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2012 Dairy and Veal Healthy Calf Conference

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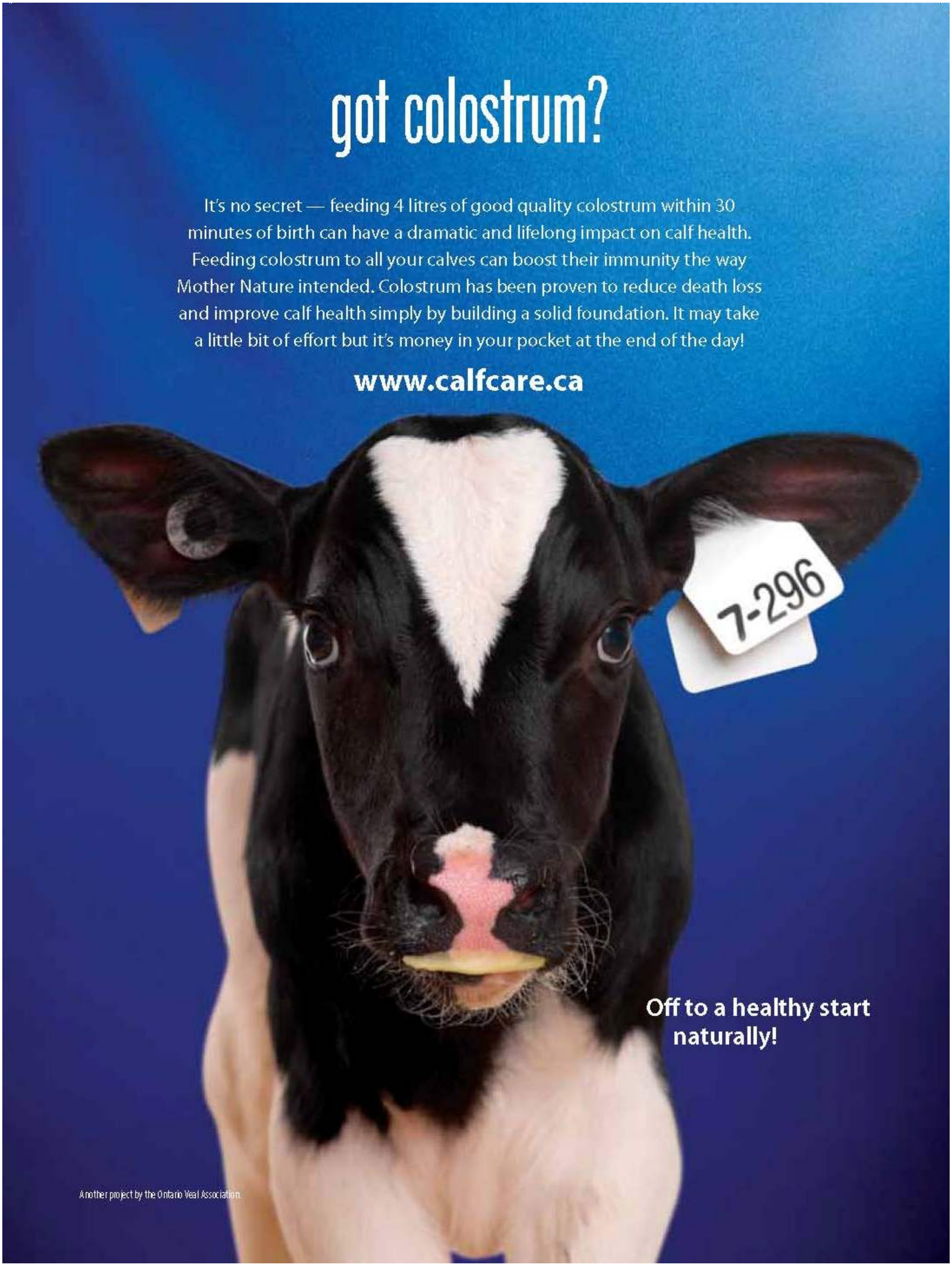
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Dairy and Veal Healthy Calf Conference 2012

WELCOME

Dear Conference Participants,

This year marks ten years of healthy calf promotion by the Ontario Veal Association (OVA) and our fifth biennial *Building the Foundation: Dairy and Veal Healthy Calf Conference*. Healthy calf promotion has been an important mandate for the OVA. Not only do veal farmers need healthy, hardy calves but dairy farmers also. Whether you are a veal farmer or a dairy farmer, we are all working towards a common goal of improving the quality of all calves in Ontario. Thank you for your attendance.

New this year we have added a second location to eastern Ontario. The OVA felt it was important to extend our healthy calf promotion out further in the province to the east. We have the same amazing line-up of speakers in both locations. Our speakers have a wide variety of expertise; I know there will be something for everyone as we all work towards growing healthier calves.

On behalf of the OVA I would like to thank our speakers for taking the time out of their busy schedule to present at this year's Healthy Calf Conference. I would also like to say a special thank you to all of our industry partners who have graciously provided sponsorship and support for this important educational event, without them this event would not be possible. I hope that each of you take the time to speak with the many representatives in attendance today to discuss their product line-up and thank them for their support of this important educational event.

On behalf of the board and staff, I welcome you to the fifth biennial Healthy Calf Conference!

Sincerely,

Judy Dirksen
OVA President

For more information on the Ontario Veal Association or to become a member contact the OVA office at 519-824-2942 or visit *www.ontarioveal.on.ca*.

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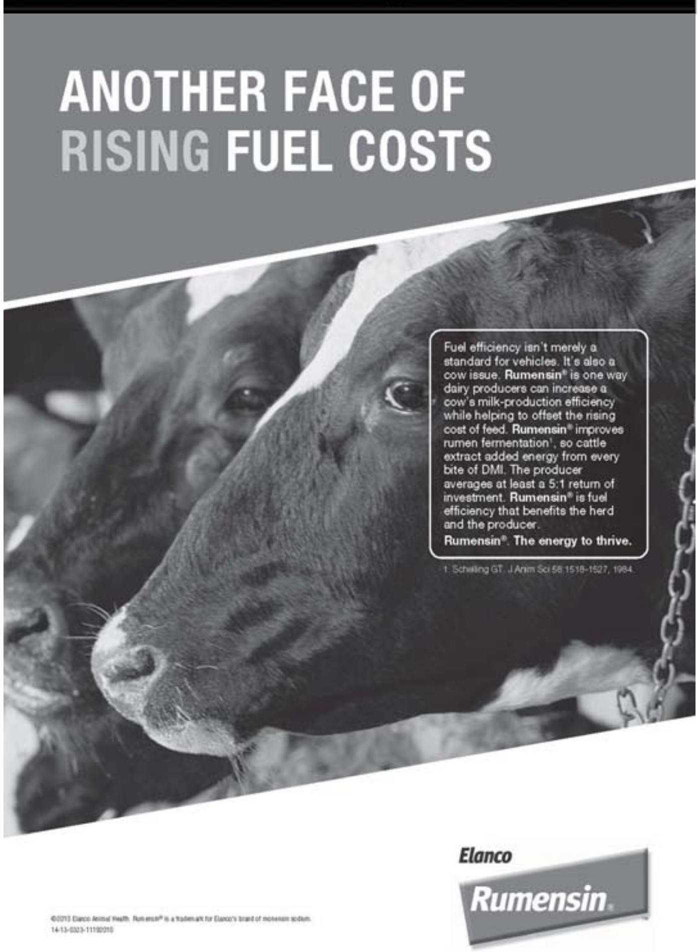
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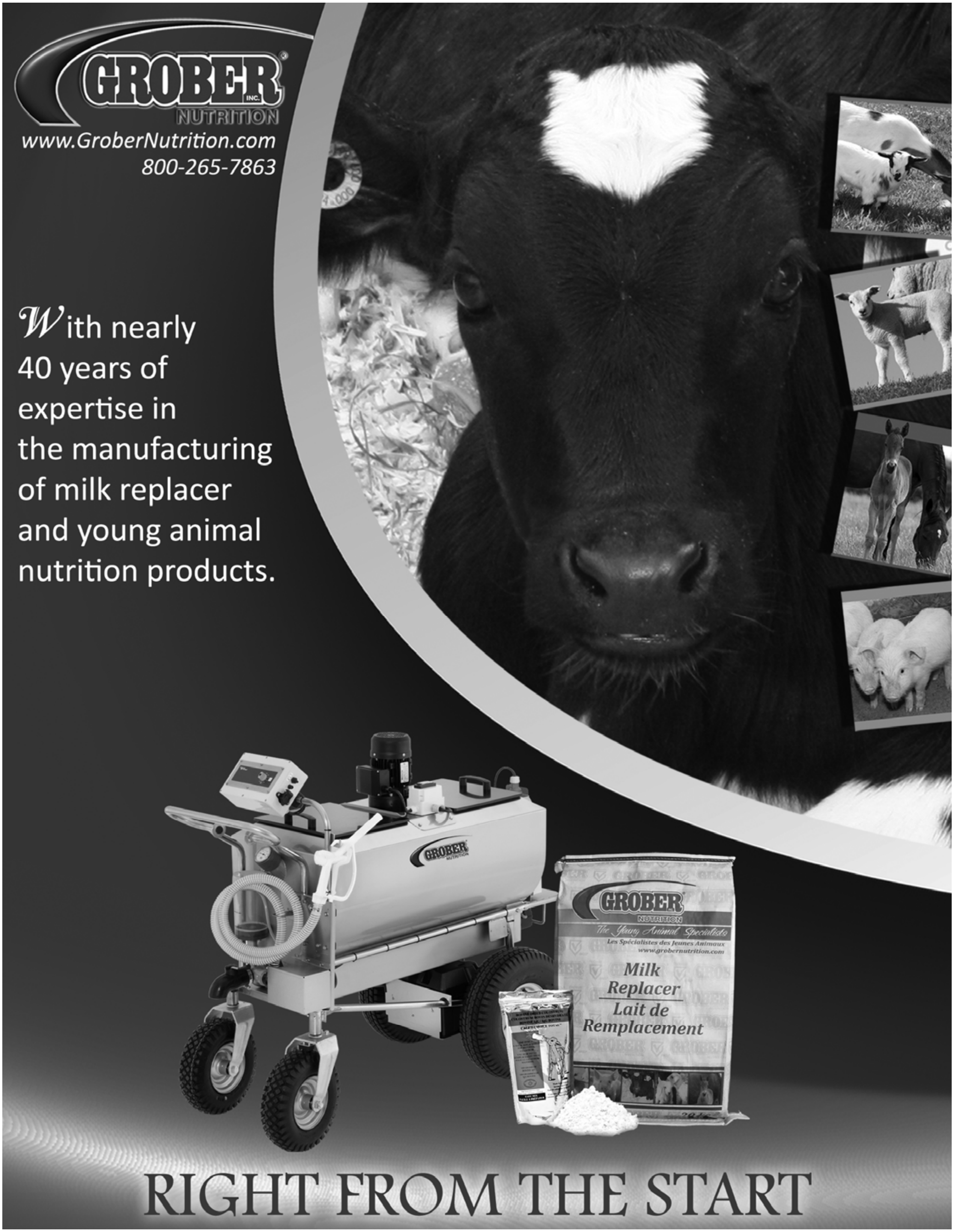
AGENDA

Wednesday December 5th, 2012
Stratford Rotary Complex

Friday December 7th, 2012
Chesterville Legion

8:30am	**Registration and Tradeshow Open**
9:00am	**Welcome and Opening Remarks**
9:15am	**Calving Difficulties: Impact on the Cow and Calf** *Marianne Villettaz Robichaud and Christine Murray, University of Guelph*
9:45am	**Ultrasonography for the Diagnosis of Respiratory Disease in Dairy Calves** *Dr. Theresa L. Ollivett, University of Guelph*
10:45am	**Calf Health Begins at Conception** *Dr. Stephen B. Blezinger, Reveille Livestock Concepts*
11:45am	**LUNCH AND TRADESHOW**
1:15pm	**Improving Housing for Better Calf Health** *Dr. Ken Nordlund, University of Wisconsin-Madison*
2:15pm	**Managing Respiratory Disease in Group Housing** *Dr. Amy Stanton, University of Wisconsin-Madison*
3:15pm	**Exploring Early Calf Management: What's New and What's Important to Review** *Kathleen Shore, M.Sc., Grober Nutrition*
3:30pm	**Wrap up and Adjourn**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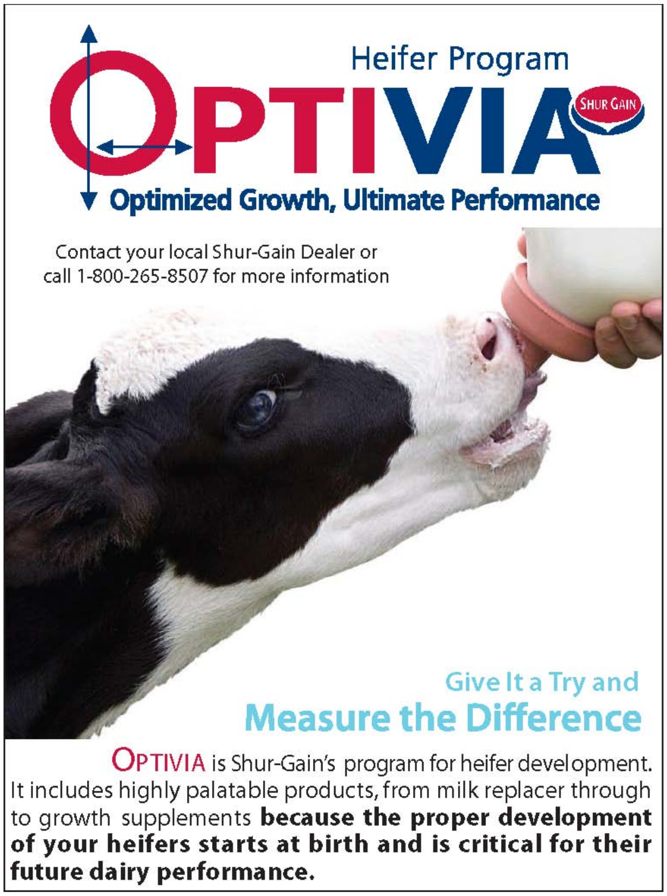
Thank you to all our industry partners for your continued support of the Healthy Calf Conference!

