Novel Approaches to the Diagnosis of Respiratory Disease in Cattle

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Bovine Respiratory Disease Complex

39.6 % of mortality in pre-weaned calves

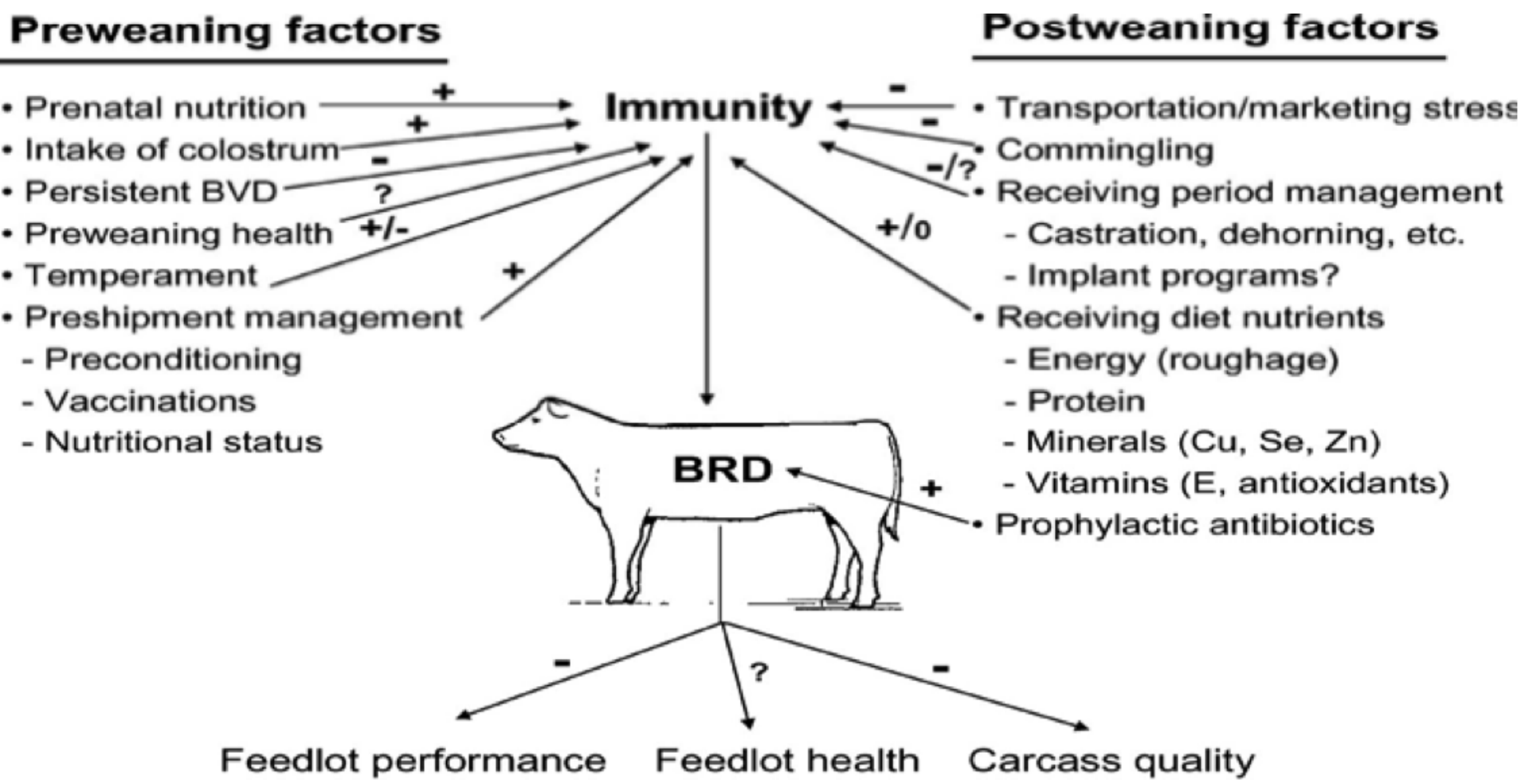
Over 50% treatments in sick cattle

Average incidence of up to 14%

Economically significant

- Treatment costs
- Labor
- Loss of animal performance
- Loss of reproductive performance
- Survival

BRD is multifactorial



BRD has many etiologic agents and often is caused by multiple pathogens

Viral Pathogens	Bacterial Pathogens
BHV-1	*Mannheimia haemolytica*
BVDV (I & II)	*Pastuerella multocida*
BRSV	*Histophilus somni*
PI3	*Mycoplasma bovis*
BoCOV	*Trueperella(Archanobacter) pyogenes*

Approach new cases of BRD as undifferentiated respiratory disease to avoid bias

The problem….

