# FOOTHILL ABORTION
## (EPIZOOTIC BOVINE ABORTION : EBA )

UCDAVIS VETERINARY MEDICINE
*Pathology, Microbiology and Immunology*

CALIFORNIA CATTLEMEN'S ASSOCIATION
CCA
SINCE 1917

UNIVERSITY OF NEVADA RENO
1874


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# FOOTHILL ABORTION

**Distribution: CA, NV & OR**

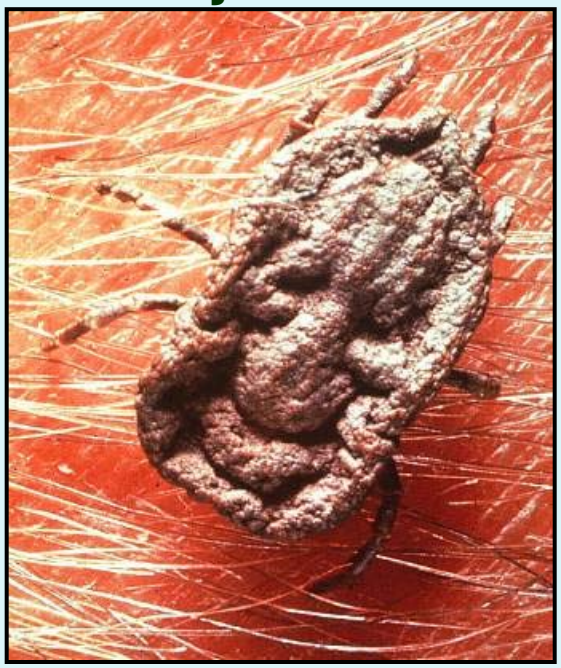
**Up to 90% fetal mortality (1ST exposure to ticks)**

**Window of susceptibility (60-140 days gestation)**

**Term abortions/weak calves**

**Diagnosis: Pathology does not develop until ~100 days post-infection**

## The Pajaroello Tick



**Distribution: Mexico, CA, NV & OR**

**Rapid feeders (15-20 minutes)**

**Larvae > nymphs (multiple stages) > adult**

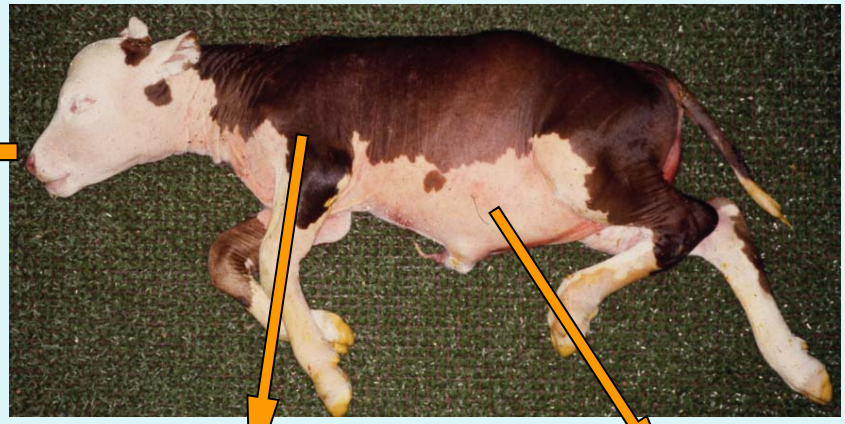
**Long-lived (~10 years?)**

**Greatest activity: May-October**

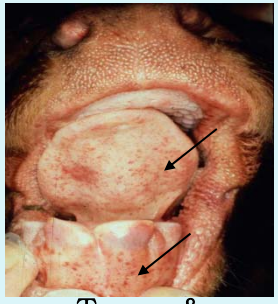
# DIAGNOSIS

- **History of the dam**
- **Gross and microscopic pathology**
- **Serum immunoglobulin**