To receive electronic e-blasts from **Calf Care Corner** on calf management topics sign up at ***www.calfcare.ca***



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Housing
- housing and ventilation

Disease Control
- calf diarrhea, diseases, stress

Calf News
- the latest articles and research on calf care and management

Calving Difficulties: Impact on the Cow and Calf

Marianne Villettaz Robichaud is a Ph.D. student studying Epidemiology at the Ontario Veterinary College, University of Guelph. She completed her B.Sc. in Agronomy, as well as her M.Sc. in Animal Science from Laval University where she studied dairy cow behaviour. Her project specifically focuses on the effects of different management practices and the behaviour and welfare of dairy cows and calves. She is investigating the calving practices in Canada, the effect of early assistance at calving on the animals, and the effect of housing type during calving.

Marianne Villettaz, Ph.D. student studying Epidemiology
University of Guelph

Christine Murray completed her B.Sc. In Agriculture, majoring in Animal Science from the University of Guelph. At present, Christine is a Ph.D. student studying Epidemiology at the Ontario Veterinary College. Her project focuses on the effects of dystocia on newborn calf vitality and future health; specifically, the prediction of the long term effects of dystocia and how we can mitigate these issues to ensure long-term health and productivity of the calf. She is also studying the effects of pre-weaning milk feeding levels on carcass quality at slaughter in grain-fed veal calves.

Christine Murray, Ph.D. student studying Epidemiology
University of Guelph

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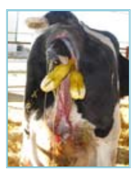
Calving difficulties: Impacts on the Cow and Calf

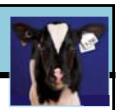
Marianne Villettaz Robichaud, Agr. MSc.
PhD. Candidate, University of Guelph
&
Christine Murray, BSc.
PhD. Candidate, University of Guelph

Overview

- Calving process
- Dystocia
- Impact of dystocia on the cow
  - Uterine health & reproduction
  - Milk production & survival
- Impact of dystocia on the calf
  - Health & survival
  - Vigor & passive immune transfer
- Economics of dystocia for the producer
- Conclusion



Signs of imminent calving



- Enlargement of the udder
- Mammary gland leakage
- Swollen vulva
- Restlessness
- Relaxation of pelvic ligament
- Prolonged elevation of the tail
- Bloody slime coming from the vagina

Stage of labour

- *Stage 1:* Relaxation and dilatation (6 to 24h prior)
  - Uterine contractions to position the calf
  - Cervix dilate and relaxes
  - End with rupture of the amniotic sac
- *Stage 2:* Actual birth with active contractions
  - Length ranges: - primiparous: 2 - 4 hours
    - multiparous: 30 min – 2 hours
- *Stage 3:* Expulsion of fetal membrane
  - Normal range 1-8 hours
  - Retained: ⍰ 12 h

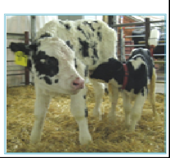
Dystocia incidence

- Definition:

  Calving difficulty resulting from prolonged spontaneous calving or prolonged or severe assisted extraction
- Reported incidence:
  - 13.7% Holstein cows and heifers (needed assistance)
    - Canada = 985,300 dairy cows
    - Average calving interval = 14 months
    - Estimated total ≈ 115,700 case/year in Canada

Causes of dystocia

- Primiparous
  - Feto-pelvic disproportion
    - Calf birth weight (dystocia increase 13%/kg)
    - Dam pelvic size
- Multiparous
  - Fetal malpresentation, malposture
  - Incomplete dilation of cervix or vulva
  - Uterine torsion
  - Uterine inertia
  - Hypocalcemia



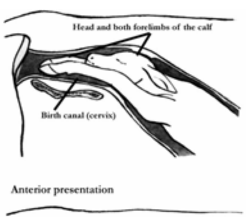
Ways to detect dystocia

- Lack of calving progress during Stage 2:
  - After appearance of amniotic sac, visible progress every 15 min
  - Assistance needed 70 min after amniotic sac or 65 min after feet appearance
- Examination:
  - Clean perineal area with soap (iodine based)
  - Use of gloves & lubricant to help the way in
  - Determine position of the foetus & its viability
  - Evaluate dilation of birth canal

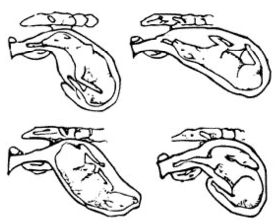
(Schuenemann et al., 2011)

Ways to detect dystocia

- Normal forward presentation



- Abnormal presentations



Ways to manage dystocia

- Determine if vaginal delivery is the best approach:
  - Easy movement in and out of hooves during straining
  - Confirm that foetus is in dorso-sacral position
  - Sufficient dilation of the cervix
- When to call the vet:
  - Any time you think it is appropriate
  - If you think it will not fit through the canal
  - If you cannot pull the calf in 30 min
  - Twisted uterus

Impacts on the cow

- Uterine health
- Reproduction
- Milk production
- Following calving performance
- Survival

Impacts on uterine health

- **Retained placenta:** retained fetal membrane ⍰ 12 h post calving
  - 13.3% of cows with difficult calving
- **Metritis:** inflammation of the uterus + systemic signs of sickness
  - 4.8 times more likely when dystocia
- **Endometritis:** inflammation of the uterus with chronic bacterial infection of the uterus
  - Risk is 1.7 times higher when dystocia

(Benzaquen et al., 2007; Joosten et al., 1987; Potter et al., 2010)

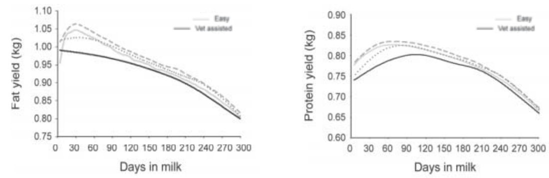
Impacts on reproduction

- Interval calving – first breeding:
  - 8 days longer for cows with vet assisted calving
- Interval calving - conception:
  - 28 days longer when vet assisted calving
- Number of inseminations:
  - 0.7 more inseminations for conception to occur

(Eaglen et al., 2011)

Impacts on milk production

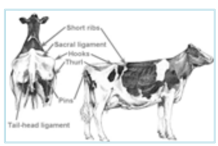
- Losses of 2 kg/d until 90 DIM
- Reported losses from 300 to 700 kg over the lactation
- No significant effects of dystocia on SCC
- Milk composition not altered by dystocia:



(Djemali et al., 1987; Dematawewa and Berger, 1997; Eaglen et al., 2011)

Impacts on survival

- On survival:
  - Risk of culling:
    - Increase by 18% for cows with dystocia
- On future performance:
  - Body condition lower during lactation
  - Odds of dystocia are 2.9 times higher for cows that experience dystocia



(Lopez de Maturana et al., 2007; Dematawewa and Berger, 1997; Eaglen et al., 2011)

Effects on the calf

- Parturition can be the most hazardous and traumatic event in the life of a calf
- Dystocia and subsquent health events account for up to 50% of all calf deaths
- In sever dystocia cases, calves have:
  - 20.7 greater odds of stillbirth
  - 1.7 & 1.3 greater odds of being treated for respiratory & digestive disease, respectively
  - 6.7 greater odds of mortality

(Lombard et al., 2007; Furman-Fratczak et al, 2011)

Why such high losses?

- Blood loss, fractures & trauma
- Hypoxia
  - Respiratory acidosis
  - Metabolic acidosis
- Impaired thermoregulation
- Reduced vigor
- Reduce passive transfer

(Meyer et al., 2000; Lombard et al.,2007; Waldner and Rosengren, 2009)

Improper obstetrical assistance

- Fetal blood loss
  - Improper clamp timing
  - Premature umbilical cord rupture
- Fractures
  - 40% of stillborn calves from vet-assisted deliveries had rib fractures & 10% had fractured vertebra
  - Long bones
- Trauma
  - Tracheal collapse
  - Meningeal hemorrhages
  - Liver rupture

Hypoxia

- Hypoxia refers to an inadequate supply of oxygen to the cells & tissues of the body
- Premature umbilical cord rupture causing an inability to breath = **Respiratory Acidosis**
  - Termination of blood oxygenation from the placenta
  - Intense and prolonged labor contractions
  - Trauma during forced extraction
- If severe, fetal tissues will derive O_2 from anaerobic glycolysis = **Metabolic Acidosis**

Hypoxia

- Calves born from a severe dystocia with serious acidosis:
  - Recovered more slowly/low vigor
  - Greater risk of mortality
  - Reduced thermoregulatory response


(Schuijt and Taverne, 1994; Bleul et al., 2007)

Thermoregulation

- Calf moves from controlled sterile environment to adverse external environment
- Mobilize energy reserves from brown adipose tissue (non-shivering thermogenesis)
- Following severe dystocia requiring a mechanical calf puller, calves were less able to withstand cold stress


(Bellows and Lammoglia, 2000)

Thermoregulation

- Calves born in ⍰10°C or windy/wet conditions were slower to stand after birth
- Cold stress is associated with delaying the onset of colostrum intake and decreasing the rate of IgG absorption
- Calves born in January through May, had lower mean serum Ig concentrations than calves born from June through September

(Diesch et al., 2004; Olson et al., 1980 ; Robison et al., 1988)

Calf vigor

- Trauma, pain, hypoxia, acidosis, and impaired thermoregulation all lead to calf weakness and reduced vigor
- Decrease ability to perform tasks for survival
  - Standing
  - Walking
  - Suckling colostrum

(Schuijt and Tavern ,1994 ; Diesch et al., 2004 ; Barrier et al, 2012)

Calf vigor

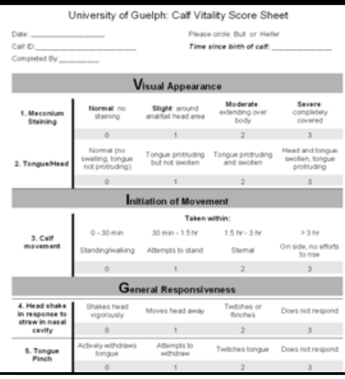
- Suckling reflex and time to sternal recumbency have been used as objective indicators of fetal stress and vigor in newborn calves
- Calves forcefully extracted took significantly longer to achieve sternal recumbency and had a lower overall state of vitality
- Suggested that time to standing be used to assess calf vigor as part of a modified APGAR score

(Schulz et al.,1997; Schuijt and Taverne, 1994)

Human fetal monitoring

- APGAR (Virginia Apgar)
- 5 essential assessments:
  - **A**ppearance (Color)
  - **P**ulse (Heart rate)
  - **G**rimace (Stimulation)
  - **A**ctivity (Muscle tone)
  - **R**espiration

U of G – Calf VIGOR score sheet



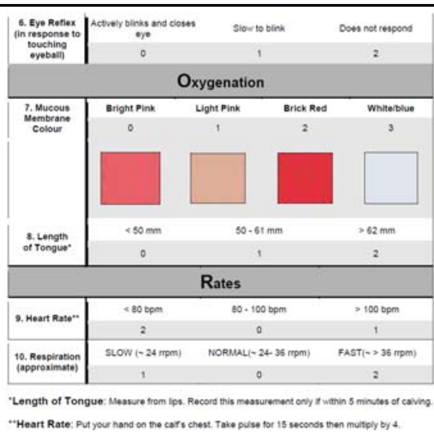
University of Guelph: Calf Vitality Score Sheet