Antemortem

Clinical Illness Scoring-Illness Behavior

Sampling Sites

Serum Biomarkers

Postmortem

Lung Scores

Getting the most out of diagnostic lab sample

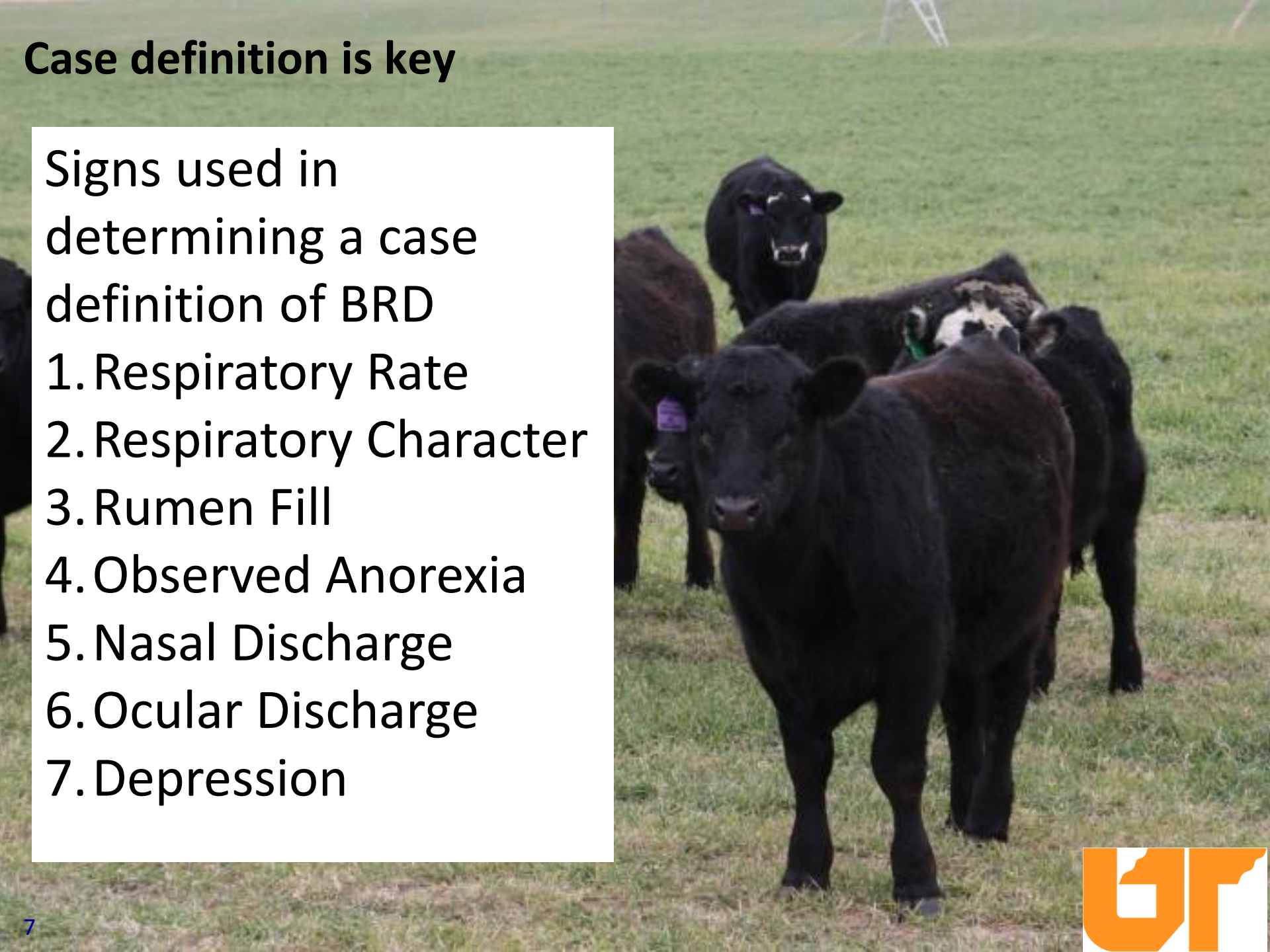
Pen riding is an art and a science

- **Observation is critical**
  - **Same time every day**
  - **Ideally the same person**
  - **Should be pulling 5-10% with no disease**

Case definition is key

Signs used in determining a case definition of BRD

1. Respiratory Rate
2. Respiratory Character
3. Rumen Fill
4. Observed Anorexia
5. Nasal Discharge
6. Ocular Discharge
7. Depression



Clinical illness scoring attempts to remove the subjectivity of diagnosing BRD

Depression Scores
1 -- mild
2 – moderate
3 – marked
4 – severe

Lung Scores (Stethoscope)
1 – Normal
2 – Mild increased
3 – Moderately increased
4 – Severely increased
5 – Diffusely severe

Rectal Temperature
Arbitrary cut off
- in light of ambient temperatures

> 103.5 ^{0} F

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Depression Scores	Lung Scores (Stethoscope)	Rectal Temperature
1 -- mild	1 – Normal	Arbitrary cut off
2 – moderate	2 – Mild increased	- in light of ambient
3 – marked	3 – Moderately increased	temperatures
4 – severe	4 – Severely increased	
	5 – Diffusely severe	> 103.5 ^{0} F

Calf 1-		
Mild Depression 1	Moderately Increased Lung Sounds 3	>103.5 ^{0} F 4 TREAT !

Assigning a CIS aids in identifying animals early in the course of the disease

Clinical illness scoring attempts to remove the subjectivity of diagnosing BRD

Depression Scores	Lung Scores (Stethoscope)	Rectal Temperature
1 -- mild	1 – Normal	Arbitrary cut off
2 – moderate	2 – Mild increased	- in light of ambient
3 – marked	3 – Moderately increased	temperatures
4 – severe	4 – Severely increased	
	5 – Diffusely severe	> 103.5 ^{0} F

Calf 2-		
Mild Depression 4	Moderately Increased Lung Sounds 5	Temp +/- elevated 9 TREAT?? CHRONIC??

Calves with elevated CIS have poorer prognosis and are more likely to develop chronic lung infections

If you can't measure it, you can't manage it

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A1 | Calf ID

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S	T	U
1	**Calf ID**	**Date Treated**		**Clinical Illness Score**			**Antibiotic Admninistered**			**Retreatment Date/Product**			**Notes**								
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Sheet1 | Sheet2 | Sheet3

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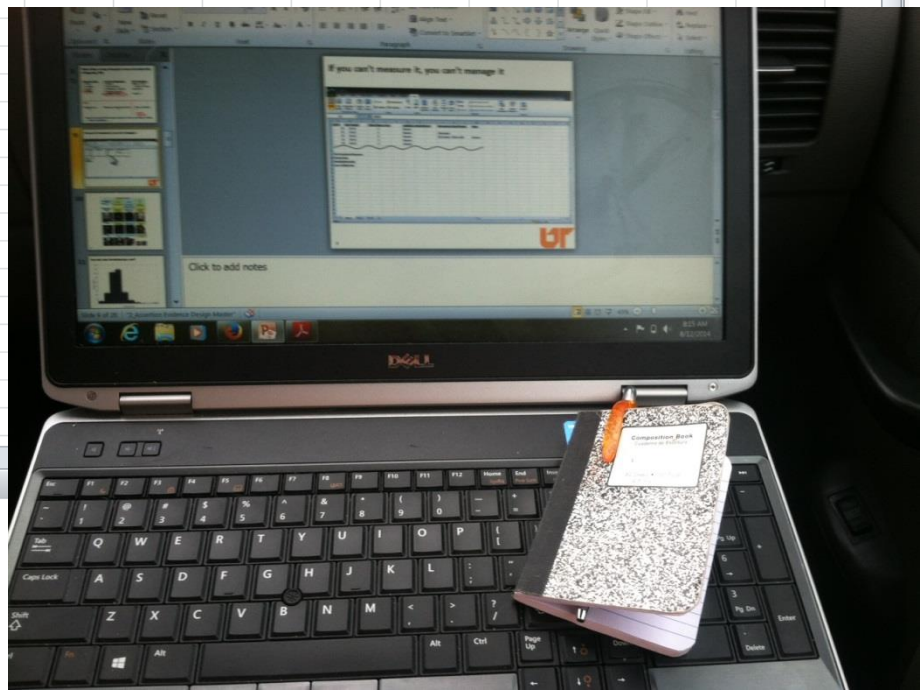
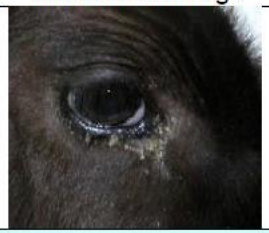


Calf Health Scoring Criteria			
0	**1**	**2**	**3**
Rectal temperature			
100-100.9	101-101.9	102-102.9	≥103
Cough			
None	Induce single cough	Induced repeated coughs or occasional spontaneous cough	Repeated spontaneous coughs
Nasal discharge			
Normal serous discharge	Small amount of unilateral cloudy discharge	Bilateral, cloudy or excessive mucus discharge	Copious bilateral mucopurulent discharge




Eye scores			
Normal	Small amount of ocular discharge	Moderate amount of bilateral discharge	Heavy ocular discharge



