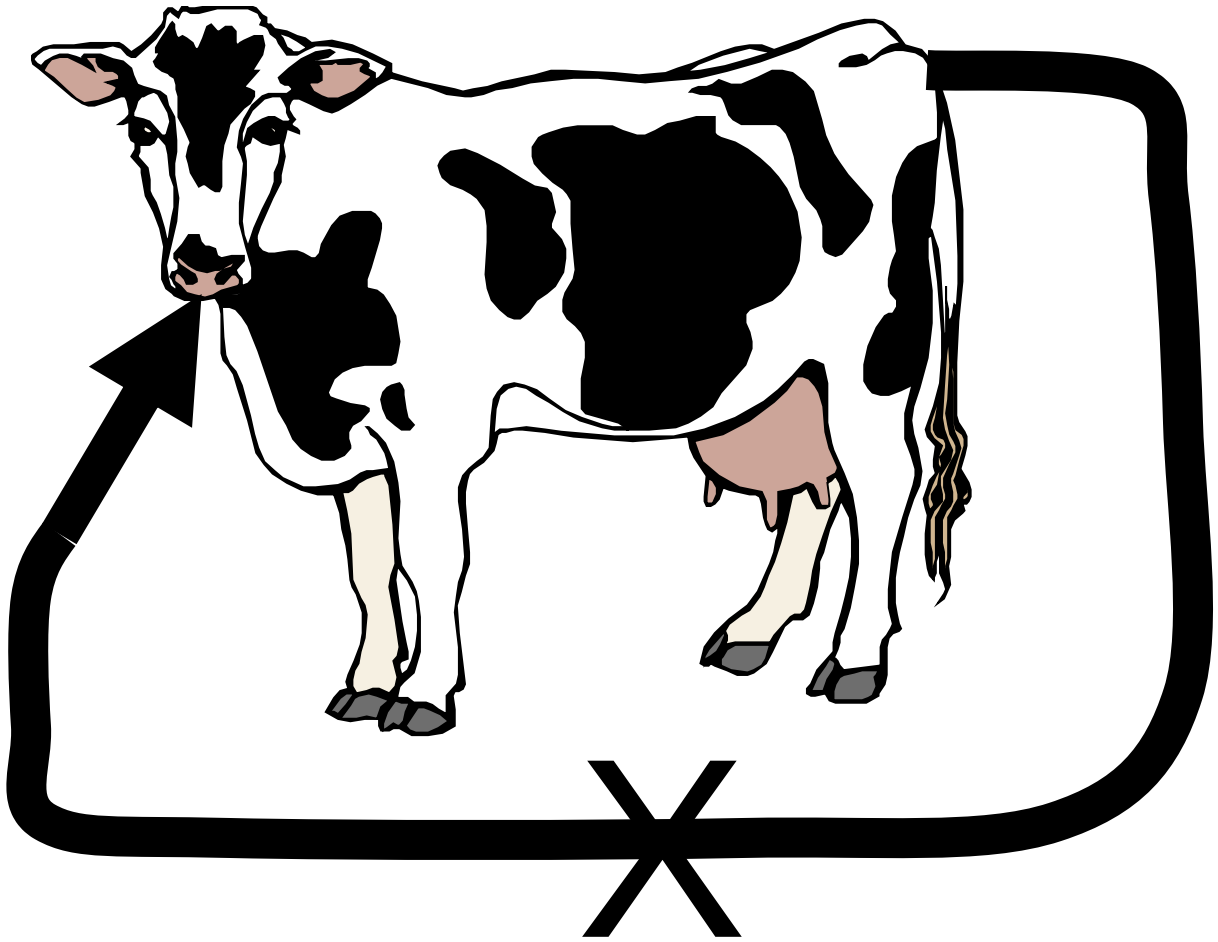
Vicious Cycle of Outbreaks

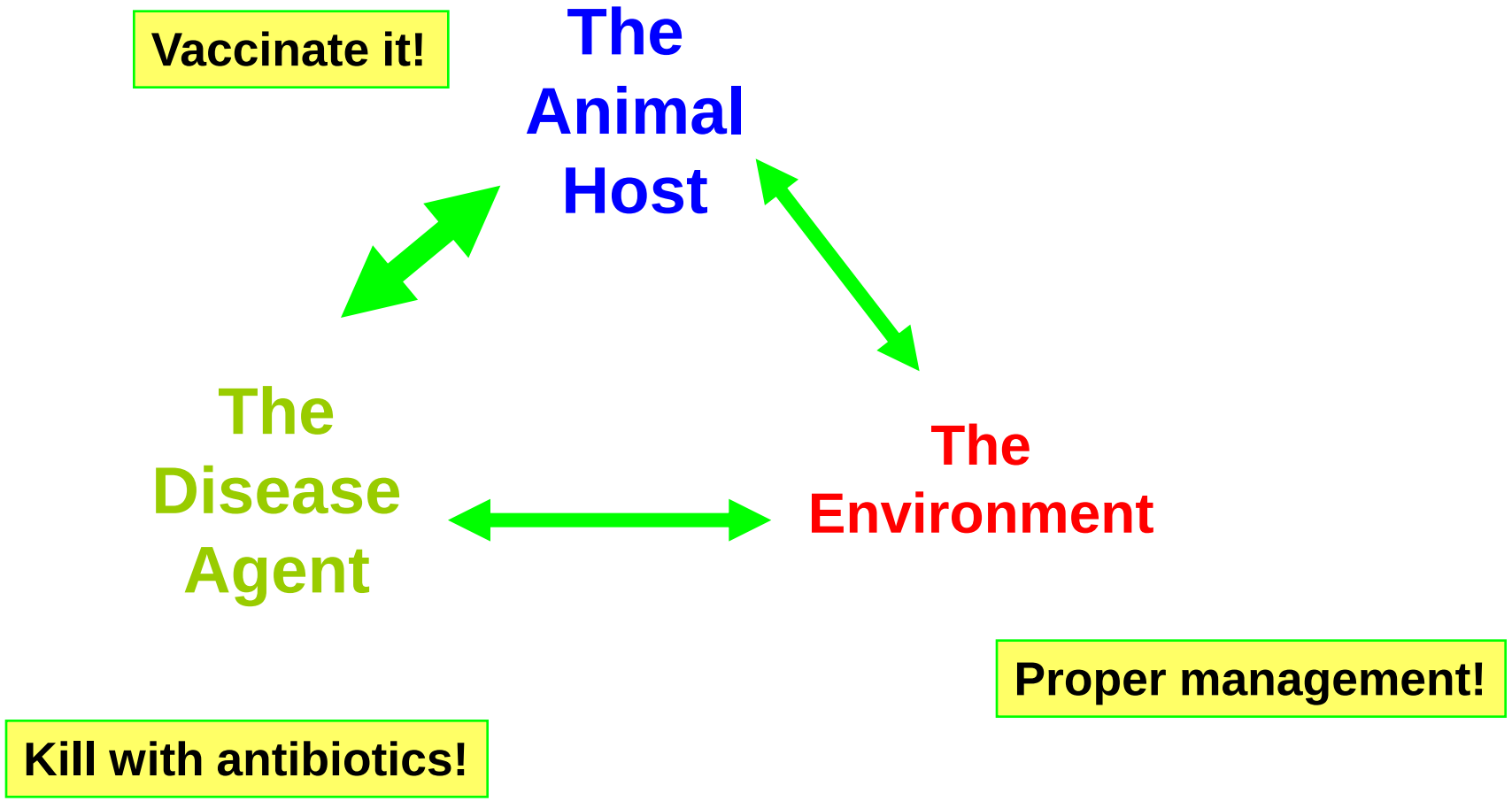