Date: ______________ Please circle: Bull or Heifer

Calf ID: ____________________ *Time since birth of calf:* ____________

Completed By: ________

Visual Appearance				
1. Meconium Staining	**Normal**: no staining	**Slight**: around anal/tail head area	**Moderate**: extending over body	**Severe**: completely covered
	0	1	2	3
2. Tongue/Head	Normal (no swelling, tongue not protruding)	Tongue protruding but not swollen	Tongue protruding and swollen	Head and tongue swollen, tongue protruding
	0	1	2	3
Initiation of Movement				
3. Calf movement	**Taken within:**			
	0 - 30 min	30 min - 1.5 hr	1.5 hr - 3 hr	> 3 hr
	Standing/walking	Attempts to stand	Sternal	On side, no efforts to rise
	0	1	2	3
General Responsiveness				
4. Head shake in response to straw in nasal cavity	Shakes head vigorously	Moves head away	Twitches or flinches	Does not respond
	0	1	2	3
5. Tongue Pinch	Actively withdraws tongue	Attempts to withdraw	Twitches tongue	Does not respond
	0	1	2	3



6. Eye Reflex (in response to touching eyeball)	Actively blinks and closes eye		Slow to blink	Does not respond
	0		1	2
Oxygenation				
7. Mucous Membrane Colour	**Bright Pink**	**Light Pink**	**Brick Red**	**White/blue**
	0	1	2	3
8. Length of Tongue*	< 50 mm		50 - 61 mm	> 62 mm
	0		1	2
Rates				
9. Heart Rate**	< 80 bpm		80 - 100 bpm	> 100 bpm
	2		0	1
10. Respiration (approximate)	SLOW (~ 24 rpm)		NORMAL(~ 24- 36 rpm)	FAST(~ > 36 rpm)
	1		0	2

***Length of Tongue**: Measure from lips. Record this measurement only if within 5 minutes of calving.

****Heart Rate**: Put your hand on the calf's chest. Take pulse for 15 seconds then multiply by 4.

Passive transfer

- Serum immunoglobulin G (IgG) concentration should be ⍰ 10 mg/mL
- Serum total protein should be ≥ 5.2 – 5.5 g/dL
- Calves with ↓ vigor have ↑ risk of failure of passive transfer
  - Failure to get up and drink
  - Reduced suckling reflex

Passive transfer

- Up to 74% reduced colostrum intake in calves with fetal distress 12 hrs after birth
- A 52% decrease in colostrum intake is correlated with a 35% decrease in serum IgG concentration in severely acidosis calves
- In other studies, IgG absorption is reduced in calves with dystocia induced respiratory acidosis

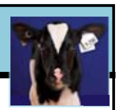
(Vermorel, 1989 ; Drewery et al., 1999 ; Besser et al., 1990; Boyd, 1989)

Long term health effects

- Long term health effect due to passive transfer
  - 31% of pre-weaning mortality is attributed to failure of passive transfer
  - 30% decrease in pre-pubertal growth rate
  - 30 day increase to first insemination
  - Produced 2,263 lbs less milk over first 2 lactations
  - 16% decrease in survival to the end of the second lactation

(DeNise et al., 1989; Faber et al., 2005; Furman-Fratczak et al., 2011)

Economic impact of dystocia



Parity	Needed Assistance	Considerable Force	Extreme Difficulty
1	$78.99	$134.75	$383.03
2	$78.45	$181.23	$334.33
≥3	$73.28	$85.60	$279.00

(C.M.B. Dematawewa and P.J. Berger, 1997)

Economic impact of dystocia

- Break down of total economic losses:

Trait	Parity		
	1	2	3
Milk Yield Loss, %	40.51	31.12	5.13
Fertility Loss, %	38.11	38.42	65.15
Cow Loss, %	5.99	12.10	8.02
Calf Loss, %	15.39	18.36	21.70

(C.M.B. Dematawewa and P.J. Berger, 1997)

Summary

- Dystocia impaired cow's uterine health, reproduction, milk production and survival
- Short term effects of dystocia: pain, fractures, trauma, hypoxia & impaired thermoregulation leading to reduced calf vigor & failure of passive transfer
- Long-term impacts on health: increased mortality, reduced ADG & decreased overall productivity

Questions?

University of Guelph
Changing Lives Improving Life

Ontario VEAL

Acknowledgments:
- Advisory committees
- Funding

Ultrasonography for the Diagnosis of Respiratory Disease in Dairy Calves

Dr. Theresa L. Ollivett, DVM, Diplomate ACVIM
University of Guelph

Dr. Theresa L. Ollivett, DVM, Diplomate ACVIM is a Ph.D. student in Epidemiology at the Ontario Veterinary College at the University of Guelph. She has participated in research involving dairy calf nutrition and diarrheal and respiratory diseases. With degrees from the College of Veterinary Medicine at Cornell University and Siena College in New York, Dr. Ollivett has taught university courses in ruminant health management and animal health and disease. She has also worked as an associate veterinarian in northern NY for three years and as a large animal internal medicine resident at Cornell for three years.

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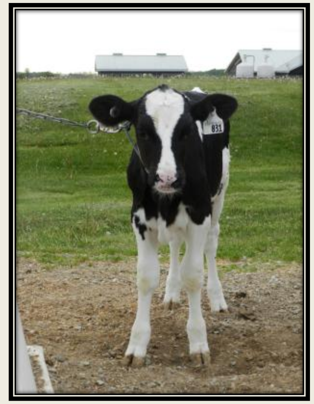
Ultrasonography: A new tool to examine respiratory disease in dairy calves

T. L. Ollivett, DVM, DACVIM

Ontario Veterinary College

Outline

- General considerations
- Literature
- Clinical research



Bovine Respiratory Disease - Dairy

- Morbidity & mortality in pre-weaned dairy calves
- Less likely to complete first lactation *(Bach et al., 2011. JDS. 94:1052-1057)*
- Improved rates of gain with metaphylactic antimicrobials
  (Stanton et al., 2010. JDS. 93:574–581)

Table 1
Changes in respiratory disease incidence 1991 to 2007

	1991	1996	2002	2007
Pre-weaned calf mortality	8.4	10.8	10.5	7.8
Percentage of deaths caused by respiratory disease pre-weaned calves	21.3	24.5	21.3	22.5
Weaned calf mortality	2.2	2.4	2.8	1.8
Percentage of deaths caused by respiratory disease–weaned calves	34.8	44.8	50%	46.5

Patrick J. Gorden, Paul Plummer. 2010.Veterinary Clinics of North America: Food Animal Practice, 26: 243-259

BRD – Spectrum of disease

Considerations

- Anatomy
  - Normal
  - Pathologic
- Ultrasonography
  - Mechanics
  - Terminology
  - Benefits
  - Limitations

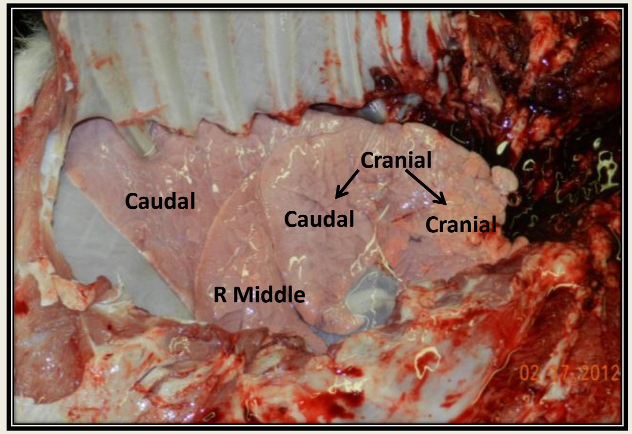
Anatomy – Lung Borders

Anatomy – Lung Borders

Anatomy – Lung Borders

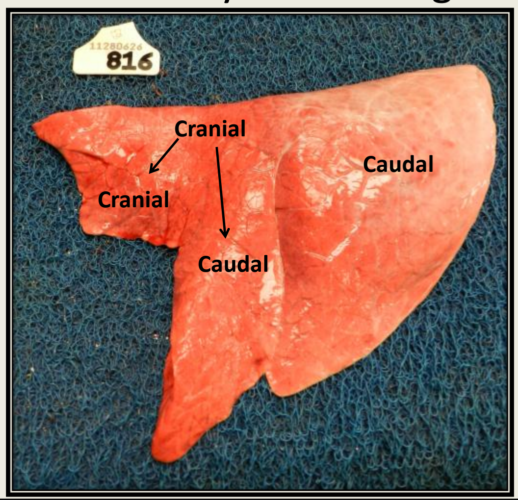
Anatomy – Right Lung

Anatomy – Right Lung



Anatomy – Left Lung

Anatomy – Left Lung



Cranioventral Distribution of Lesions

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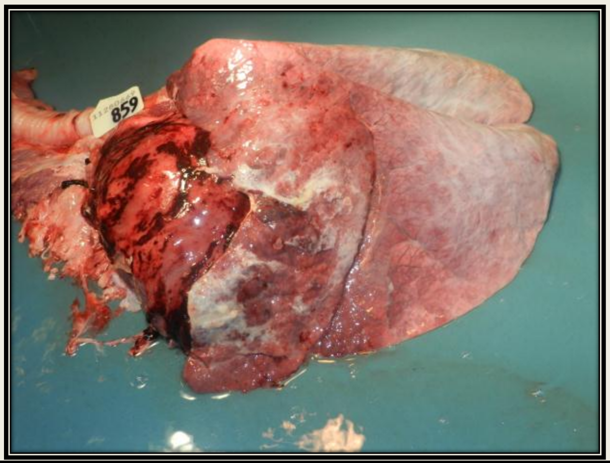
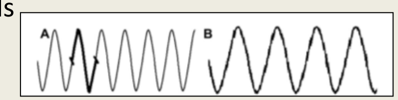


Ultrasound Mechanics - basic

- Crystal stimulation
- Soundwaves
  - generation
  - absorption
  - reflection
- Restimulation of crystals
- Image generation

http://medicalimpo.com



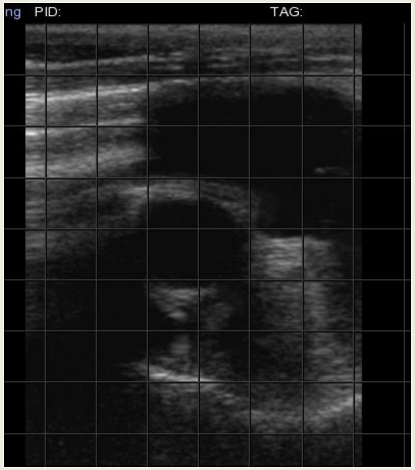
Blond & Buczinski, 2009

Orientation

Superficial

Deep

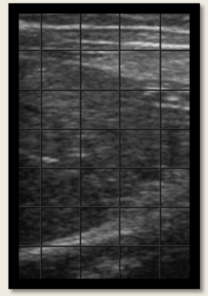
Dorsal



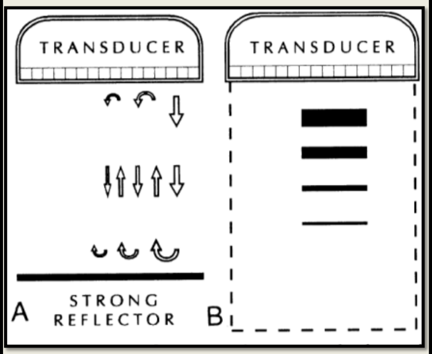
Ventral

Terminology

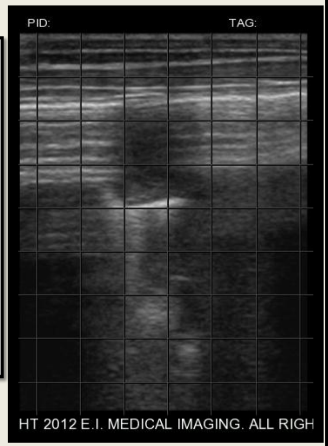
- Hyperechoic
  - white
- Hypoechoic
  - gray
- Anechoic
  - black



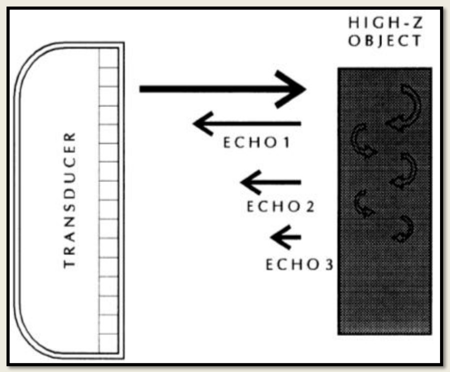
Reverberation Artifact - normal

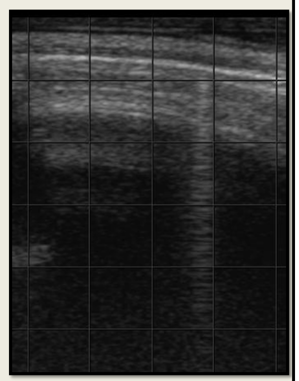


Hedrick & Peterson, Journal of Diagnostic Medical Sonography 1995 11: 300



Comet tailing – pleural thickening





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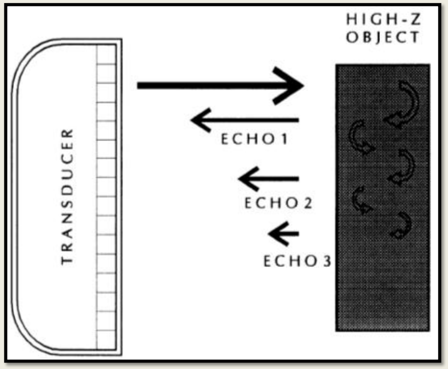
Comet tailing – pleural thickening