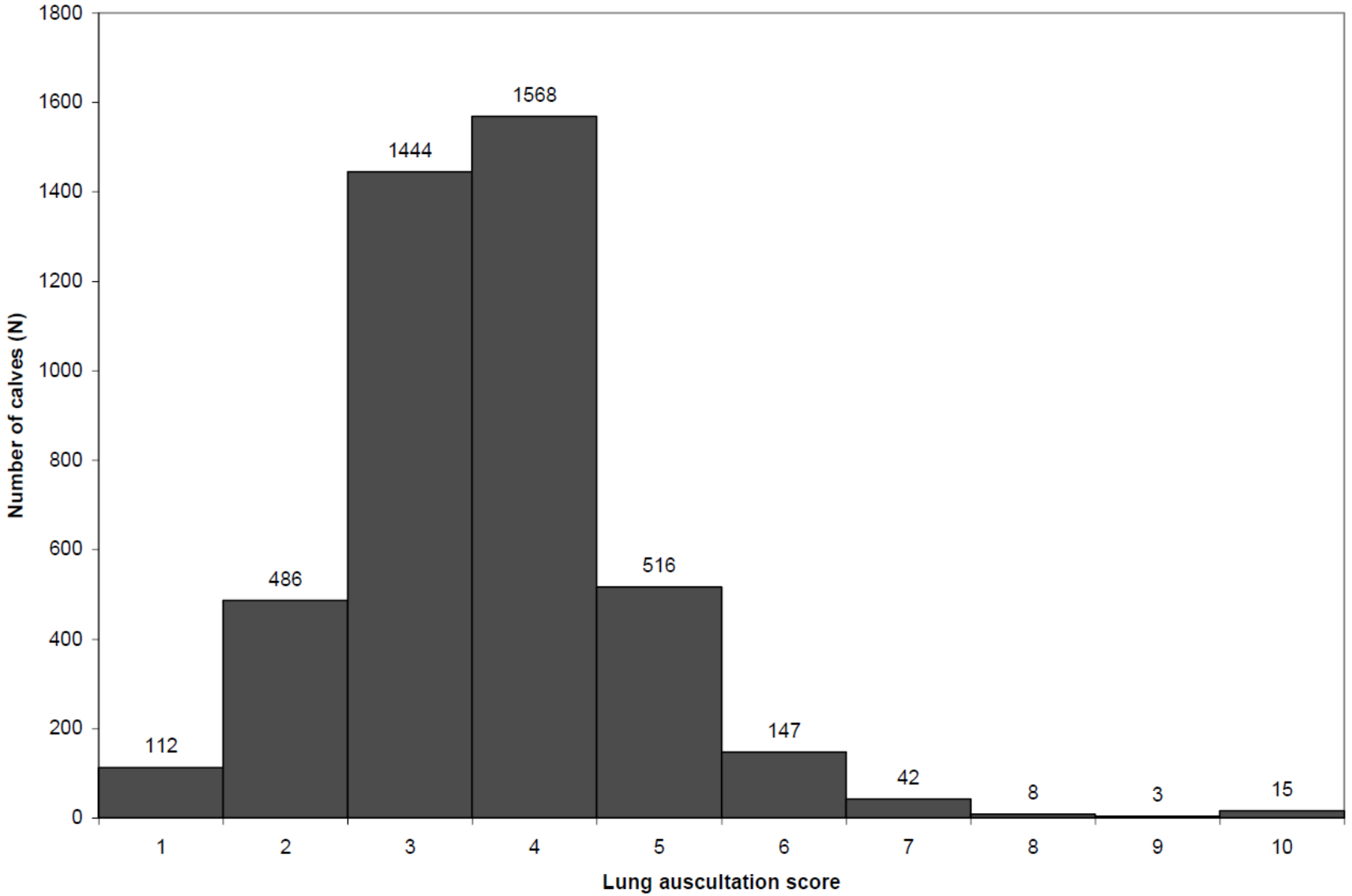



Ear scores			
Normal	Ear flick or head shake	Slight unilateral droop	Head tilt or bilateral droop





How well does the stethoscope work?



Buczinski et al. 2014 JVIM

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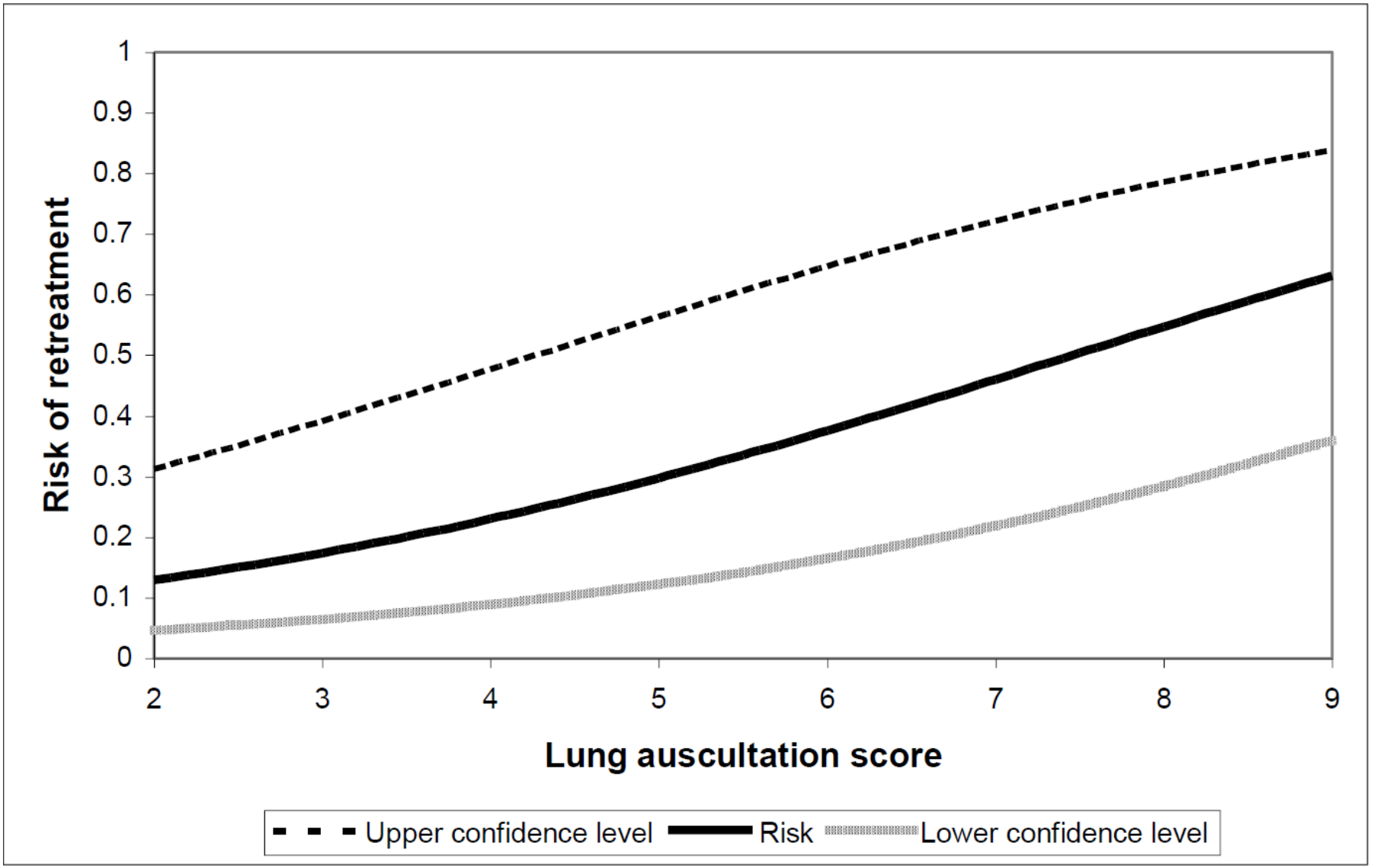