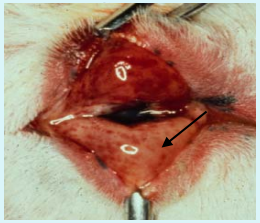
# GROSS PATHOLOGY



Mucosal Hemorrhages



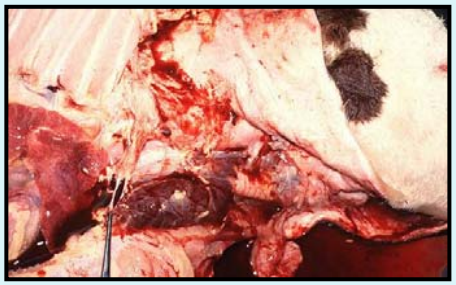
Tongue &



Eye

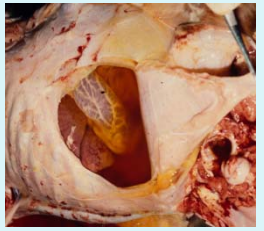
Enlarged Lymph Nodes

Internal Gross Pathology

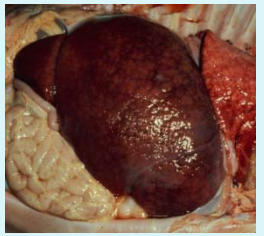


**Thymus**

Enlarged Spleen
(liver not involved)



Ascites



Enlarged,
Mottled Liver

# TRANSMISSION OF EBA


# IMPROVED METHOD OF TRANSMISSION

**- Challenge model developed for predictable transmission of foothill abortion to susceptible pregnant heifers:**

**- Cryopreserved fetal thymus harvested from select infected term fetuses**

**- Very reliable if you find the right fetus!**

# ANTIBIOTIC STUDIES

| Antibiotic | Dose/ Schedule | Results |
|---|---|---|
| Tetracycline + Penicillin | Tet (IP① & IM②)<br>Pen (SQ③ & IV④) | Protection |
| Tetracycline | LA200 ② | Protection |
| Penicillin | Aquacillin (SQ③) & Procaine (IV④) | Protection |
| Tetracycline | 1 dose at challenge | No |
| Tetracycline | 1 dose at 45 days post - challenge | No |

① Oxytetracycline, IP, 100mg/ml, 1X/day for 3 days
② LA200, IM, 9mg/lb, 3 day intervals for 3 weeks
③ Aquacillin, SQ, 17,500 U / lb, 2x / day for 7 days
④ Procaine Penicillin, 10mil U, once @ 24hr PC

# CAUSATIVE AGENT

- **Antibiotic studies proved the causative agent is a bacterial**

- **Molecular biology identified the bacteria**
  - δ **-Proteobacteria**
    - ***Myxobacteria***
      - An odd group of fruiting-gliding bacteria
      - Many are soil organisms

- **Referred to as the "agent of EBA"**

- **Proposed scientific name: Pajarellobacter abortibovis**

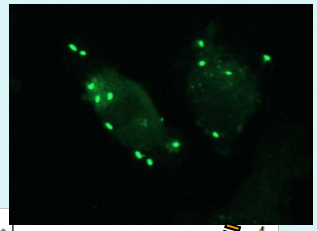
# ALTERNATE HOST FOR EBA

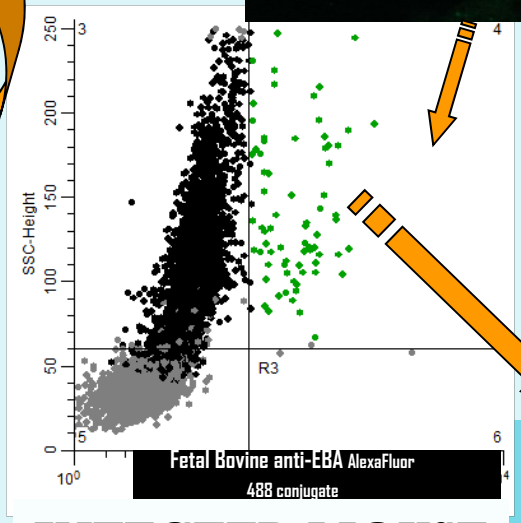
**P. abortibovis-Infected Immunodeficient Mice**