Hedrick & Peterson, Journal of Diagnostic Medical Sonography 1995 11: 300

Terminology – lung pathology

- Hepatized lung
  - consolidation
- Fluid bronchogram
  - Black tubes
- Air bronchogram
  - White dots/lines

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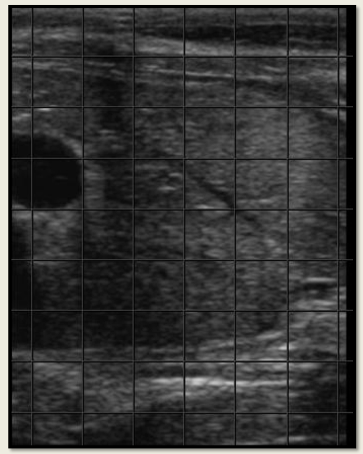

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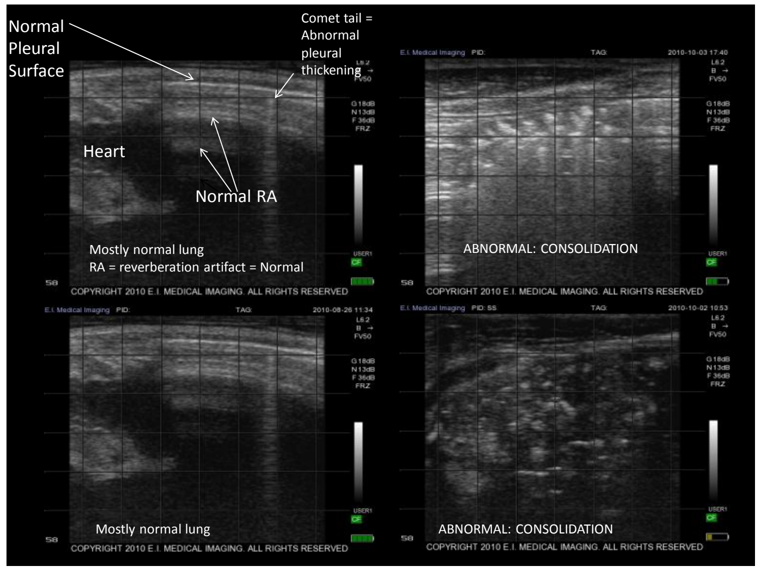

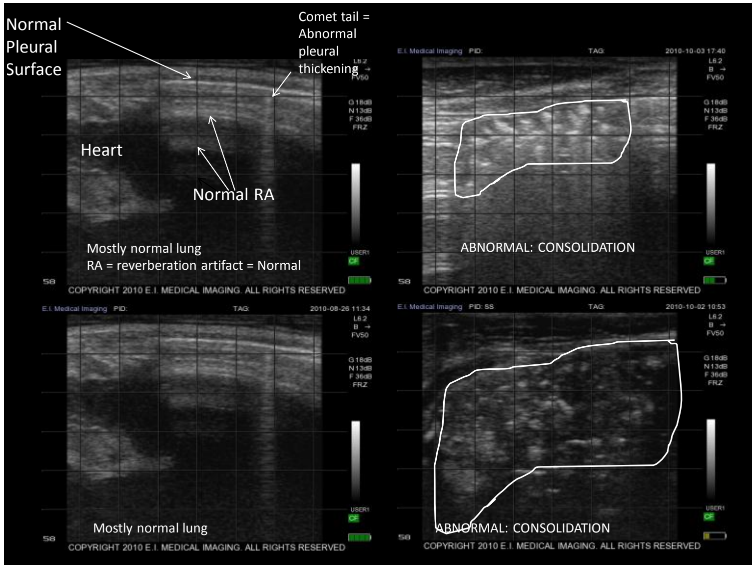
Normal
Pleural
Surface
Comet tail =
Abnormal
pleural
thickening
Heart
Normal RA
Mostly normal lung
RA = reverberation artifact = Normal
ABNORMAL: CONSOLIDATION
COPYRIGHT 2010 E.I. MEDICAL IMAGING. ALL RIGHTS RESERVED
COPYRIGHT 2010 E.I. MEDICAL IMAGING. ALL RIGHTS RESERVED
Mostly normal lung
ABNORMAL: CONSOLIDATION
COPYRIGHT 2010 E.I. MEDICAL IMAGING. ALL RIGHTS RESERVED
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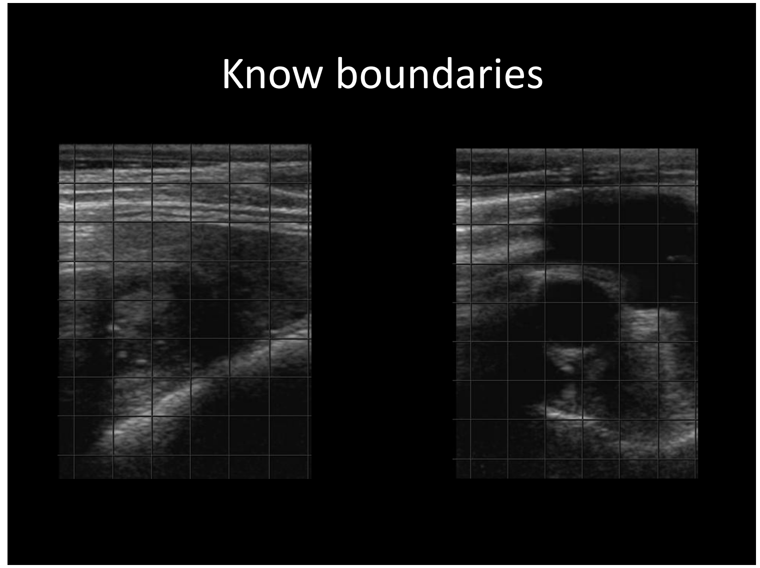
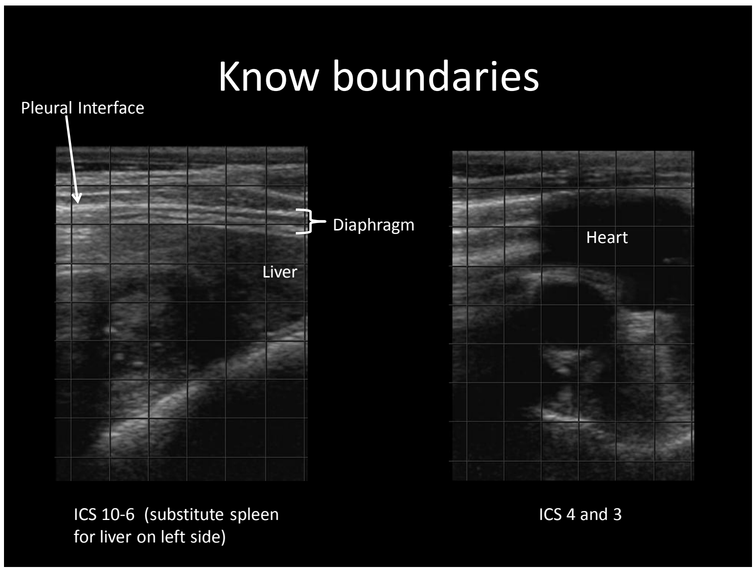
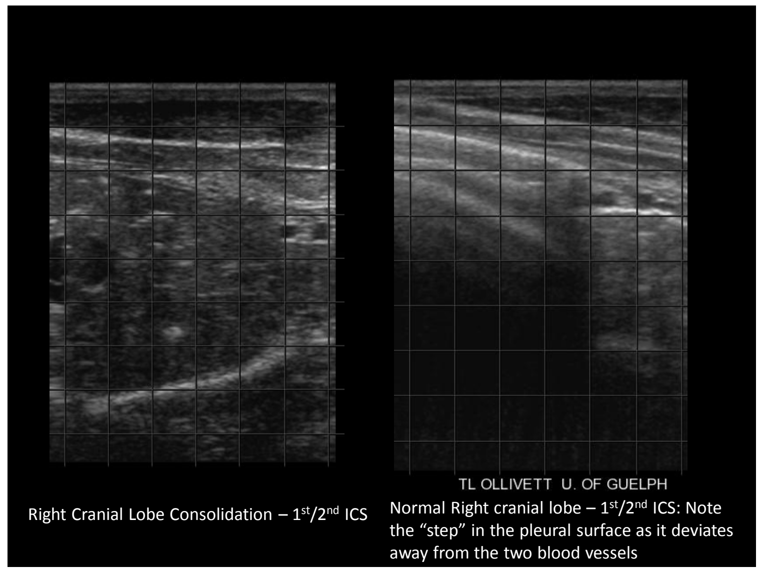
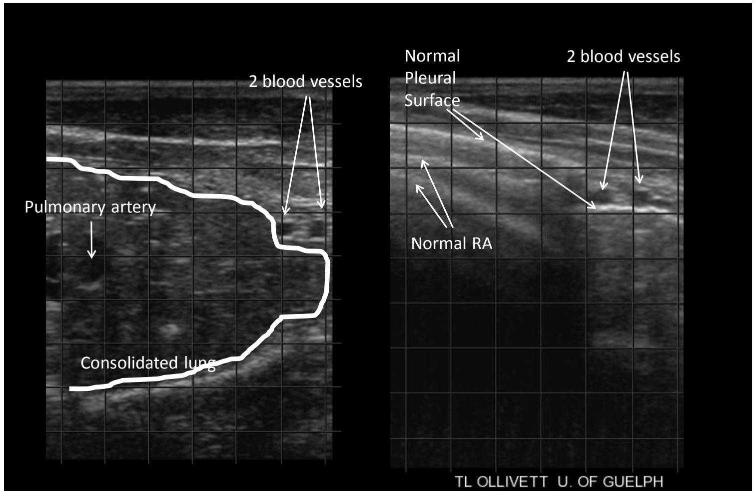

Know boundaries

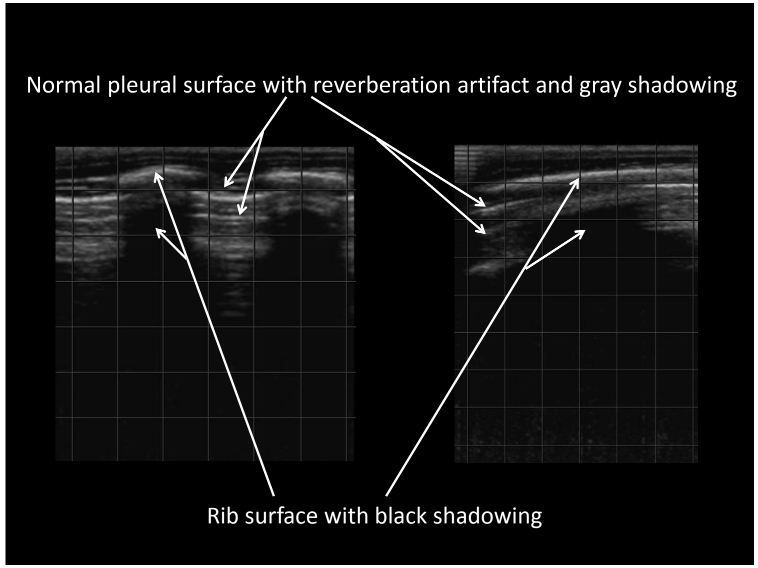

Know boundaries
Pleural Interface
Diaphragm
Liver
Heart
ICS 10-6 (substitute spleen for liver on left side)
ICS 4 and 3


TL OLLIVETT U. OF GUELPH
Right Cranial Lobe Consolidation – 1st/2nd ICS
Normal Right cranial lobe – 1st/2nd ICS: Note the “step” in the pleural surface as it deviates away from the two blood vessels



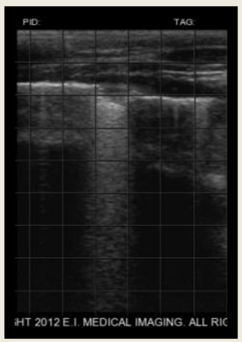
Right Cranial Lobe Consolidation – 1st/2nd ICS

Normal Right cranial lobe – 1st/2nd ICS: Note the "step" in the pleural surface as it deviates away from the two blood vessels



Pulmonary ultrasonography

- Benefits
  - quick & easy to learn
  - non-invasive
  - High Se and Sp
- Limitation
  - extent of disease
  - Rads v. US



Literature

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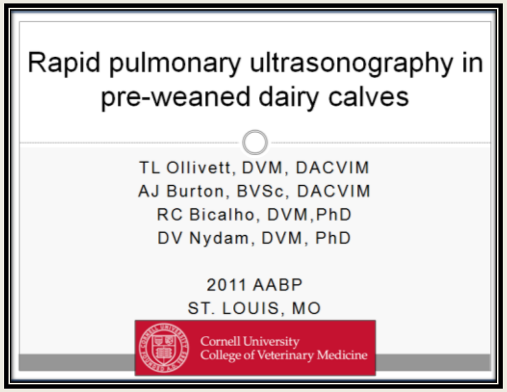
- Rabeling, B., J. Rehage, D. Döpfer, and H. Scholz. (1998) Ultrasonographic findings in calves with respiratory disease. Vet. Rec. 143: 468-471.
- Flock, M. (2004) Diagnostic ultrasonography in cattle with thoracic disease. Vet. J. 167:272–280
- Jung, C. and H. Bostedt. (2004) Thoracic ultrasonography technique in newborn calves and description of normal and pathological findings. Vet. Radiol. 45: 331-335.
- Babkine, M. And L. Blond. (2009) Ultrasonography of the bovine respiratory system and its practical application. Vet. Clin. Food Anim. 25: 633-649.