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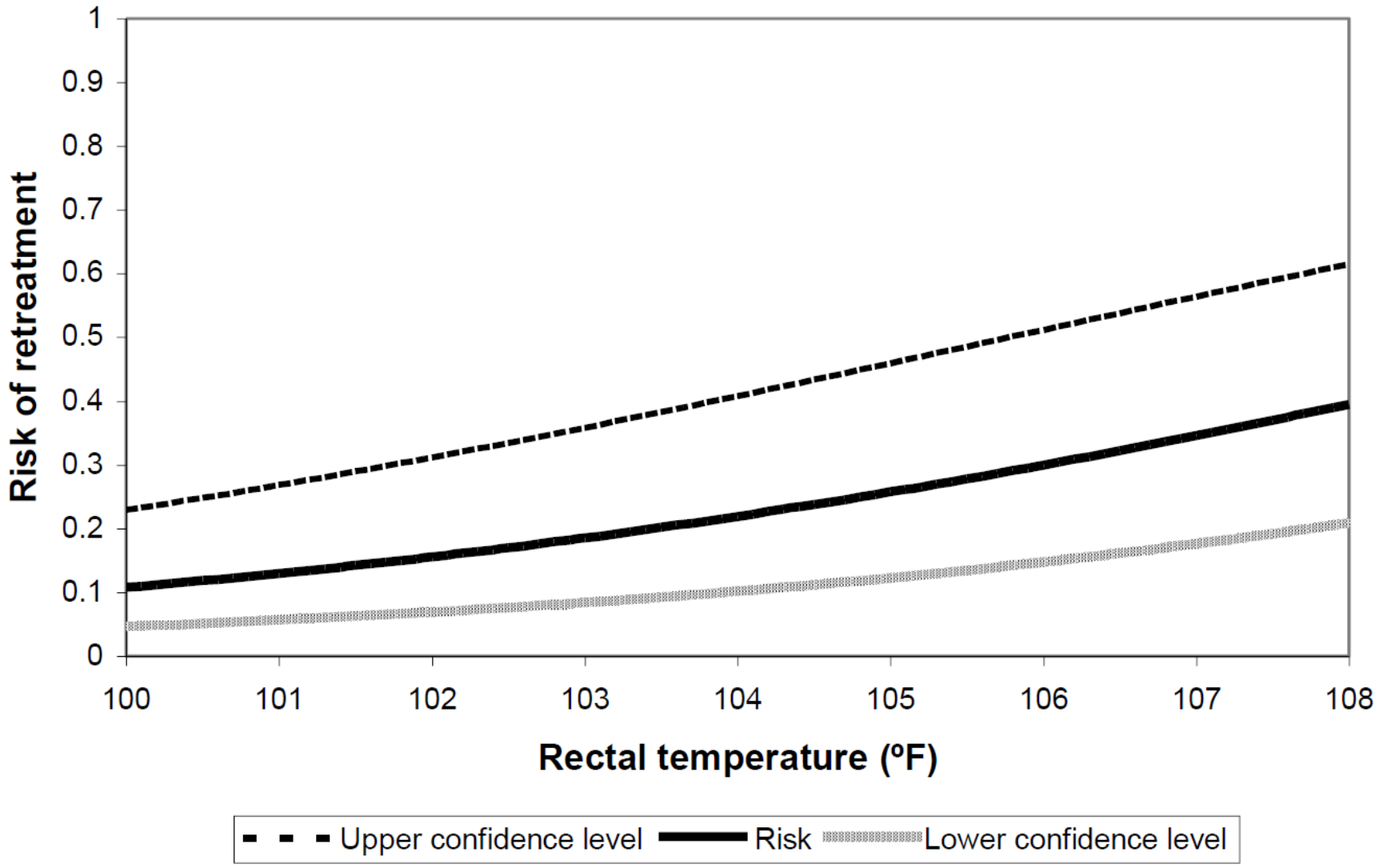
How well does the thermometer work?



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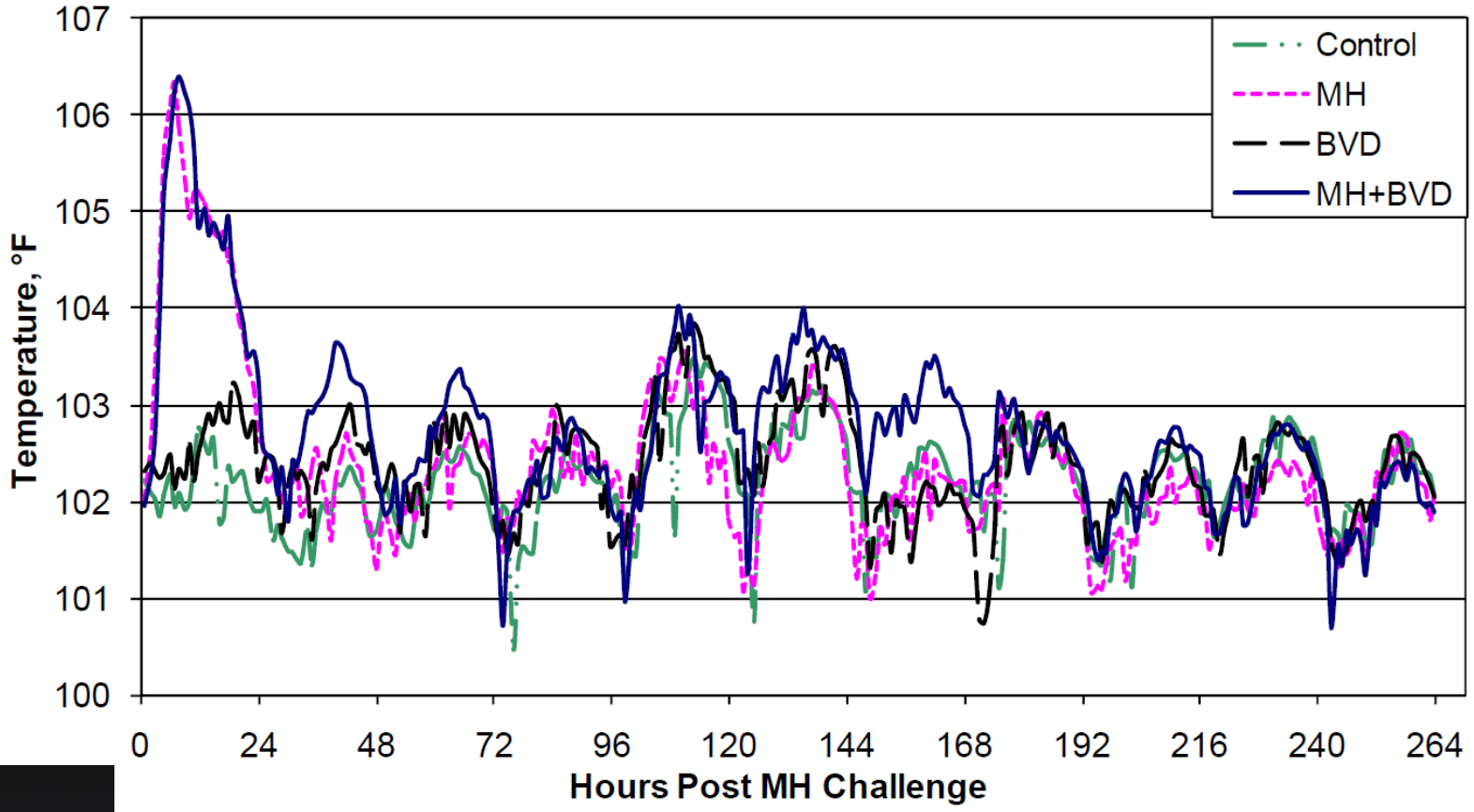
The whole cow and nothing but the…..