Transmission from infectious agent's perspective

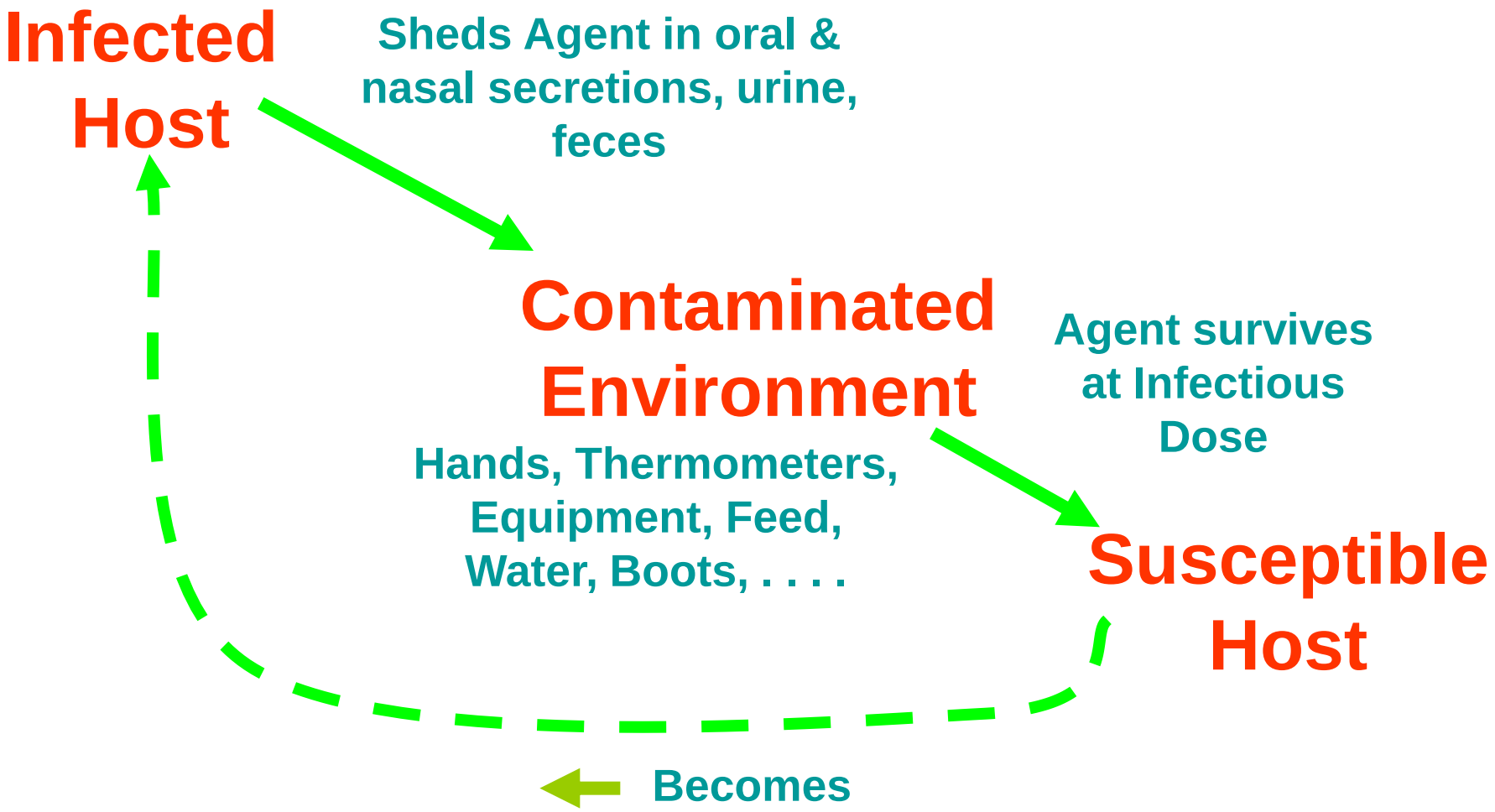


Major Transmission Cycle




Vaccinate it!
The Animal Host
The Disease Agent
The Environment
Proper management!
Kill with antibiotics!