Clinical Research



Objectives of Study 1

- Develop a rapid technique for diagnosis of pneumonia on large groups of dairy calves
- Identify the frequency and characteristics of pulmonary lesions in commercial dairies
- Describe the relationship between pulmonary lesions and calf health

Materials and Methods

- 6 NY Holstein dairies
- Heifer calves
- 2 time periods
- Respiratory score
  (McGuirk. 2008. Vet Clin Food Anim. 24:139–153)
- Body weight
- Pulmonary ultrasound

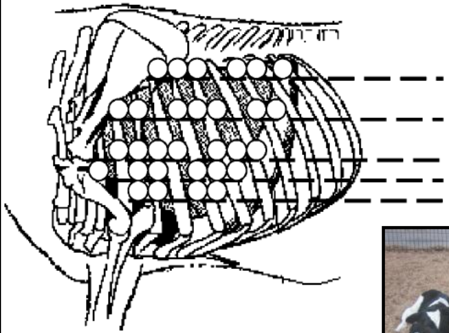
Ultrasonography

Ibex portable linear rectal transducer

Alcohol only; No clipping hair

www.EIMedical.com

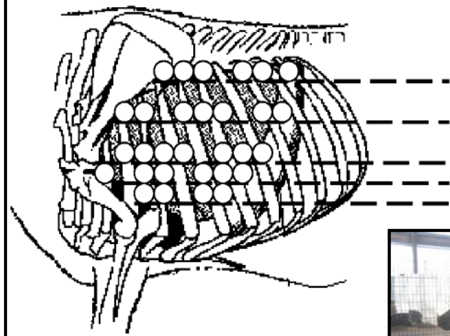
Lesion Location and Restraint



ICS 3-10
H: hip
HS: hip to shoulder
S: shoulder
SE: shoulder to elbow
E: elbow

Jung & Bostedt. Vet Radiol Ultrasound. 2004 Jul-Aug;45(4):331-5

Lesion Location and Restraint



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H: hip
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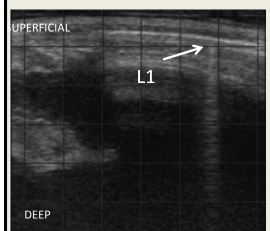
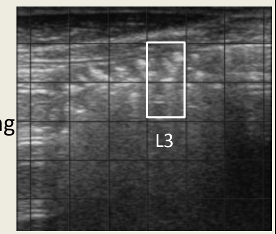
Jung & Bostedt. Vet Radiol Ultrasound. 2004 Jul-Aug;45(4):331-5

Voice recorded data

LESION SCORING





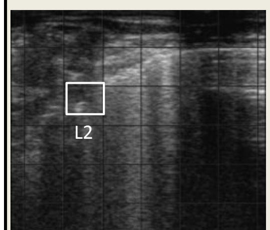
L0: normal

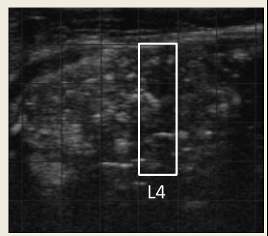
L1: pleural thickening

L2: <1cm diameter

L3: 1-3 cm diameter

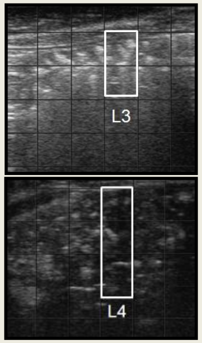
L4: >3 cm diameter





Materials & Methods

- Subclinical pneumonia
  - RS ≤ 4: NOT sick
  - L ≥ 3: 1 cm lesion or larger
- Clinical pneumonia
  - RS ≥ 5: SICK
  - L ≥ 3: 1 cm lesion or larger
- Farm records to identify treated calves
- Linear regression and Wilcoxon Rank Sum for data analysis

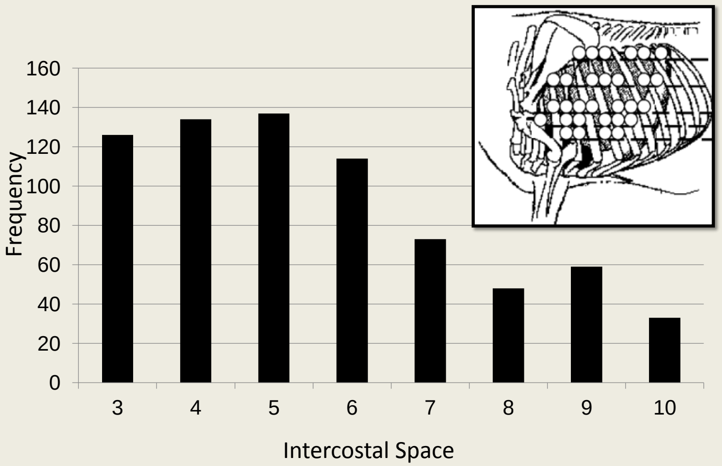


Results – Calf Level Data

	Ultrasound 1	Ultrasound 2
Number of calves	91	85
Age in days; median (interquartile range)	13 (12-15)	46 (44-47)
Time per calf (min)	<4	<4
# abnormal ICS/calf; median (interquartile range)	3 (2-5)	4 (2-6)

ICS = intercostal space

Cranioventral Distribution of Lesions

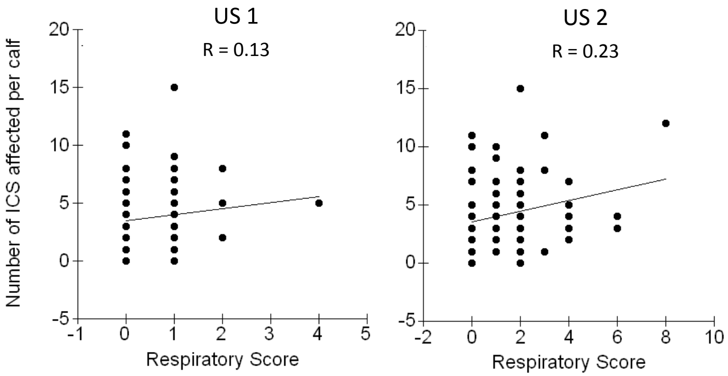


Results – Disease

	Ultrasound 1 – 2 weeks	Ultrasound 2 – 6 weeks
Subclinical Pneumonia (%)	5/91 (5.5)	12/85 (14.1)
Clinical Pneumonia (%)	0/91 (0)	3/85 (3.5)

Subclinical Pneumonia (SCP): RS ≤ 4, L ≥ 3   Clinical Pneumonia (CP): RS ≥ 5, L ≥ 3

Association between respiratory score & ultrasonographic abnormalities



Results – Body Weight (lbs)

	Normal US Median (IQR)	Abnormal US Median (IQR)	P-value
US 1	154 (147-169)	154 (151-177)	0.8
US 2	220 (193-230)	189 (159-198)	0.01
US 2 – SCP	220 (193-230)	202 (181-202)	0.07
US 2 – CP	220 (193-230)	185 (159-189)	0.04

IQR = interquartile range

Conclusions – pilot study

- Pulmonary ultrasound is not time consuming
- Poor association between lesions and RS
- High frequency of subclinical pneumonia
- Lower body weight in affected calves

RS = respiratory score

The next step…

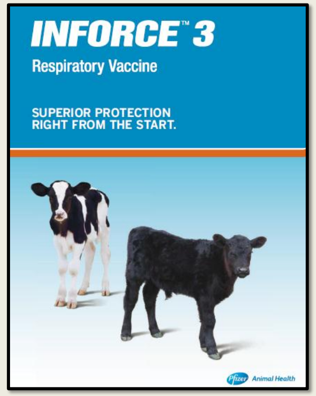
- Validate using:
  - Markers of inflammation
  - Performance parameters
    - Growth
    - Reproduction
    - Milk production
- Research tool
- Management tool

Current Project

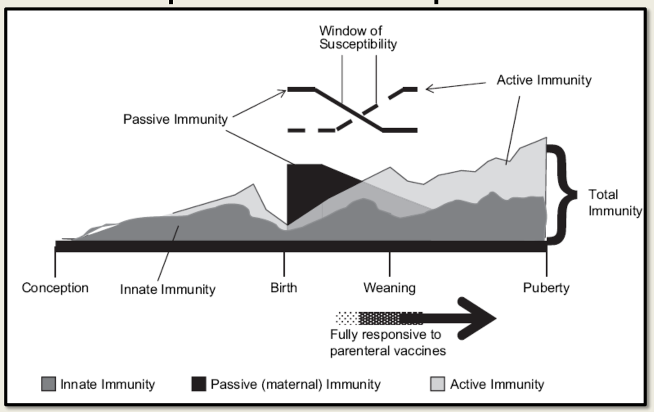
- Objective
  - Determine the effect of vaccination protocol on health and performance in dairy calves using US to diagnose subclinical pneumonia

Vaccination against BRD

- Intranasal (IN) week 1
  - Mucosal protection
  - Avoids maternal antibody
- Prevents BRSV
- Lessens IBR, PI_3 disease
- Good challenge studies
- Needs field studies



Can we provide better protection?



Chase CC et al.Vet Clin North Am Food Anim Pract. 2008 Mar;24(1):87-104.

Current Project

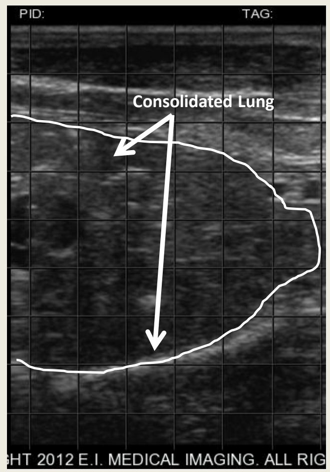
- Randomized Field Study
- 5 Ontario dairy herds
  - Convenience sample
  - ~1000 calves
- Experimental groups
  - Treatment (n = 465)
    - Inforce 3: d 3-6 & w 6-8
  - Positive control (n = 465)
    - Bovishield Gold: w 6-8
  - Negative control (n = 50)
    - No vaccine

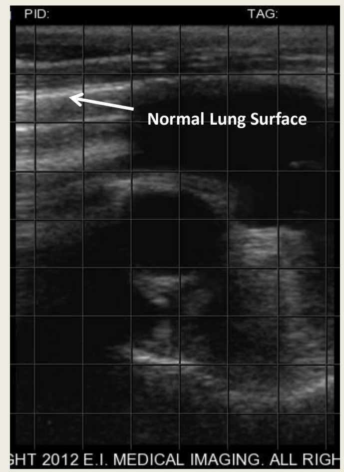
Methods and Materials

- At d3-6
  - Document passive transfer status
- From d3-6 to 12 weeks
  - Respiratory score
  - Weigh
  - Ultrasound*
  - Blood sample
  - Vaccinate
- Monitor records

Methods and Materials

- Outcomes
  - Respiratory score
  - Severity of disease
  - Serum markers
  - Average daily gain
  - Morbidity/Mortality
  - Necropsy/Lung fluid data
  - Age at first breeding
  - First lactation milk



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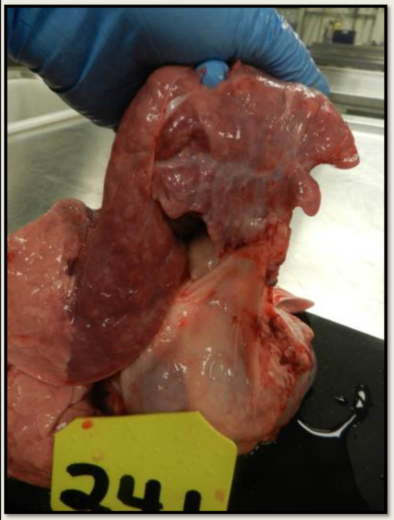


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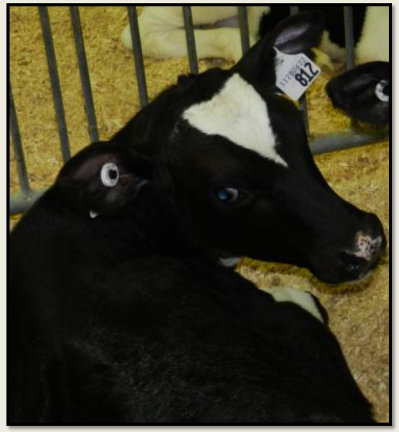
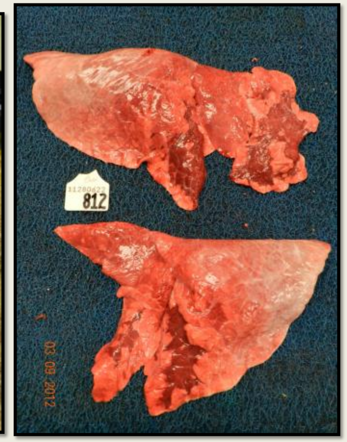
Subclinical disease





Results

- Incidence of US lesions
- Measures of association
  - Vaccination status
  - Ultrasound status
- Answer the 2 questions
  - Lesion significance?
  - Better vaccination protocol?