- Attention to details
  - Animals clinical condition (scoring system for consistency)
  - Behavior

What can technology do for me?

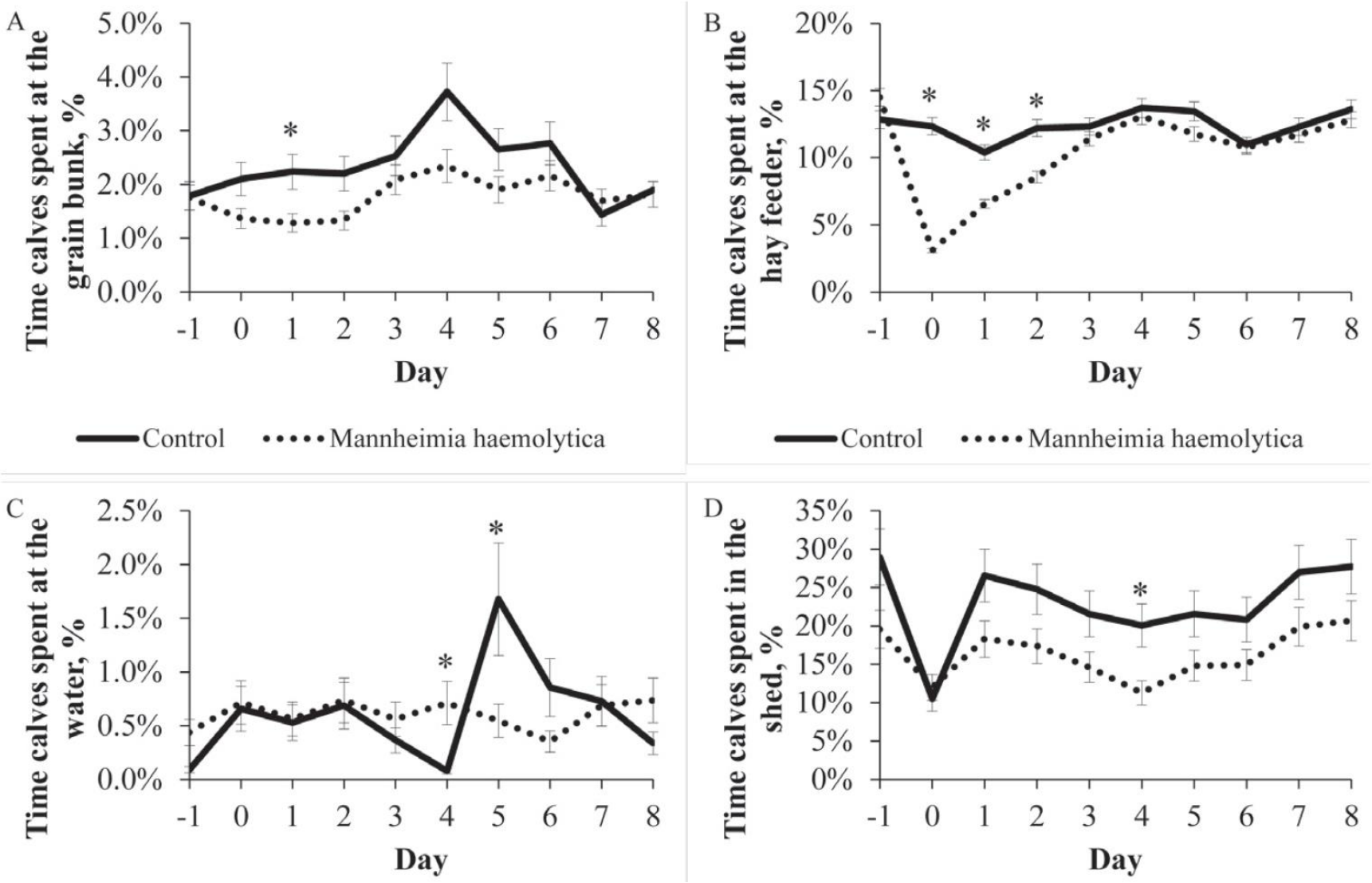
GrowSafe Calf Feeding System

Can technology helps us capture information about sick cattle?



Rumen Temperature boluses can capture transient spikes in fever that occur following exposure to *M. haemolytica*

GPS monitoring technology can detect subtle changes in behavior



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Accelerometers can determine time spent lying down or walking

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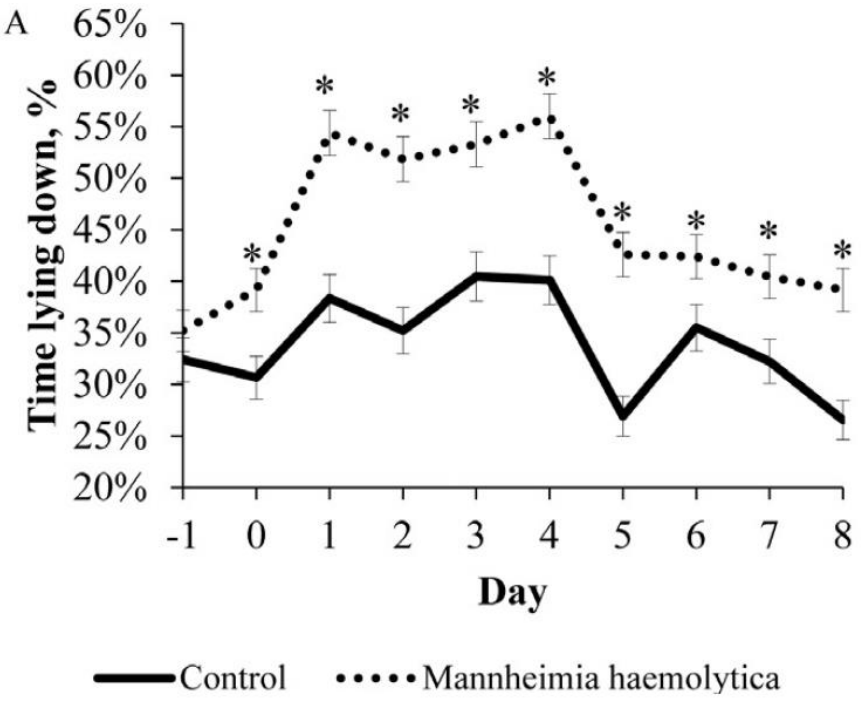