Infection Transmission Chain

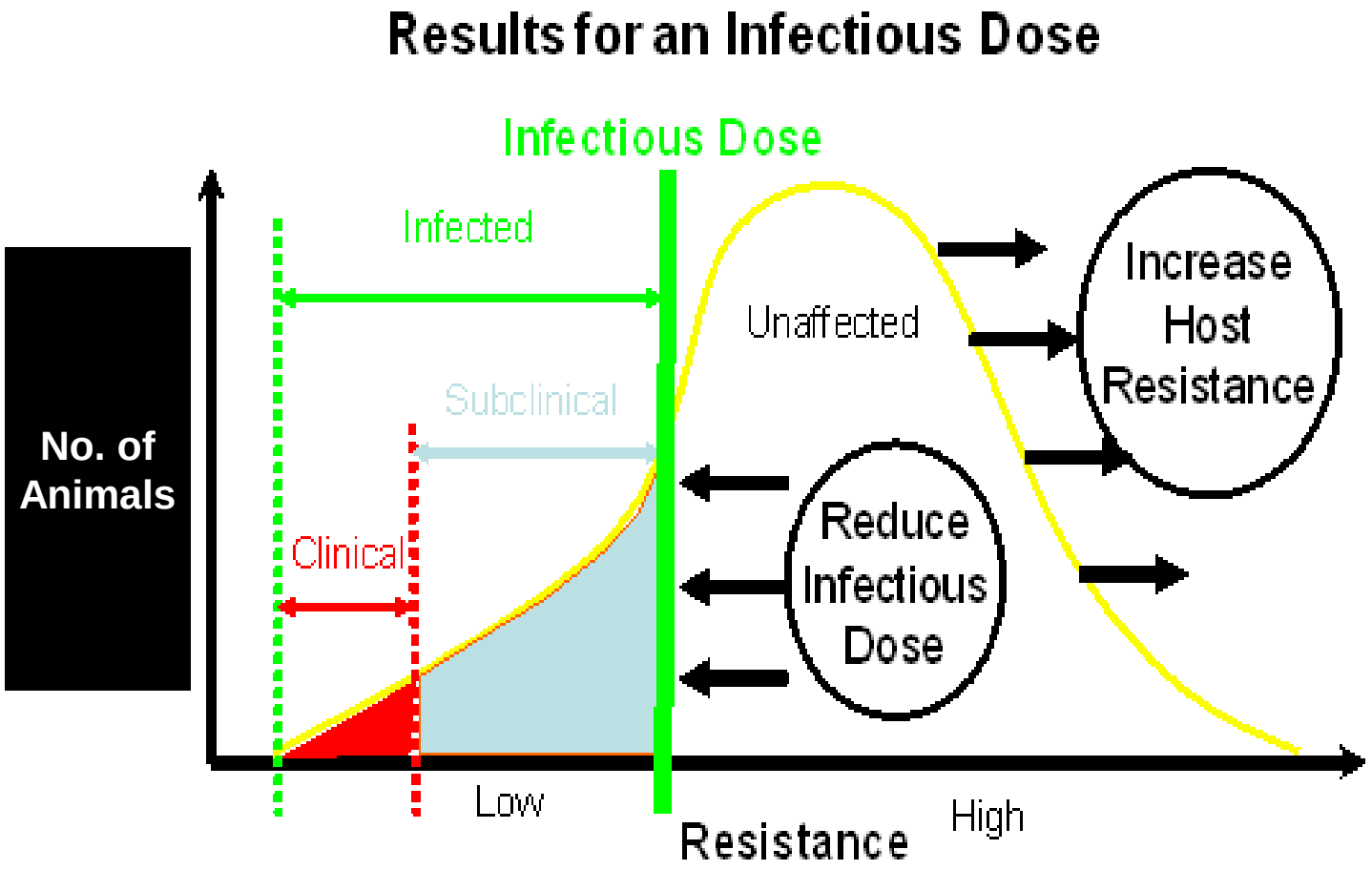


General Principles

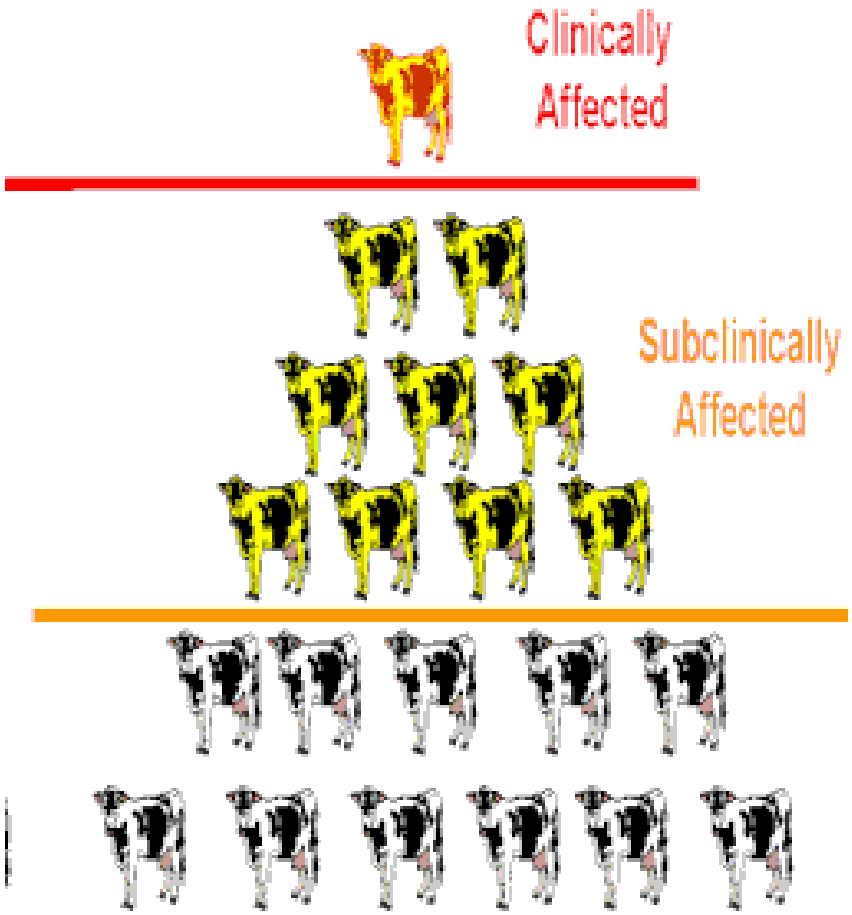
- **Maximize** the calf's **natural resistance** and **acquired immunity**.