Conclusions

- Understanding effects of SCP may help regain control of BRD on dairies
  - HIGHLIGHT the importance of early diagnosis
- US can be used to identify calves with SCP
  - Treat? Sell? Isolate? Hold back?
- Monitor management changes

BRD – Spectrum of disease

Acknowledgements

Cornell Clinical Fellowship

Zach Wilcox, MS

NY and Ontario Dairy Farms

Ken Leslie, Dave Kelton, Todd Duffield, Jeff Caswell, Joanne Hewson, Daryl Nydam, Randy Graham, Jolene Cyples, Sam Deelen, Jessica Cyples, Melissa Wagner, Erin Wynands, OMAFRA

Cornell University College of Veterinary Medicine

Ontario Veterinary College

Questions?

Email: tollivet@uoguelph.ca

Calf Health Begins at Conception

Dr. Stephen B. Blezinger

Dr. Steve Blezinger is a food animal nutritionist specializing in nutrition and management of dairy and beef cattle. He graduated with a doctorate in ruminant nutrition from Texas A&M University in College Station, Texas in 1991 and has worked as both a corporate and an independent consulting nutritionist for 20 years. Working in a broad spectrum of the industry his focus has continuously been on the research and development of effective, practical nutrition programs for all classes of cattle and across species. This has included a variety of problem solving applications resulting in a maximization of efficiency, performance and profitability for producer clients. He has written extensively in a wide range of publications in hard print and now on the internet. Most recently, significant focus has been on the study and application of the effects that nutrition and management have on genetic expression of performance traits of the pre and postnatal calf and the subsequent long term effects on animal performance and productivity.

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Reveille Livestock Concepts
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Sulphur Springs, TX 75482
(903) 352-3475

Calf Health and Performance Begins at Conception

Fetal Programming. While the term has become increasingly common in the cattle industry the concept remains a little "out there." This is to quote a magazine editor friend when the topic was suggested for an article a few months ago. And he is correct - the concept that how we feed and manage the cow affects the calf she is carrying from the time of conception through its entire life can be a little challenging to wrap one's brain around. Essentially what the concept means is how we feed and manage the pregnant cow will "program" the calf from birth on. This is also referred to as metabolic imprinting. It may even mean that how we feed and manage the previous generations may have trans-generational effects on an individual animal (Lumley, 1992).

Actually the concept is not new. Scientists have long known that the nutrition and management of a pregnant female (the concept was actually first recognized in humans) has direct effects on the health and growth of the fetus and the baby. Some of the earliest specific work by Barker and his team (1993) at Southampton University in England showed that mothers who were malnourished during the first half of their pregnancy had children that had an increased incidence of health problems as adults which included diabetes, obesity and cardiovascular disease. More recently, literature regarding the effects of fetal programming in domesticated livestock has been reviewed (Funston et al., 2010a). In livestock production settings, lack of proper nutrition can often occur during gestation, particularly during the first two trimesters, even though we know that the bulk of fetal growth occurs in the third trimester. This results from either low feed reserves and/or management practices that result in cows losing weight during late fall and early winter (Sletmoen-Olsen et al., 2000a,b). However, data indicate that health and growth of offspring born from undernourished mothers are diminished (Godfrey and Barker, 2000; Vonnahme et al., 2003). While variations in the duration and severity of maternal undernutrition do not always result in a reduced birth weight, physiologic alterations such as glucose intolerance, skewed growth patterns and alterations in carcass characteristics have been reported. It becomes obvious that birth weight alone may not be the best predictor for calf survival and productivity.

For the cattle producer this is very tangible. For example, if the nutrition program is mismanaged or there is failure to take the appropriate steps to minimize stress during pregnancy there will be affects on the unborn calf. Negative nutrient environment can result in possible fetal programming responses due to several factors (Wu et al., 2006; Reynolds et al., 2010). These may include:

1) Breeding of young dams who compete for nutrients with the rapidly growing fetal systems.
2) Increased incidences of multiple fetuses or large litters.
3) Selection for increased milk production, which competes for nutrients with increased energy demand from fetal and placental growth.
4) Breeding of livestock during high environmental temperatures and pregnancy occurring during periods of poor pasture conditions.

These and other studies have reported instances of compromised maternal nutrition during gestation which resulted in increased neonatal mortality, intestinal and respiratory dysfunction, metabolic disorders, decreased postnatal growth rates, and reduced meat quality (Wu et al., 2006). Proper management of cow nutrition during gestation can improve progeny performance and health, perhaps through its entire life.

One of the most significant signs of maternal undernutrition is obvious. Initially the calf may be born very weak or even dead. The calf born as a result of that pregnancy may not gain weight to its genetic potential while still on the cow or later as it begins producing in the milking string or placed in the feedyard. This effect has been documented as reflected in Tables 1 and 2. In 2012, Underwood and co-workers reported increased body weight (BW) gains, final BW, and hot carcass weight (HCW) in steers from cows grazing improved pasture from day 120 to 180 of gestation when compared to progeny from cows grazing native range during that same time. Steers from cows grazing improved pasture had increased back fat and tended to have improved marbling scores compared to steers from cows grazing native range. Similarly, a study was pursued to determine the effect a dietary energy source had on progeny calf performance. Radunz (2009) offered cows 3 different diets during gestation beginning on approximately day 209: hay (fiber), corn (starch), or distillers grains with solubles (fiber plus fat). Corn and distillers grains diets were limit fed to ensure consistent energy intake among treatments. Results indicated reduced birth weights for calves from dams fed grass hay when compared to calves from the other two groups, with an increase ($P \leq 0.05$) in calf body weight reported through weaning when comparing calves from corn fed dams to hay fed dams. Feedlot performance among treatments was not different; however, calves from hay fed cows required 8 and 10 more days on feed to reach a similar fat thickness when compared to calves from distillers and corn fed dams, respectively.

Table 1. Effect of maternal nutrition on steer progeny performance.

	Dietary treatment				
	Underwood et al. (2010)[1]		Radunz (2009)[2]		
Item	NR	IP	Hay	Corn	DDGS
Birth BW, lb	85	81	86[a]	95[b]	91[b]
Weaning BW, lb	534[a]	564[b]	580[a]	607[b]	591[a, b]
ADG, lb/d	3.28[a]	3.65[b]	3.37	3.46	3.41
HCW, lb	726[a]	768[b]	688	688	675
12th rib fat, in	0.49[a]	0.65[b]	0.48	0.50	0.51
Marbling score[3]	420	455	549[a]	506[b]	536[a b]

[1]NR = dams grazed native range from day 120 to 180 of gestation; IP = dams grazed improved pasture from day 120 to 180 of gestation.

[2]Hay = dams offered a diet of grass hay beginning on day 209 of gestation; Corn = dams offered limit-fed diet of corn beginning on day 209 of gestation; DDGS = cows offered a limit-fed diet of distillers grains with solubles beginning on day 209 of gestation.

[3]Where 400 = Small^0.

[a,b]Means within a study with different superscripts differ ($P \leq 0.05$).

Adapted from Summers and Funston, 2011.

Similar effects can be seen in the effects of maternal prenatal nutritional support on resulting heifer calves as reported in Table 2. Martin et al. (2007) conducted a study with cows grazing dormant Sandhills forages during the late gestation period. One group received a 42% CP (DM basis) cube offered 3 times weekly at the equivalent of 1.0 lb/day while another group received no supplement. Calf birth weight between heifer progeny from supplemented and nonsupplemented dams was not different; however, heifer progeny from supplemented cows had increased adjusted 205 day weaning weights, prebreeding body weight (BW), BW at pregnancy diagnosis, and improved pregnancy rates compared to heifers from nonsupplemented dams. Furthermore, Funston et al. (2010b), using the same cow herd, offered a distillers based supplement (28% CP, DM basis) 3 times weekly at the equivalent of 1.0 lb/day, or no supplement during late gestation as cows grazed either dormant Sandhills range or corn crop residue. Calf weaning BW was greater ($P = 0.04$) for heifers from protein supplemented dams. The study went on to show a decreased age at puberty for heifers from protein supplemented cows and a trend ($P = 0.13$) for higher pregnancy rates when compared to heifers from nonsupplemented dams, possibly related to decreased age at puberty.

Table 2. Effect of maternal protein supplementation on heifer progeny performance.

	Dietary treatment			
	Martin et al. (2007)[1]		Funston et al. (2010b)[2]	
Item	NS	SUP	NS	SUP
Weaning BW, lb	456	467	492[a]	511[b]
Adj. 205-d wt, lb	481[a]	498[b]	470	478
DMI, lb/d	14.39	14.88	20.89	20.50
ADG, lb/d	0.90	0.88	1.86[x]	1.74[y]
Residual Feed Intake	-0.12	0.07	0.08	-0.04
Age at Puberty, d	334	339	365[x]	352[y]
Pregnant, %	80[a]	93[b]	83	90

[1]NS = dams did not receive protein supplement while grazing dormant Sandhills range during the last third of gestation; SUP = dams were supplemented 3 times per week with the equivalent of 1.0 lb/d of 42% CP cube (DM basis) while grazing dormant Sandhills range during the last third of gestation.

[2]NS = dams did not receive protein supplement while grazing dormant Sandhills range or corn residue during the last third of gestation; SUP = dams were supplemented 3 times per week with the equivalent of 1.0 lb/d of a 28% CP cube (DM basis) while grazing dormant Sandhills range or corn residue during the last third of gestation.

[a,b]Means within a study with different superscripts differ ($P \leq 0.05$).

[x,y]Means within a study with different superscripts differ ($P \leq 0.10$).

Adapted from Summers and Funston, 2011.

Other implications in female cattle may also be noted. As the heifer matures to a producing cow, she may not be as reproductively sound as she should be because some genetic groundwork was not laid properly. In a nutshell the concept means that the producer needs to be managing the cow as best possible from before conception through calving. This helps insure the calf's genetic potential. Indeed this very early nutrition and management may dictate what the calf's genetic potential actually is. This concept is truly managing for the long term.

However, it's not just for the long term. How we manage the cow carrying the fetus from the time of conception can have dramatic effects on growth and development of the calf while in the uterus and then immediately after birth. In addition to the performance issues such as those listed previously we can also see negative effects on pregnancy rates and initial calving date in females. Fetal programming may also impact carcass quality in the form of muscling and the amount of marbling. So when we look at ribeye area ultrasound scans, what we see in an animal at 12 months of age may have been affected when it was only an embryo only a few weeks old as suggested by the previous data. Additional evidence exists that this early fetal development directly affects the establishment and development of the immune system and can dictate the long term function of the immune responses as well as autoimmune conditions.

In general, most producers recognize how important it is to provide adequate nutrition to the cow during the third trimester of pregnancy. Most of the unborn calf's growth occurs during this latter part of gestation, with about 75% of growth occurring during the last two months (Robinson, et al, 1977, Vonnahme, 2007). The cow's nutritional status during the later months of pregnancy also influences how quickly her reproductive system recovers after calving and resumes normal estrous activity. It has been proven time and time again that it is hard to get a cow ready to breed if she is in poor condition at the time of calving. Consequently, much research and producers' efforts have concentrated on the cow's dietary needs during late pregnancy.

In many cases, historically, the first half of gestation has seemed less important. This seems especially true considering that the fetus has limited nutrient requirements for growth and development at this stage. However, growing evidence suggests there is a lot going on at the very beginning, at and from conception, as well as later in the pregnancy — things that can have significant effects on producer profitability — as a result of fetal or developmental programming. The key concepts to focus on here is that the cow must be managed prior to breeding, at breeding and in the early periods after conception in such a way that the developing embryo and fetus will receive the necessary nutrients in these early developmental stages to insure its productivity through its life. A correlation would be the construction of a house on a sound foundation.