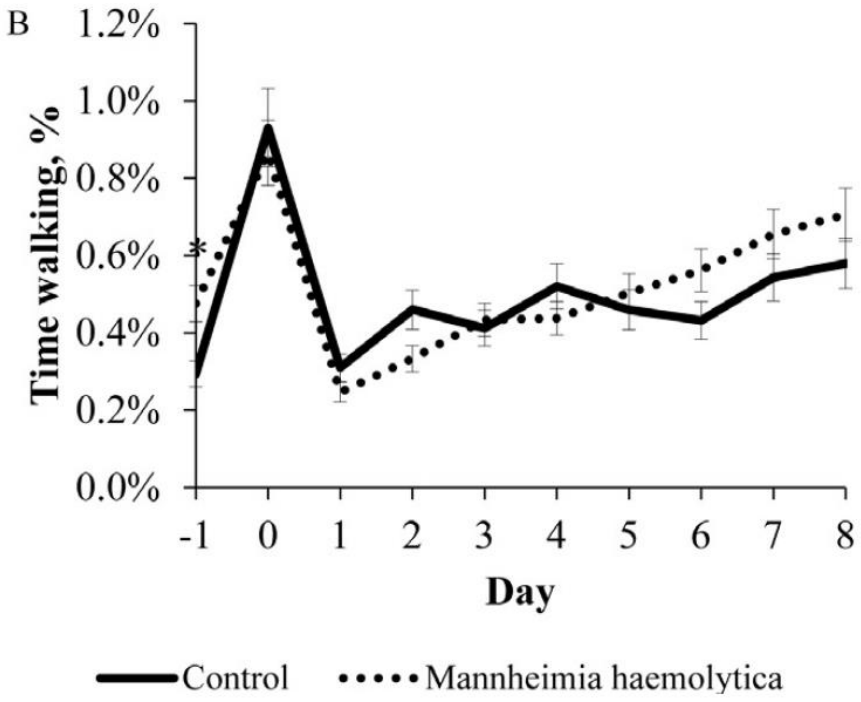

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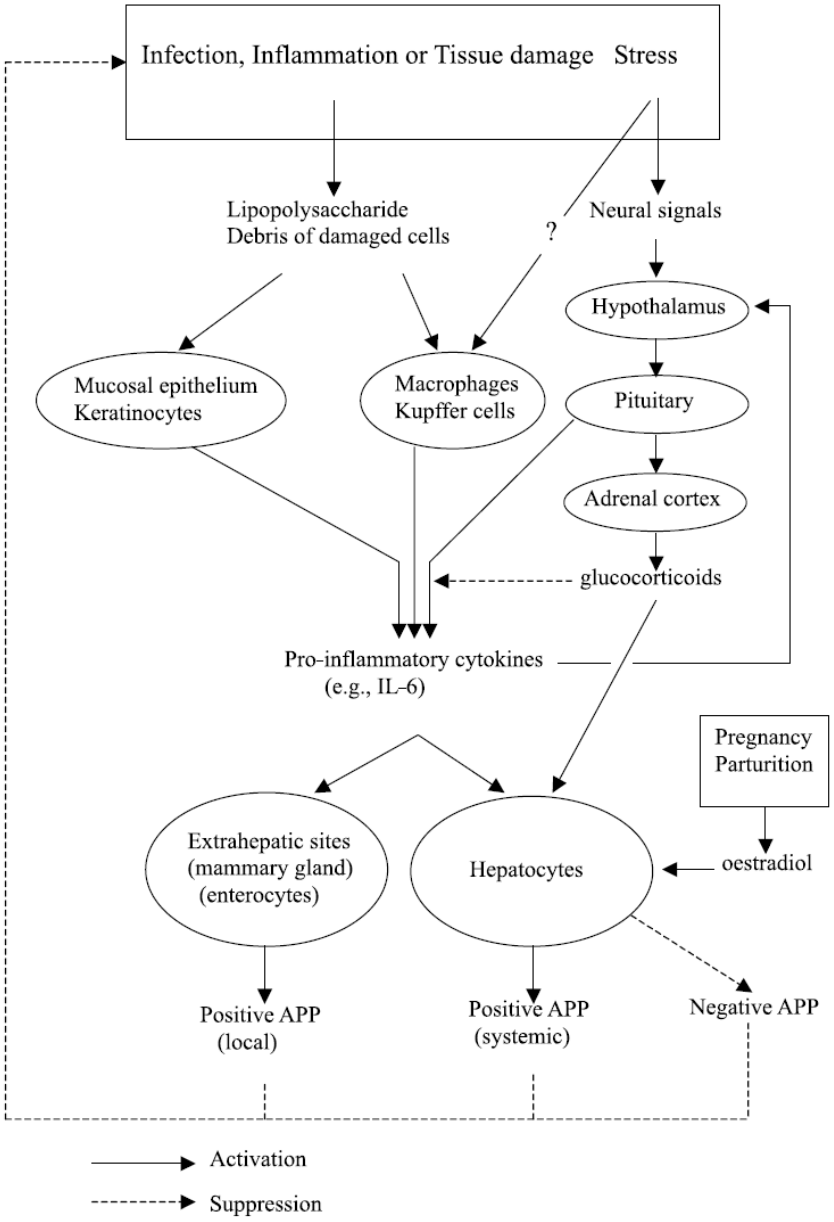
Inflammation induces acute phase protein production