- **Delay and minimize** the **infectious dose** the calf is exposed to
  - As most of these agents are ubiquitous, calf must eventually acquire the infection and develop an active immunity

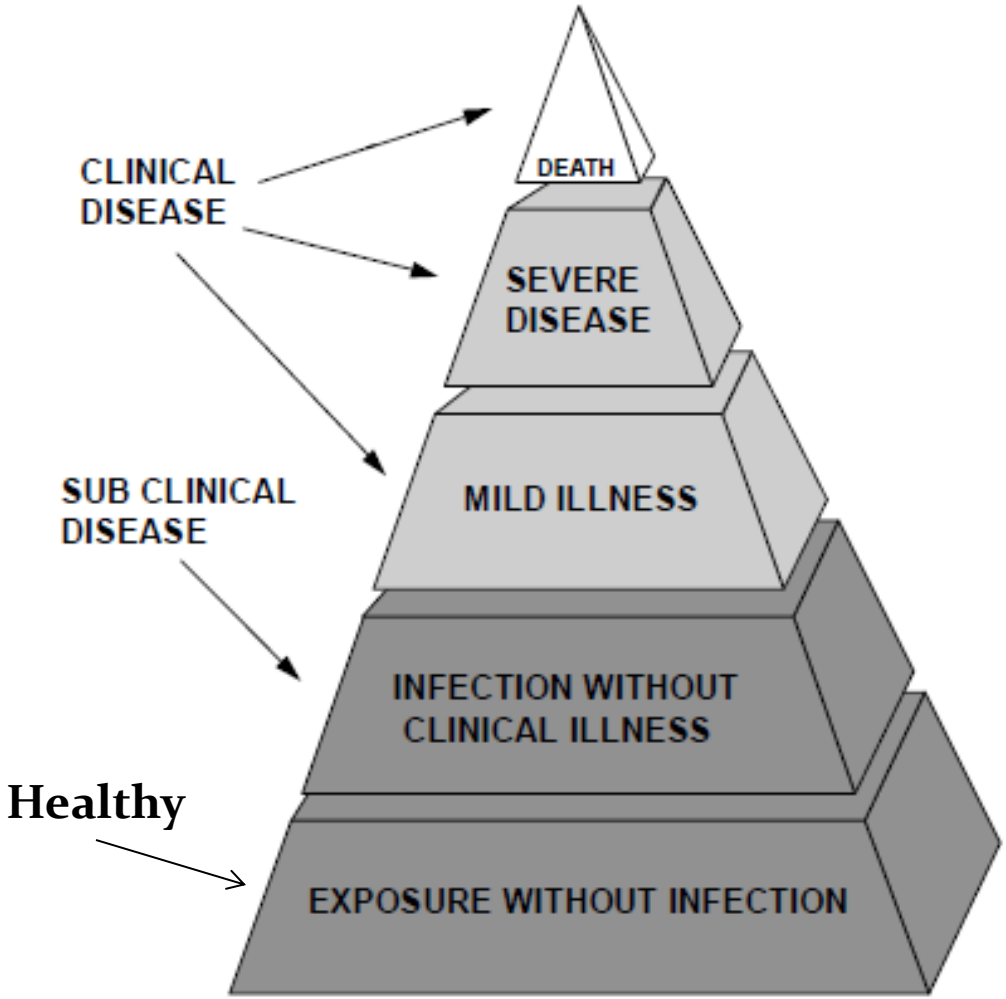
"Hardening" Strategies



Failure to Recognize the "Iceberg"



- **Most infections are subclinical**
  - **Typically > 10:1**
- **Can't identify every infected animal**
- **Some animals are much more susceptible than normal**
  - **Neonates**
  - **Animals with other diseases**



The iceberg concept of disease

BRUCELLOSIS

Brucellosis

- **Other names**
  - **Contagious abortion, Bang's disease, epizootic abortion and Slinking of the calf (animals).**
  - **Undulant fever, Malta fever, Mediterranean fever and Bang's fever (humans).**
  - **مرض الاجهاض المعدى**
  - **مرض البروسيلا**