Some of the Basics

There are two primary keys for the producer to understanding the initial fetal programming process in the animal. First, there has to be recognition of what is happening at conception and the period following. This includes what is going on with the genetic material. Secondly, once conception takes place, there has to be a connection made between the developing embryo and the cow.

To begin, as we learned in high school biology, the blueprint for life is deoxyribonucleic acid or DNA. This material is essentially the instruction manual for everything happening in the animal physiologically from the start – how cells and tissues divide, multiply and accumulate, how the fetus and later the animal grows and develops, establishment of the immune system, the ability to grow at a certain rate, everything! The DNA for a given individual is established at the point of conception and is a combination of that DNA delivered from the sire in the sperm and from the dam in the ova. This is the true mechanics of the selections breeders make when mating specific bulls and cows. Many producers carefully consider EPD's which provide an indicator of what an animal's genetic potential is for traits like birth weight, weaning weight, milk production and so on. These EPD values have a physiological base in the genetic material that is the basis for this performance. Purebred breeders invest significant dollars in "genetics." Thus, providing the proper nutritional and management support for the dam is critical to optimizing the expression of the genetic investment.

The DNA begins its role almost immediately after conception, instructing the fertilized egg cell to begin dividing and transitioning into an embryo and then a fetus. The DNA blueprint then goes on to set the protocol for how the tissues and various physiological systems in the growing body develop. This is a key period of time. During these very early stages (only a few days after conception) the new embryo is undergoing exponential growth, some of the most rapid cellular division in its entire life. If conditions are not optimal, opportunity exists for problems or errors to occur in the genetic codes or instructions. This is where a material known as RNA or Ribonucleic Acid comes into the picture. While DNA is the instruction manual that resides in the nucleus of the cells, RNA leaves the nucleus and the cells and is essentially the individual pages of the instruction manual. It provides specific instructions on how the countless actions and reactions in the cells, tissues and entire body are to occur.

This is where a significant opportunity for problems to develop. While DNA is very stable, has methods of error detection and the means to correct these errors, RNA does not have these same capabilities. Both DNA and RNA make copies of themselves. DNA copies are generally very good. With RNA this is not always the case as it can make flawed copies of itself and does not really have a way to repair these flaws. Additionally, RNA replicates itself about 10 times faster than DNA so appropriate nutritional building blocks must be in place constantly to support this copying process (Blezinger, 2012).

The second important step is how the embryo connects to the dam and more importantly to the dam's blood supply. This placental connection is believed to be an equally important factor in he fetal programming process as it establishes the delivery system for all nutrients and critical compounds from the cow to the developing embryo/ fetus. Establishment of functional uteroplacental and fetal circulation is one of the earliest events during embryonic and placental development (Patten, 1964; Ramsey, 1982) allowing for transportation of all respiratory gas, nutrient, and waste exchanges between the maternal and fetal systems (Reynolds and Redmer, 1995; 2001). The efficiency of transport is related to uteroplacental blood flow (Reynolds and Redmer, 1995) and although placental growth slows during the last half of gestation, blood flow to the placenta increases three to fourfold from mid to late gestation to support the exponential rate of fetal growth (Rosenfeld et al., 1974; Reynolds et al., 1986; Metcalfe et al., 1988; Ferrell, 1989).

It has been well known for many years that many nutrients are critical to this whole process. For most producers the nutrients they give the most focus are protein and energy. Adequate provision of both these nutrients is important for production of genetic materials. Remember that both DNA and RNA are essentially proteins. In order for proteins to be synthesized, basic building blocks (dietary proteins and amino acids) must be present to create the structure. Energy is required to facilitate the synthesizing reactions. The availability of protein has very practical results. Research studies have shown that calves born to cows that are fed a diet lacking in protein in the early stages of pregnancy, may be more susceptible to respiratory disease later in life. This is thought to be caused by poor lung development during gestation. Further research has examined the incidence of bovine respiratory disease (BRD) in feedlot cattle. Fifteen to 45% of cattle have been affected by BRD and 1% to 5% of cattle placed in feedlots die from this disease. Anything we can do to reduce BRD and respiratory problems will be huge for the industry in the form of additional profits. There is likelihood that fetal programming through proper nutrition can help reduce the incidence of BRD in these cattle. This may also become increasingly important as the industry's access to antibiotics becomes more restricted.

But protein and energy are not the only nutrients we need to focus on. We have know for a long time that minerals have long played a role in embryo and fetal development. Wilberg and Neuman reported in 1957 that there was an association between DNA and the trace mineral Manganese (Mn). Based on their work it was suggested that Mn has a functional relationship in the transmission of genetic information. De Carvalho and co-workers (2010) reported that Mn seems intimately involved in the synthesis of protein as well as DNA and RNA. Their results suggested that epiphiseal growth plate cartilage was affected during the early stages of embryo development due to Mn deficiency in the diet of the dam. This went on to result in malformations of the calf's reproductive systems and birth of calves with congenital defects in the skeletal tissues. So from this we can infer that if manganese is in short supply in the cow, this deficiency will be present in the reproductive tissues and may be in short supply during the initial phases of cellular division when the transmission of this genetic information is critical.

Additionally, to illustrate the importance of certain nutrients at very early developmental stages, Lequarre and co-workers (2001) reported the presence of Zinc (Zn), Copper (Cu) and Mn dependent enzymes in bovine embryos prior to placental implantation. These enzymes include Superoxide dismutase which is a critical anti-oxidant and is found in virtually every cell in the body. This study showed that this enzyme was present from the very early stages of life. The synthesis and effect of this enzyme requires the presence of Cu, Zn and Mn.

A second key to the fetal programming concept is the development of the placenta and the vascular system the supplies the blood flow in the fetus. From conception to Day 90 the fetus is developing vital organs along with the development of the placenta so cow nutrition is important at this time. The critical time period for attachment of the placenta to the uterine wall and the subsequent vascular system for the fetus begins at 90 days after conception. By day 120, blood (and nutrient) flow to the fetus has increased greatly. During this critical span of days, (90 to 120 days) if the cow is malnourished, the development of the vascular system between the uterus and the fetus affects the ability of the fetus to get nutrients and oxygen from the mother. If this nutrient delivery system is inadequately developed it will negatively impacting the growth and development of the fetus. Vonnahme (2007).

And all This Means what to the Producer?

Most cattle producers (beef or dairy) will tell you that they focus strongly on management and nutrition during the period prior to calving and leading up to breeding. But in many cases this focus is driven by a desire to get the cow rebred after calving. For some dairymen, especially in a typical dairy economy, rebreeding and producing a genetically optimal calf takes a back seat to producing milk. With high producing herds, the competition for nutrients between the cow for milk production and the fetus (mid trimester) is significant. All cattlemen are looking for that subsequent pregnancy but maybe are not as focused on what is happening with that new conception and the early stages of that embryo. What this concept emphasizes is that not only do we need to be attentive to facilitating the next pregnancy but also that what we are feeding and how we are managing the cow at this point in time has significant and long term implications on the overall life and productivity of the new calf. And in a time when production efficiency is so critical, the producer cannot leave anything on the table.

So while it is important to pay attention to year-round nutrition and total management, special attention should be given to that period starting 45 to 60 days prior to calving on through the first 90 days after conception. First, because we are equipping the cow to deliver the optimum genetic material (DNA). Also remember, it takes approximately 60 days for sperm cells to develop so there needs to be a focus on the bulls prior to the breeding period as well to insure their genetic integrity as well. Second, at conception we want that initial cellular multiplication, growth and development to be as sound as possible and for that embryo to become implanted and the vascular attachment to develop optimally. Finally, the nutrient supply from the cow to the developing fetus must be complete with nothing compromised. Again, all of this attention being given to insure maximum genetic expression and performance throughout the unborn calf's life.

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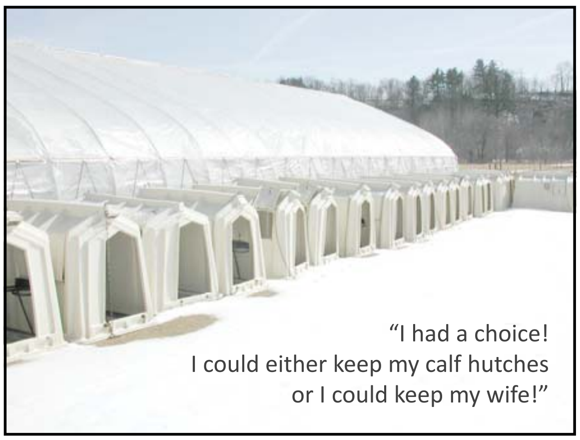
Improving Housing for Better Calf Health

Dr. Ken Nordlund
University of Wisconsin-Madison

Dr. Ken Nordlund is a Clinical Professor in the Food Animal Production Medicine group in the School of Veterinary Medicine at the University of Wisconsin-Madison. He received his veterinary degree from the University of Minnesota in 1977 and was a private practitioner and practice owner in Fergus Falls, Minnesota from 1977 to 1989.

Dr. Nordlund is a board-certified Dairy Specialist in the American Board of Veterinary Practitioners. In 1989, he joined the University of Wisconsin and helped to found the Food Animal Production Medicine program. His research interests include dairy record systems including development of the Transition Cow Index™ and interactions between dairy cattle housing and health.


Building the
Foundation
Healthy Calf
Conference
December 5-7, 2012
Improving
Housing for
Better
Calf Health
Ken Nordlund, DVM
School of Veterinary Medicine
University of Wisconsin-Madison

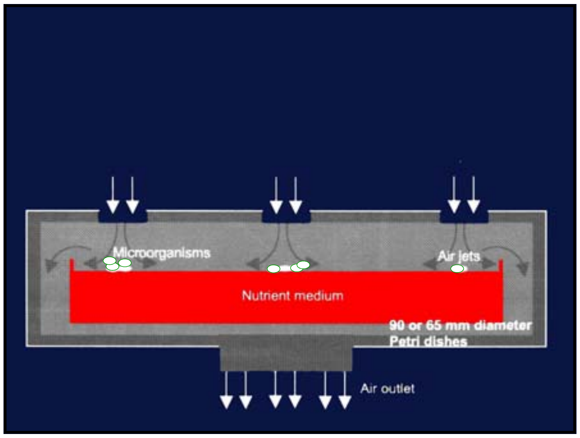

"I had a choice!
I could either keep my calf hutches
or I could keep my wife!"

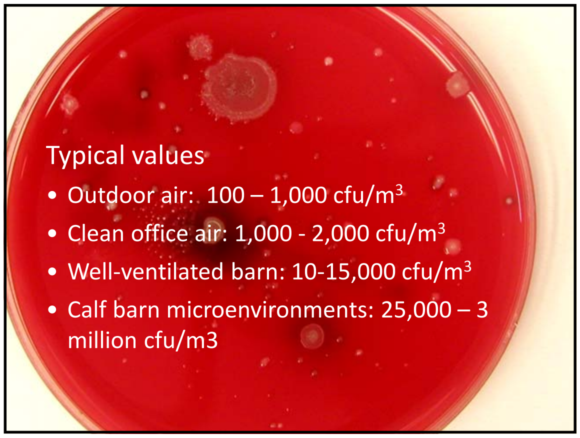

Naturally
ventilated
calf barns


Individual pens
Solid or mesh sides
Pen covers?
Variable bedding
Respiratory disease


Field trial to examine risk factors
Lago, McGuirk, Bennett, Cook, & Nordlund. 2006. J Dairy Sci 89: 4014 - 4025


IDEAL


Microorganisms
Air jets
Nutrient medium
90 or 65 mm diameter
Petri dishes
Air outlet


Typical values
• Outdoor air: 100 – 1,000 cfu/m3
• Clean office air: 1,000 - 2,000 cfu/m3
• Well-ventilated barn: 10-15,000 cfu/m3
• Calf barn microenvironments: 25,000 – 3 million cfu/m3

Topics

Preferred features of calf barns (group or individual pen)

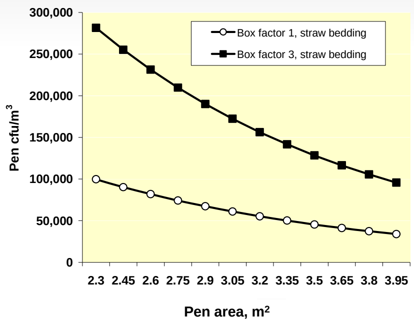
General comments about supplemental positive pressure tubes

Preferred features of individual calf pens

Key features in preferred calf barns

1. Spatial allowances of approximately 3 m^2 (30 $feet^2$) or more of bedded space per calf not including service alleys
2. Deeply bedded surfaces in cool weather less than 10° C *(50 degrees F)*
3. Drainage below the bedding
4. Natural ventilation with positive pressure supplemental ventilation