# VACCINE CANDIDATE:
## Cryopreserved murine-derived live bacteria

Infected thymus &/or spleen

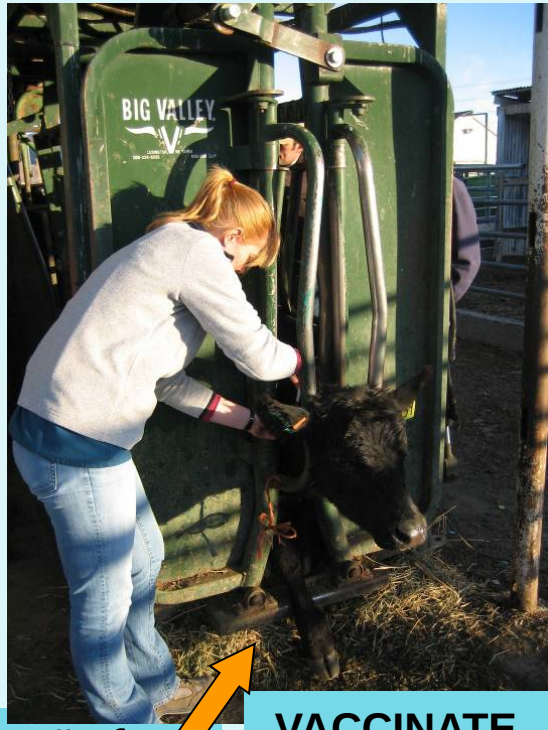
SCID MOUSE



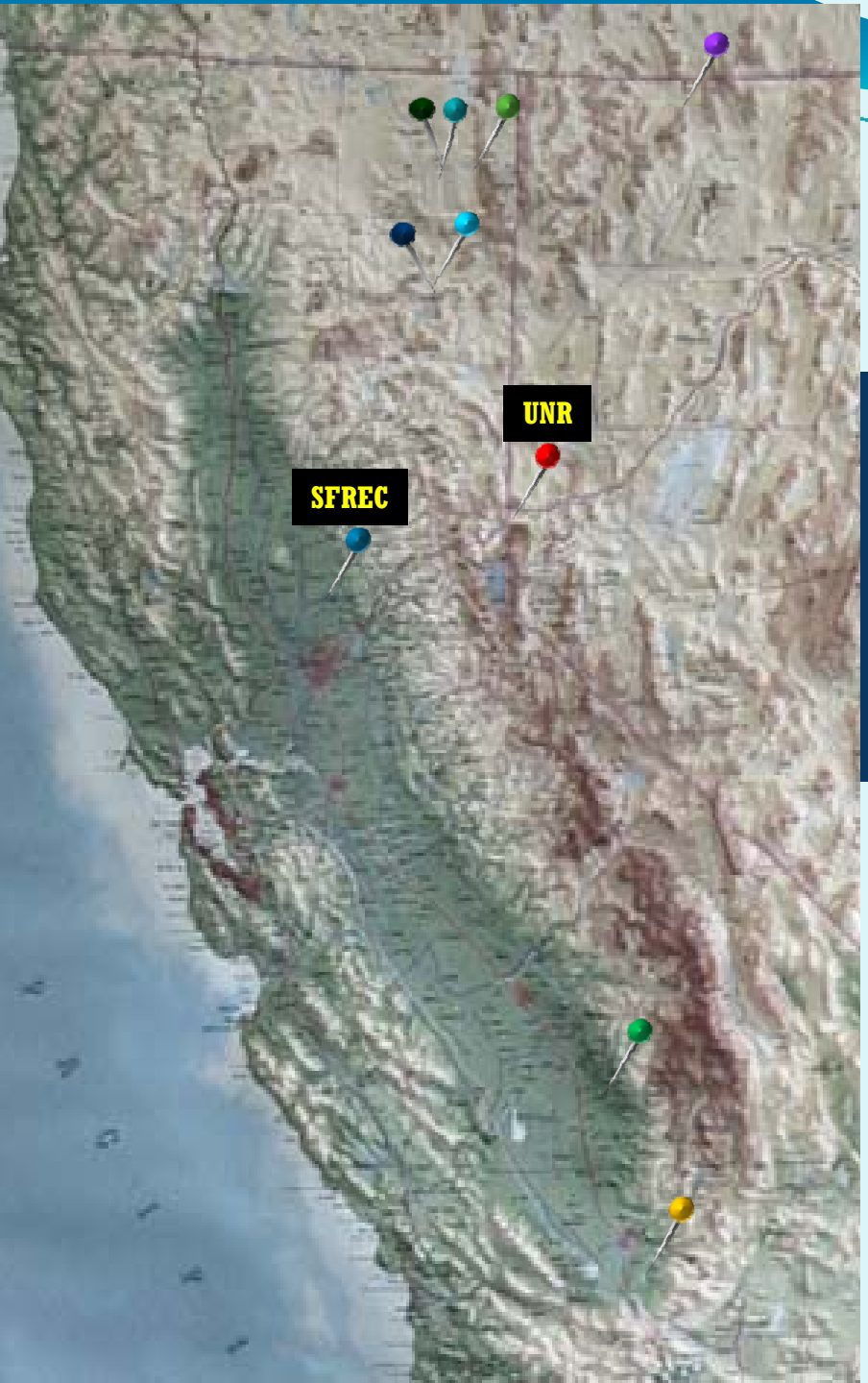



INFECTED MOUSE SPLEEN CELLS

Determine # of Infected Cells




VACCINATE




# Current status of foothill abortion vaccine

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# STUDY SUMMARIES:
# PHASE 1: *SAFETY* & EFFICACY
## - REQUIRED FOR LICENSING

## ADVERSE REACTIONS:

- Data collected from >2000 head on 10 ranches
- Immediate reactions (i.e. anaphylactic shock) – None noted to date
- Systemic delayed reactions – None noted to date
- Localized injection site reactions
  - Soft swelling
    - Beginning ~ 3 weeks post vaccination
    - Lasting 1 to 5 weeks
    - Usually not noticed unless palpated
- Conception rates: similar between groups
- Embryonic losses: ??
  - 5 to 10% greater losses noticed in vaccinated heifers compared to controls (3 herds)
    - All were in studies with heifers vaccinated <5 weeks prior to breeding
    - Only noted in large groups of heifers with tight breeding times (30-45 days) or SFREC research herd in which heifers were preg checked at monthly intervals
  - Interval between vaccination & breeding extended from 4 to ≥8 weeks
    - Data acollected to date suggests the problem has been solved!

# STUDY SUMMARIES:
## PHASE 1: *SAFETY* & EFFICACY
# CHALLENGE STUDIES AT UNR

**Experimental Challenge Trials (needle & syringe challenge)**

**Performed at UNR Main Field Station (collaborators since 1992)**

- **Free from tick vector = *NAÏVE HEIFERS!***
- **Variables tested in 4 completed trials:**
  - **Dose requirement (1 vs. 2 vaccinations): Year #s 1 & 2**
  - **Vaccine potency (how much bug/dose): Years #'s 1-4**
  - **Increased interval between vaccination and breeding to 6 weeks: (Year #4)**

| | Vaccinates | Controls |
|---|---|---|
| | % EBA | % EBA |
| Year #1: | 0% | 50% |
| Year #2: | 0% | 75% |
| Year #3: | 0% | 65% |
| Year #4: | 0% | 90% |