Definition

- **Brucellosis is an extremely contagious disease mainly of cattle, sheep, goat and swine and could infect other animals and man.**
- **Caused by Brucella spp.**
- **Characterized by:**
  - **inflammation of the genital organs.**
  - **Abortion.**
  - **Retained placenta.**
  - **High rate of infertility.**
  - **Persistent life long infection.**

Brucellosis: History

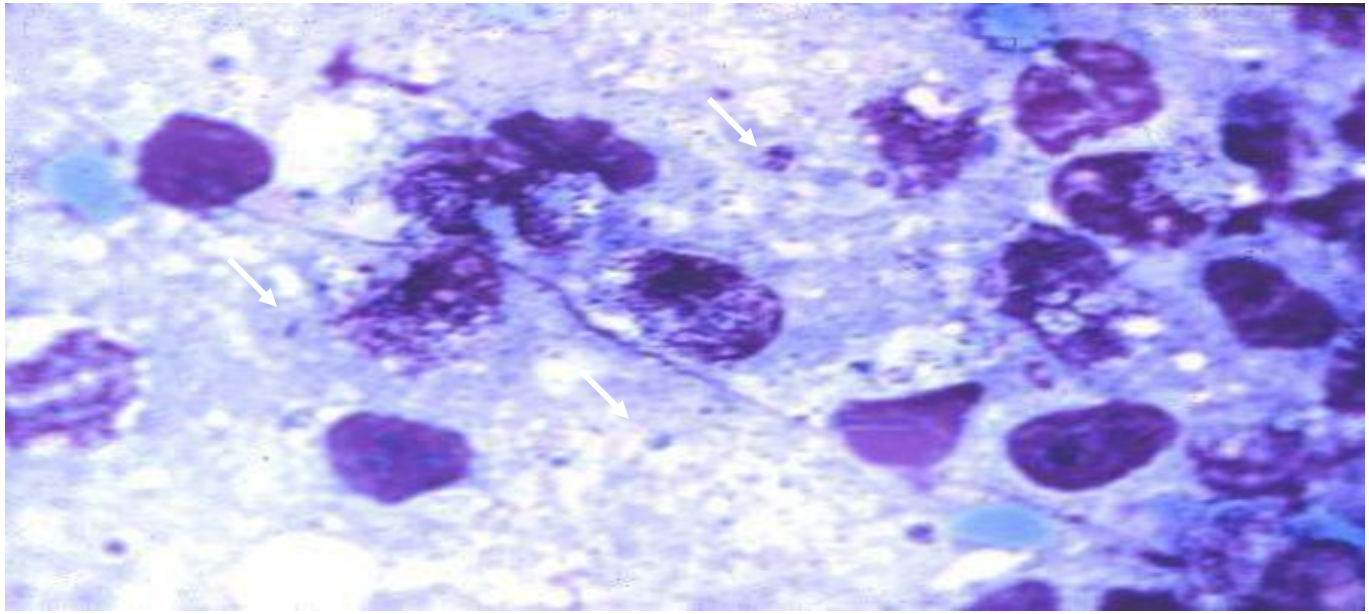
- B. melitensis
  - David Bruce – English doctor
  - Discovered in 1887
  - British soldiers sick in Malta
  - Identified in goats' milk
- B. abortus
  - By Bang at Denmark 1897

BRUCELLOSIS

- **Microbiology**
  - **Gram negative coccobacilli**
  - **Non-spore forming**
  - **Lack capsules**
  - **Non-motile (no flagella)**
  - **Metabolism**
    - **primarily oxidative**
    - **aerobic to microaerophillic (5-10% CO_2)**
    - **slow growth @ 37°C on enriched medium**