Important Systemic APPs in Cattle

Haptoglobin

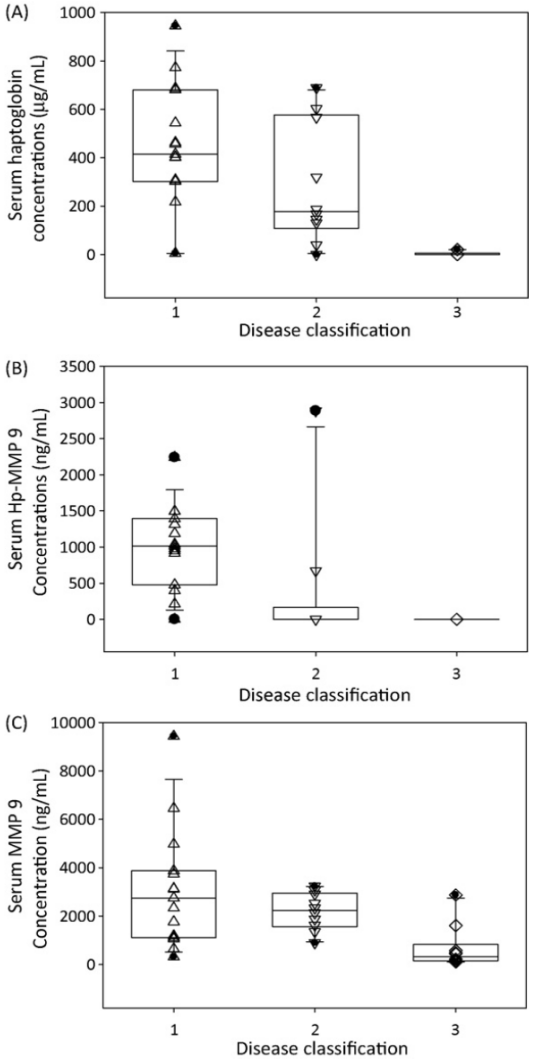
Serum Amyloid A

α1 acid glycoprotein

Surfactant Proteins

Haptoglobin alone poorly predicts cattle with acute inflammation

Hp-metalloproteinase 9 complex is more accurate at discriminating acute septic inflammation



Bannikov et al.

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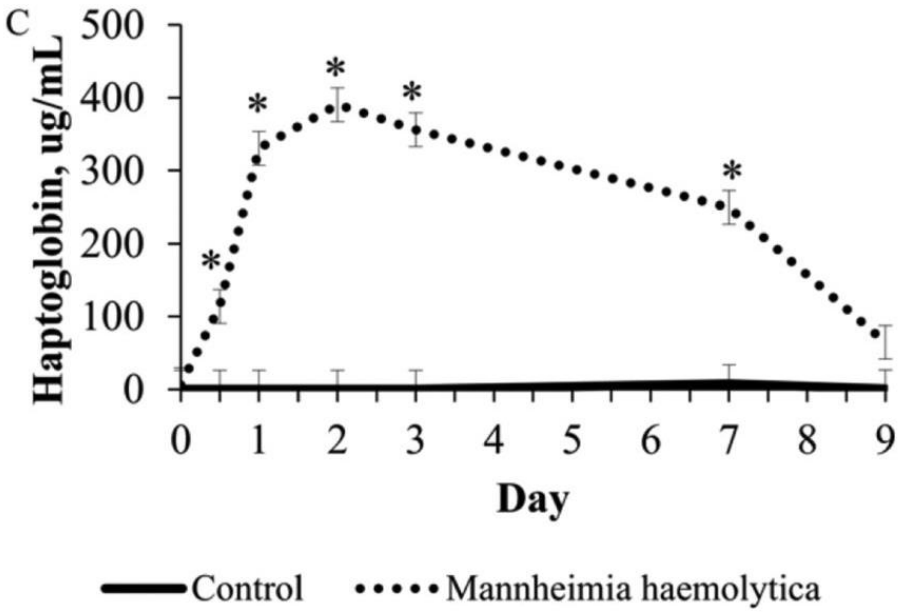
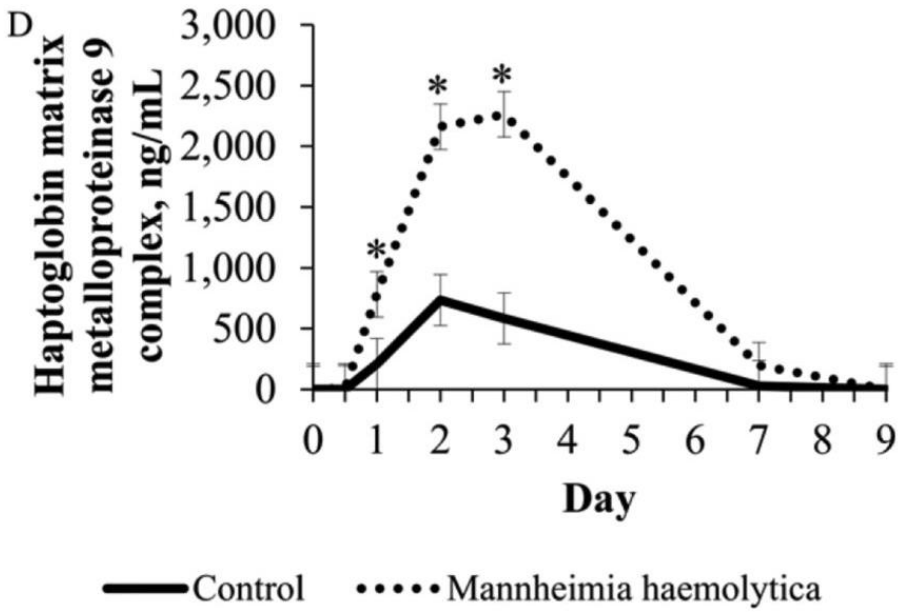
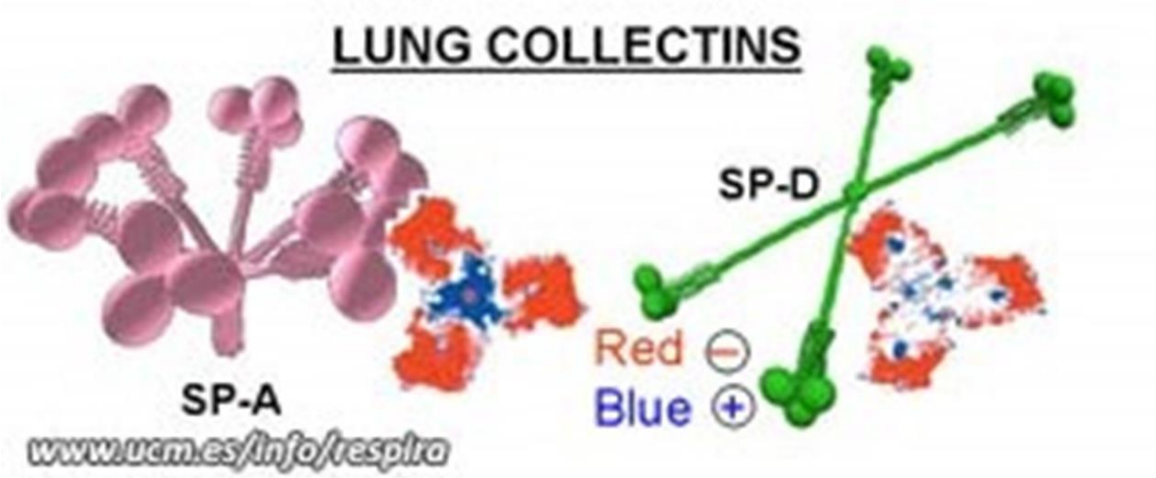