**YEAR #5-7 : CURRENT and UPCOMING STUDIES:**

- **Length of vaccine immunity: 1 or 2 years?**
- **Studies to better understand embryonic mortality in Yrs #2 & 3**
- **How early can we vaccinate?**
  - **Testing younger heifers (8-10 month) in combination with BANGS vaccine**

# STUDY SUMMARIES: FIELD EFFICACY FIELD TRIALS (NATURAL TICK EXPOSURE)

## ½ EBA VACCINATED; ½ CONTROLS

- **UC Sierra Foothill Research & Extension Center (SFREC)**
  - ~100 heifers enrolled each year
  - Year 1: 0% EBA in Vaccinates; 10% EBA in controls (100% of fetuses recovered)
  - Year 2: 0% EBA in Vaccinates; 2% EBA in controls (100% of fetuses recovered)
  - Year 3: Data not yet analyzed

- **2011-13: ~1800 head from 8 Private Producers (2 S. CA, 5 N. CA, 1 NV)**
  - 2 Ranches showed significant losses in the controls compared to EBA vaccinated heifers
    - Ranch #1 (N. CA): 95% healthy calves from vaccinates compared to 44% from controls
    - Ranch #2 (N. CA): 98% healthy calves from vaccinates compared to 72% from controls
  - Remaining ranches: No ***statistically significant*** difference between vaccinates and controls

Of fetuses recovered and submitted for diagnosis,
all EBA positives were from controls (i.e. no break in the vaccine documented)

# STUDY SUMMARIES: FIELD EFFICACY FIELD TRIALS (NATURAL TICK EXPOSURE)

## ½ EBA VACCINATED; ½ CONTROLS

## 2013-14: Focus on field efficacy

- Safety study requirements were met in 2011-12

## ~650 head from 6 Private Producers (5 in N. CA, 1 in NV)

- Interval between vaccination and breeding increased to a minimum of 6 weeks
- Dosage reduced ~4-fold from previous year
- Vaccine administered with repeater "guns" to better simulate field conditions
  - Individual syringes were used in 2011-12 to insure consistent dosing for each animal

# Completed studies - Items required by USDA

- **"Minimum Effective Dose" - complete**
  - **This sets the minimum potency for the vaccine**
  - **Naïve vaccinated heifers were challenged with the bacteria**
  - **A recent study targeted at lowering the minimum effective dose was just completed at UNR (Year #4)**
    - **All vaccinated animals had healthy calves**
    - **90%of controls aborted with EBA-positive calves**
- **"90-day Withdrawal period" – USDA approved 10/2013**
- **Field safety and efficacy studies (12 total)–completed**
  - **8 commercial herds**
  - **2 research herds over a 2 year period**

**REPORTS FOR ALL OF THESE STUDIES ARE BEING PREPARED FOR SUBMISSION TO USDA**

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# TARGETS for Vaccine production

- **Establish a Business Plan**
  - **Marketing/Distribution**
    - **Results from a CCA study were provided**
      - **6% response w/ 91% of those indicating they would purchase vaccine (est 12,000 doses)**
    - **Expand market by establishing current endemic area: north-central Oregon, SW Idaho?**
      - **Several ranchers in central OR have been approached to provide fetal tissues/dam serum samples**
- **Start-up Capital**
  - **Production facilities**
  - **Production personnel**
  - **Equipment**
  - **Distribution network**
  - **Pre-distribution production of vaccine**
- **Production Facility:**
  - **Production facility (including mice facilities) has been identified at UCD**
  - **USDA pre-inspection performed in late June**
    - **Awaiting feedback from USDA**
- **Establish "Scale Up" in Production - priority**
  - **Maintaining sterility**
  - **Identifying appropriate machinery for filling and capping**
- **Establishing "Master Seed" and sub-serials**
  - **Testing: Bacteria , Mycoplasma, Select viruses**