BRUCELLOSIS

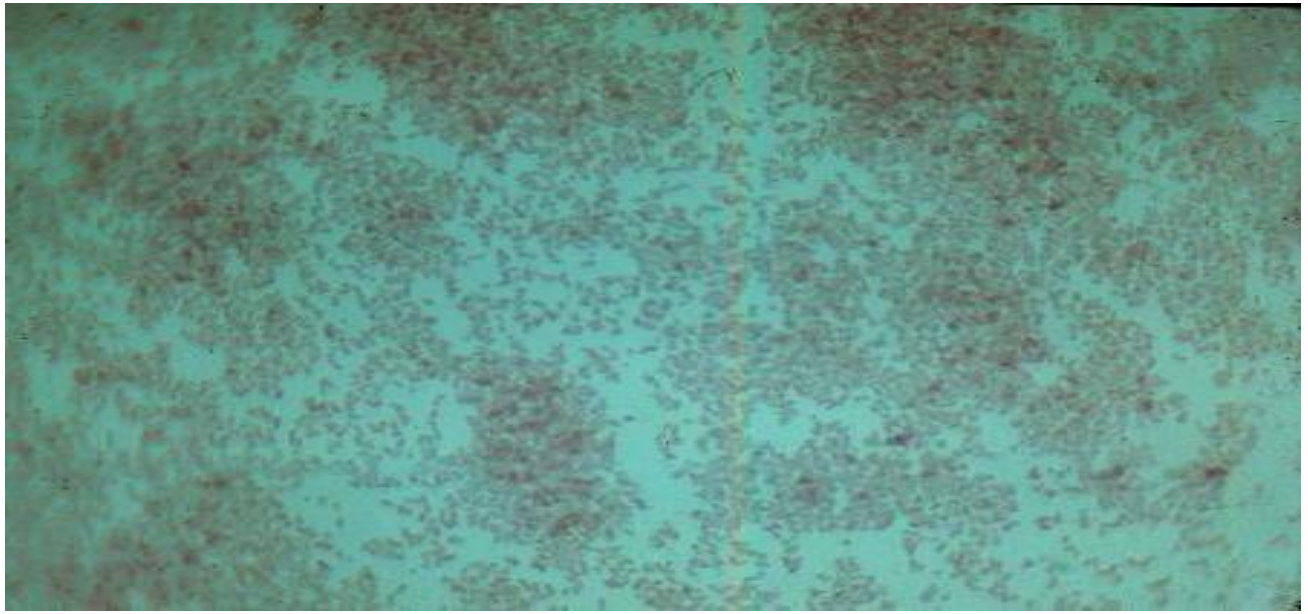
- **Microbiology**



Impression smear of *B. abortus* from aborted fetus

BRUCELLOSIS

- **Microbiology**



Impression smear of *B. suis* from aborted tissue

Etiology

Brucella melitensis

Goat, sheep, camels

Most widespread

Most virulent

Etiology

Brucella abortus

Cattle and camels

Less virulent

Etiology

Brucella suis

Pigs, swine

Less virulent

Etiology

Brucella canis

Dogs

Least common

BRUCELLOSIS

Microorganism	Reservoir Host
Brucella abortus	Cattle
B. Melitensis	Sheep, goats, cattle
B. Suis	Swine
B. Canis	Canine
B. Ovis	Sheep
B. Maris	Marine mammals
B. neotomae	Desert wood rat

Species	Biovar / Serovar	Natural Host	Human Pathogen?
B. abortus	1-6, 9	cattle	yes
B.melitensis	1-3	goats, sheep	yes
B. suis	1, 3	swine	yes
	2	hares	yes
	4	reindeer, caribou	yes
	5	rodents	yes
B. canis	none	dogs, other canids	yes
B. ovis	none	sheep	no
B. neotomae	none	Desert wood rat	no
B. ?		marine mammals	?

Epidemiology

- **<u>Distribution:</u>**

- **Well distributed in undeveloped countries including Egypt.**

- **Some developed countries are free such as USA, UK, Canada, Germany and Japan.**

Transmission and mode of infection

- **Sources of infection:**

- **The contents of gravid uterus:**

  including the fetus, fetal membranes

- **Urine**
- **Milk**
- **Semen**
- **Faeces**

Mode of transmission

- **Ingestion……cont. food, water and milk.**
- **Penetration of skin, mm…..even intact ones**
- **Venereal transmission**
- **W. animals, rodents, insects and blood sucking arthropods such as tick……act as carrier and reservoir**

Susceptible hosts

Animal spp	B. abortus	B. melitensis	B. suis	B. canis	B. ovis
Cattle	+++	+	+	±	±
Camels	+	+	±	-	-
sheep	+	+	+	±	++
Goat	+	+++	+	±	±
Horse	+	-	+	±	±
Man	++	++	++	±	±
Dog & Cat	±	±	±	+	±
G. pig	+	++	++	±	±

Factors influencing susceptibility

- **Introduction of new animals without testing.**
- **Bad management.**

E. value

- **Occupational disease with public H. importance.**
- **Decrease in milk production.**
- **Abortion…….calf loss**
- **Infertility cases.**