Coetzee et al 2013 J Anim Sci

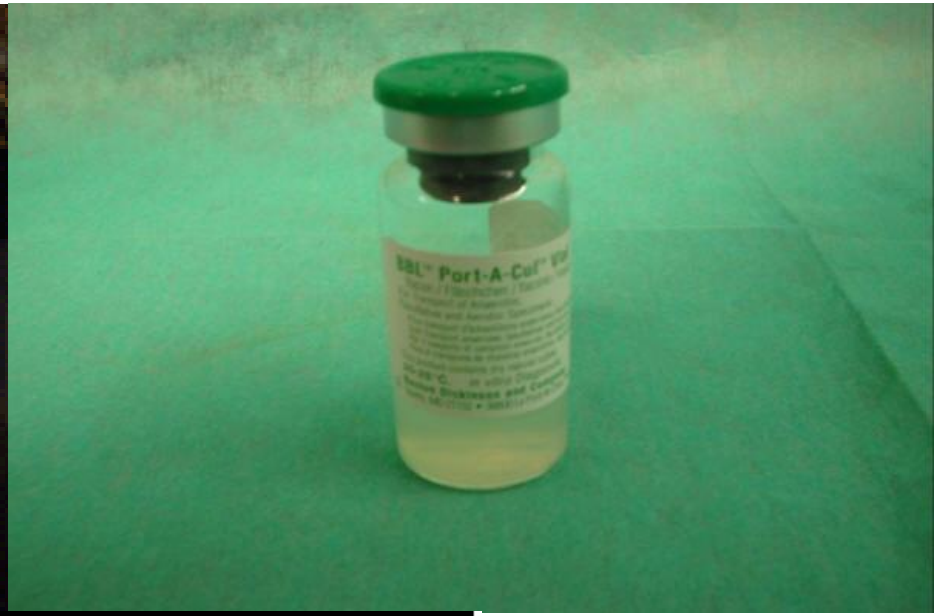
Surfactant Proteins…..Ongoing Research



Twelve Holstein calves that weigh 300 pounds

Six calves will be inoculated with 3-5 X 10^9 CFU *Mannheimia haemolytica* in their tracheal bronchus

Six control calves sham inoculated with sterile saline only



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Ready | 100%


AQHA
Dr. Roxann S. BROOKS

Nasal swabs provide the most information at the herd level, BALs provide the most information at the individual level

De Rosa *et al.* 2000

Comparison of *Pasteurella* spp. Simultaneously Isolated from Nasal and Transtracheal Swabs from Cattle with Clinical Signs of Bovine Respiratory Disease

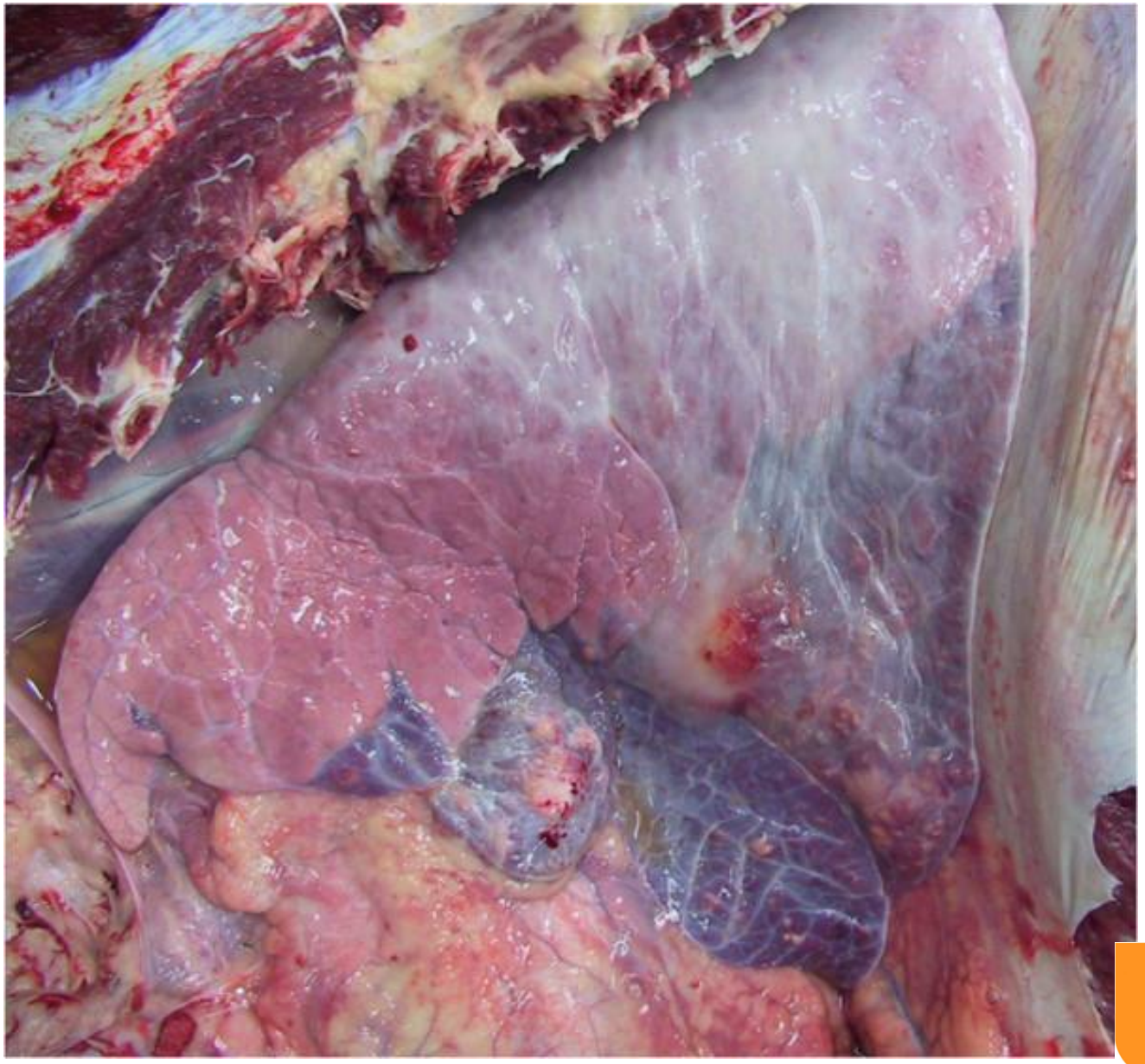
- The same bacterial species were culture from both samples 96% of the time
- 70% of cultures were the genetically identical with the same antibiotic susceptibilty

Thomas *et al.* 2002

Comparison of sampling procedures for isolating pulmonary mycoplasmas in cattle

- Only 10% of cattle with BRD had positive nasal swabs for *M. bovis*
- 55% of normal cattle cultured *M. bovis* on nasal swabs

Necropsies are a wealth of information if performed early enough



Summary

- Diagnosis of BRD is moving away from simple observation of clinical signs and temperature monitoring
- Clinical Illness Scoring can be effective at improving the diagnosis of individual BRD cases
- CIS provides data that can be used to help manage BRD
- Chute side serum biomarkers are coming
- Technology can aid in continuous monitoring and detection of subtle changes

Questions?