



Wildlife/Livestock Disease
Investigations Team
(WiLDIT)
Brucellosis Research Update

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“Developing science-based solutions to disease problems at the wildlife/domestic animal interface”



Samantha Bruce

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Management tools for Brucellosis

Immunocontraception

- GonaCon™

Vaccination

- Dry Dart
- Mucosal vaccination of killed, powdered vaccine
- Natural transmission model in elk

Detection

- Volatile Organic Compounds


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Immunocontraception

Background

- In female bison, brucellosis is transmitted if pregnancy occurs
 - In over 300 captures, *B. abortus* was isolated from vagina, milk, blood, feces, & products of parturition
- GonaCon™ (immunocontraceptive vaccine)
 - GnRH linked to sea mollusk protein and therefore looks large and foreign (not recognized as “self”)
 - Combined with adjuvant containing *Mycobacterium avium*



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Immunocontraception

Current studies

- Study 1: Duration of infertility study in southern Colorado
- Study 2: Management of *B. abortus* in bison through immunocontraception (Corwins Springs, MT)



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Study 1: Duration of infertility in southern Colorado

- Initiated Nov 2011
- Gonacon™ treatment group (N=10)
- Non-treatment controls (n=10)

Results

Number pregnant/number in group; total efficacy = 69%

	Nov 2011	Nov 2012	Nov 2013	Nov 2014	Nov 2015	Total 12-15
Treatment	4/10	3/9	1/10	3/9	3/10	10/38 (26%)
Control	4/10	9/9	6/9	9/9	6/9	30/36 (83%)



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Study 2: Management of *B. abortus* in bison through immunocontraception

First cohort (2011)

- Treatment group (n=15; *B. abortus* +)
 - Sentinels (n=5; *B. abortus* -)
- Control group (n=14; *B. abortus* +)
 - Sentinels (n=5; *B. abortus* -)

Second Cohort (2013)

- Treatment group (n=20; *B. abortus* +)
 - Sentinels (n=6; *B. abortus* -)
- Control group (n=12; *B. abortus* +)

Study 2: Management of *B. abortus* in bison through immunocontraception

Results-efficacy of immunocontraception

First Cohort:

Group	2013	2014	2015	2016
Treatments	3/15 (20) *	2/15 (13)	5/14 (36)	3/14 (21)
Controls	11/14 (79)	10/13 (77)	10/12 (83)	10/12 (83)
Efficacy	75%	88%	57%	66%

Second Cohort:

Group	2015	2016
Treatments	1/20 (5)	5/19 (26)
Controls	10/12 (83)	10/12 (83)
Efficacy	94%	69%

*Number pregnant/number in group (percent)



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Study 2: Management of *B. abortus* in bison through immunocontraception

Results on the *Brucella* Side

• Control pasture:

- 12 *Brucella* abortions + 1 positive weak calf + 5 positive live calves = 18 “shedding events” (SEs) from 11 cows
- All 5 sentinels seroconverted → 6 abortions
- 12 calves (4 each year) have seroconverted at 1st calving season.
- One cow had 1 culture positive calf, 2 culture negative calves, then a culture positive abortion
- One cow (sentinel) had 1 negative calf then 3 culture positive abortions
- One seroconversion of low-titered cow to seronegative



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Control Pasture - continued

- Of the 14 original seropositive control cows, 2 died without positive cultures after the first calving season.
- 5 have never been culture positive (4 calving seasons so far)
- 7 have had 11 “shedding events” in 4 calving seasons
- Of the 5 seronegative sentinels, 4 seroconverted to positive during or immediately after 1st calving season and subsequently had 6 “SEs”.
- The 5th sentinel did not seroconvert until after her 3rd calving season, was pregnant Jan 2016 but did not calve
- Of total 11 shedding cows (controls plus sentinels), 6 have had single SE, 3 have had two SEs, and 2 have had three SEs.



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Study 2: Management of *B. abortus* in bison through immunocontraception

Results on the *Brucella* Side (cont'd)

- Treatment (GonaCon™-vaccinated) groups:

- Group 1: 0 seroconversions or SEs
- 0 seroconversions of sentinels
- 4 seroconversions to negative
- Group 2: 1 *Brucella*-positive abortion after 1 year contraception
- 0 seroconversions



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Vaccination

Background

- Need effective/remote delivery of brucellosis vaccines in bison and elk
- Bison: RB51 given in two doses administered ~1 year apart induced increased protection against abortion vs. single dose

(Olsen et al., 2015. *Clinical Vaccine and Immunology* 23)

- Elk: Continued research toward effective vaccine and challenge model

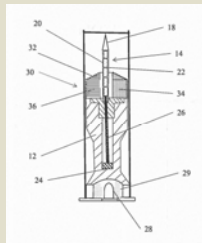
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DryDart™

- Dart system to deliver lyophilized, powdered, pelleted, or encapsulated vaccines
- 2X the payload of biobullets
- Marks injection site.
- Fired from dart gun or shotgun
- Biodegradable



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DryDart™




Pellet delivered by DryDart compared to larger Biobullet placed at site.




Dart marking injection site and bouncing out after depositing vaccine.

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Mucosal vaccination with powdered, killed vaccine

Goal: Develop killed, *B. abortus* vaccine for use on feedlines.



Right parotid lymph node with colored clay after intranasal delivery into left nasal sinus

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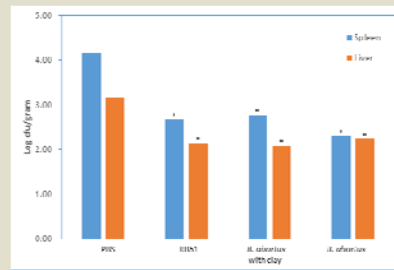


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Mucosal vaccination with powdered, killed vaccine

Initial studies in mice: Powdered, killed *B. abortus* complexed with montmorillonite clay

- Group 1: Saline-vaccinated controls (n=15)
- Group 2: RB51 5X10⁸ cfu IP (n=15)
- Group 3: Killed *B. abortus* 10¹¹ cfu (n=15)
- Group 4: Killed *B. abortus* 10¹¹ cfu with clay (n=14)
- Challenge elk strain 10⁵ cfu IP



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Developing a model for natural *B. abortus* infection in elk



- Natural exposure as challenge
- Potential model for vaccine studies



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Developing a model for natural *B. abortus* infection in elk

- Study 1: 2014
 - 10 negative elk, 2 undiagnosed elk fetuses
 - In 24 hours, 227 contacts of elk with fetuses
- Study 2: 2016
 - 11 negative elk, 1 elk fetus, 9 positive pregnant elk


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Developing a model for natural *B. abortus* infection in elk

Results (so far)

- Study 1
 - No seroconversions
- Study 2
 - No abortions in the 9 pregnant cows
 - Status of calves pending
 - No seroconversions in naïve animals after 90 days



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WiLDIT Future Works

- Continue GonaCon™ projects
- DryDart RB51 study in bison with *B. abortus* challenge
- Remote vaccination of bison calves and yearlings with DryDart RB51
- Second mouse study with powdered, killed *B. abortus*
- Powdered, killed *B. abortus* in elk

Thanks to the Folks that Helped Make it Happen!

Immunocontraception Studies

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