Pathogenesis

- **It highly invasive m.o.**
- **It gain entrance via mm of oropharynx, nose, conjunctiva, urogenital tract, teat canal and skin.**
- **Through lymphatic to regional L.N.**
- **Multiplication occurs within neutrophil, macrophages,…..thoracic duct……blood stream….bacteraemia.**

Pathogenesis cont.,

- **Localization in parynchematous organs such as gravid uterus causing placentitis …..growth favored by mesoerythritol (a carbohydrate produced by fetus and fetal membranes).**

- **If not pregnant, other organs such as udder and the adjacent LN.**

- **Other organs as liver, spleen, lungs, bone marrow and joints……granulomatous foci…….abscess due to endotoxins.**

Pathogenesis cont.,

- **In male, the testicles are the main target……orchitis.**

Clinical signs

- **IP:14 days to 4 month but usually less than 2 month…..(inversely proportional to the stage of pregnancies).**
  - **inflammation of the genital organs.**
  - **Abortion.**
  - **Retained placenta.**
  - **High rate of infertility.**
  - **Persistent life long infection.**

Clinical signs cont.,

- **Abortion occurs in the last 3 month of pregnancy.**

- **Subsequent pregnancies, the fetus is usually carried out to full term…….2nd or 3rd abortion may occur in the same animal.**

Clinical signs cont.,

- Camels: abortion or still birth.
- Sheep and goats: fever, diarrhea, abortion 3-4 m., mastitis, orchitis.
- Equines: fistulous withers and poll evil, abortion in mares.
- Human: recurrent fever, rheumatic and neuralgic pain, profuse sweating, orchitis and abortion in woman.

Diagnosis

- **Case history ….**
- **Field test…..minor importance in cattle but more sensitive in sheep and goats….inoculation in eyelids.**
- **Clinical signs…..storm of abortion.**
- **Some problems associated with diagnosis of brucellosis serologically**

Diagnosis cont.,

- Such as:
  - latent infection, - ve in serology.
  - Vaccinated animals, + ve in serology.

❑**Isolation and identification:**

- ❑ **for serology….blood samples, seminal plasma, milk….**
- ❑**For isolation: uterine discharges….**

Diagnosis cont.,

- Direct smear by gram stain…..
- Culturing on specific media……brucella albimi agar.
- Animal inoculation 2 groups of G. pigs.

Diagnosis cont.,

- Tests for the presence of brucella antibodies:
  - Abortus bang ring test (ABR test)
  - Standard tube agglutination test (STAT)
  - Standard plate agglutination test.
  - Vaginal mucous agglutination test.
  - Seminal plasma agglutination test.
  - Rose bengal plate test.
  - CFT, ELISA…….

Diagnosis cont.,

- DD:
- Leptospirosis
- Listeriosis
- Vibriosis
- Trichomoniasis

Prognosis

- **Unfavourable**

Treatment

- **No effective treatment recommended in animals.....slaughtering of the reactors.**

Prevention and control

- **A- remove the source of infection by test and slaughter of the reactors:**
  - **Regular testing by ABR test …..infected dairy herd.**
  - **Serum agglutination test to detect individual cases …… confirm by CFT.**
  - **Slaughter + ve reactors.**
  - **1 m interval for 3 consecutively – ve tests.**

Prevention and control cont.,

- B. Prevent the spread of infection:
  - Sanitary measures
  - Hygienic disposal of aborted fetus,……
  - Disinfection by carbolic acid 5%.
  - Prevent the introduction of infected animals to clean herds.
  - Control of insects, rodents….

Prevention and control cont.,

- Vaccination:
  - Calfhood living attenuated vaccine B19
    - Aqueous form
    - Lyophilized
    - 2ml s/c
    - Recommended 3 injection 6, 12 & 18m…..90% protection.
    - Disadvantages: abortion, infect humans, interfere with control program, post vaccinal reaction and vaccination to females.

Prevention and control cont.,

- Mac Ewen strain 45/20 oil adjuvant vaccine (Abortex):
  - Killed vaccine
  - Should be given after 6 m of age.
  - 3ml s/c or i/m…….another dose after 4-8w.
  - Booster every 6m

Prevention and control cont.,

- Vaccine H38 (Abrolan):
  - Killed vaccine
  - B. melitensis strain H38.
  - 12-14 m protection
  - 2 doses

Prevention and control cont.,

- Rev.1 vaccine
  - B. melitensis strain
  - Attenuated strain
  - Sheep and goats
  - 4-5 years
  - 2ml s/c