Pen Size



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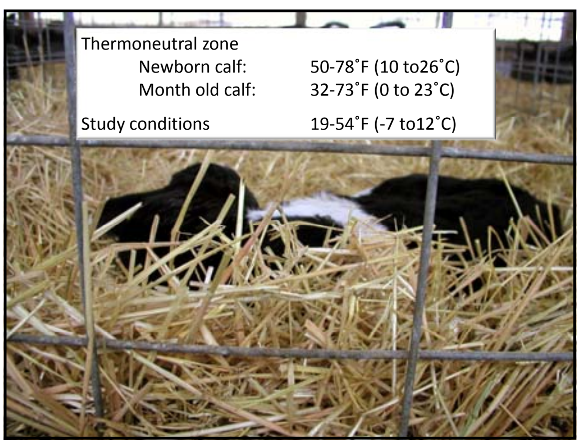
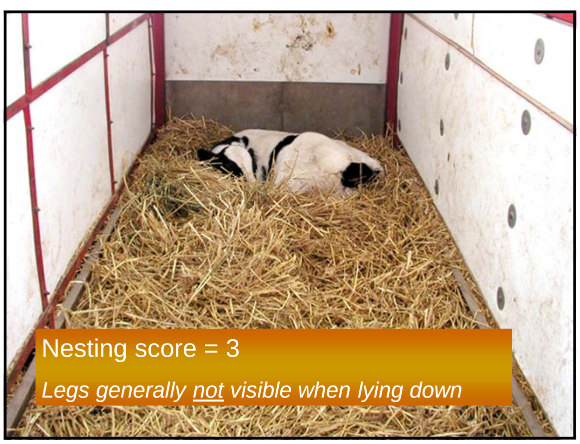
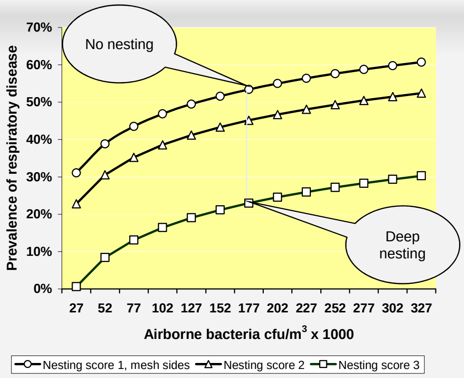



Nesting score = 1
Legs entirely visible when lying down


Nesting score = 2
Legs partially visible when lying down


Nesting score = 3
Legs generally not visible when lying down



Lago et.al., J Dairy Sci 89:4014, 2006

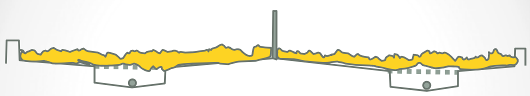
Key features in preferred calf barns

1. Spatial allowances of approximately 3 m^2 (30 $feet^2$) or more of bedded space per calf not including service alleys
2. Deeply bedded surfaces in cool weather less than 10° C *(50 degrees F)*
3. Drainage below the bedding
4. Natural ventilation with positive pressure supplemental ventilation

Reduce moisture in bedding

- Permeable drain under bedding
- 4” drain tile covered with pea gravel or coarse gravel 40 cm (1.5 ft) in depth
- The gravel base will need to be removed periodically (1-3 years)
- Remove small layer of gravel with skidsteer when removing straw bedding

Drainage under bedding



- Tile, covered with ~40 cm (18 in) gravel, carry liquid to outside storage
- ~60% of the straw used over gravel compared to full concrete base to achieve equivalent depth and improved dryness

Key features in preferred calf barns

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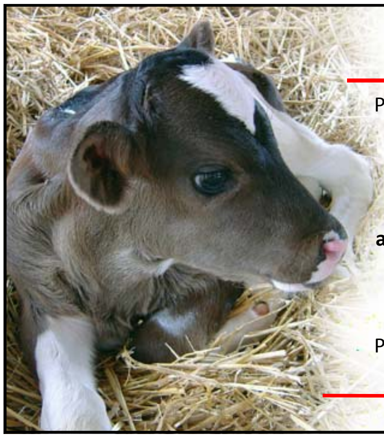


Topics

Preferred features of calf barns (group or individual pen)

General comments about supplemental positive pressure tubes

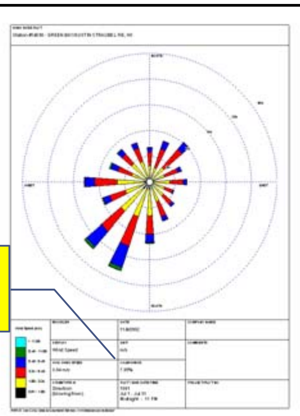
Preferred features of individual calf pens

Why supplement natural ventilation

- Calves do not generate sufficient heat to create thermal buoyancy
- "Still" or calm winds
- Depending on temperature differences between inside and out, wind does not necessarily fall into the barn

Wind rose:

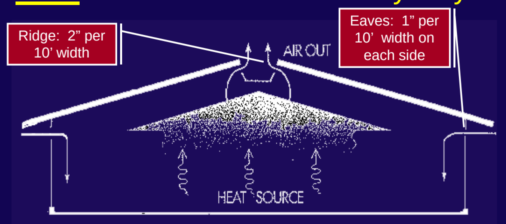
Wind in Green Bay in July



Still air 8% of time in July in Green Bay

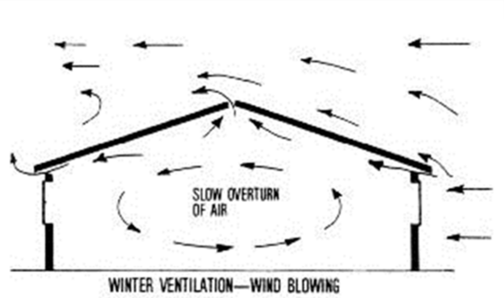
http://www.wcc.nrcs.usda.gov/ftpref/downloads/climate/windrose/

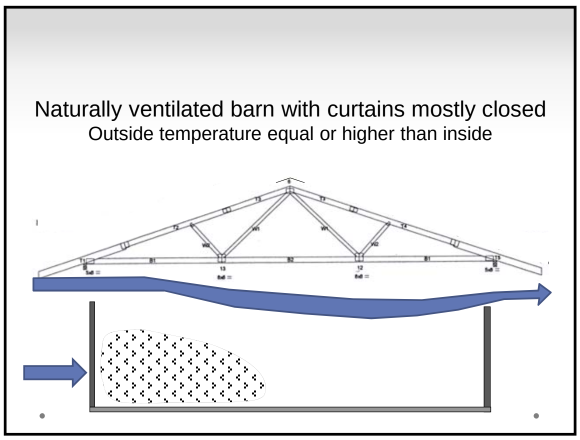
Cold conditions: Thermal buoyancy

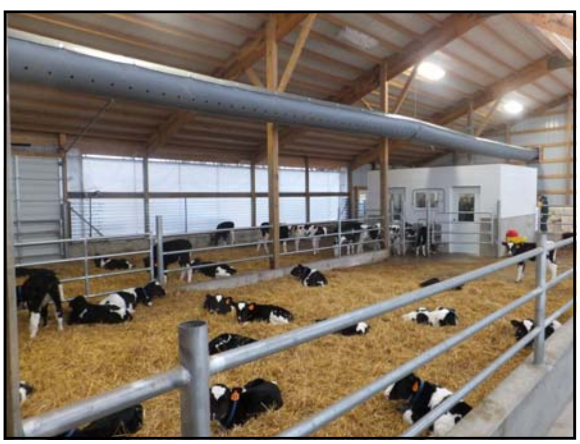


1. Open ridge and eaves
2. Adequate interior roof slope *(1:4 minimum, smooth)*
3. Heat source to create "thermal buoyancy"

Natural ventilation by wind

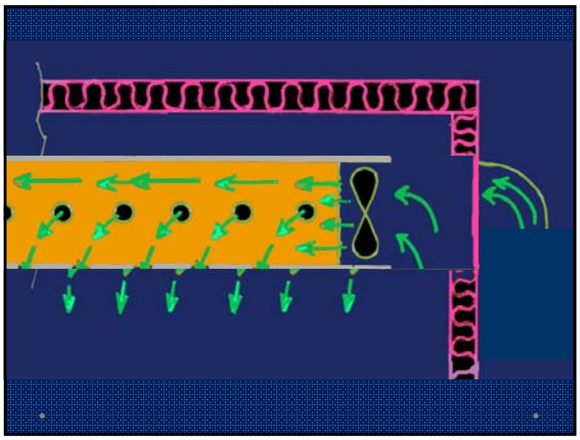


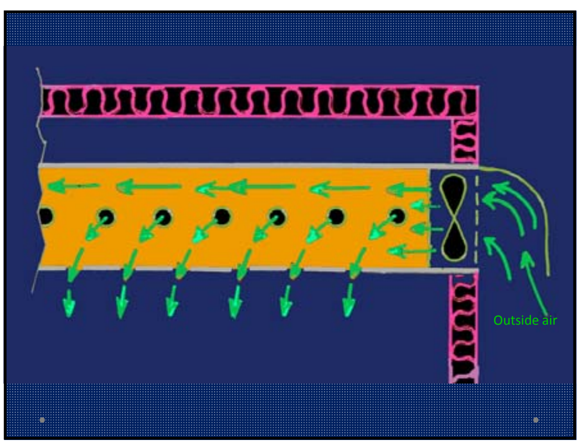

Naturally ventilated barn with curtains mostly closed
Outside temperature equal or higher than inside

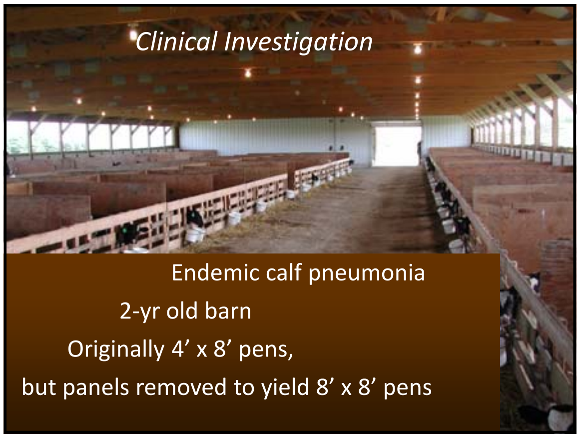


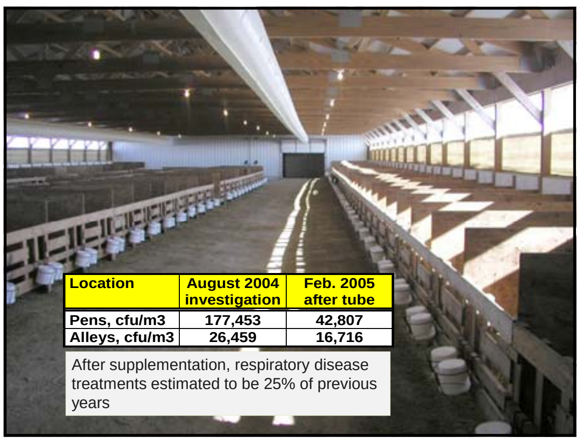
Haven't tubes been around since the 1970's?

- Yes, but these are different!
- Old tube systems were RECIRCULATION SYSTEMS
- Other fans exhausted air which drew fresh air into a louver
- Tube fans were placed 1 meter interior and recirculated air
- Discharge up or to the sides, NO worry about drafts!






Clinical Investigation
Endemic calf pneumonia
2-yr old barn
Originally 4’ x 8’ pens,
but panels removed to yield 8’ x 8’ pens

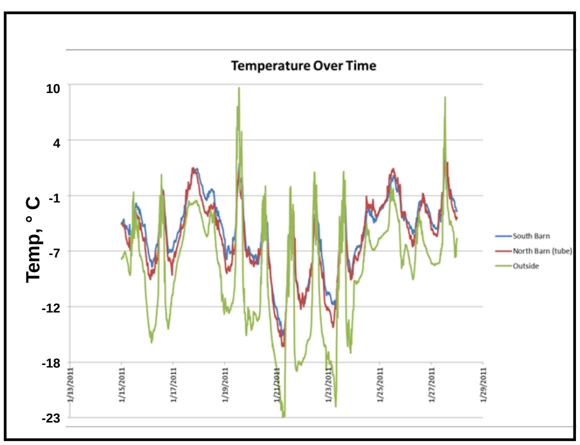


Location	August 2004 investigation	Feb. 2005 after tube
Pens, cfu/m3	177,453	42,807
Alleys, cfu/m3	26,459	16,716

After supplementation, respiratory disease treatments estimated to be 25% of previous years

Fear of cold air from tube

- Comparative trial with two identical barns
- One with tube, one without
- Temperature loggers installed in each barn (6 in each) plus two outside
- Temperature logged for two weeks


Temperature Over Time
10
4
-1
-7
-12
-18
-23
Temp, ° C
1/13/2011
1/15/2011
1/17/2011
1/19/2011
1/21/2011
1/23/2011
1/25/2011
1/27/2011
1/29/2011
South Barn
North Barn (tube)
Outside

Temperature data

	North Barn - With Tube	South Barn	Outside
Temp. (C), Min.	-16.6	-16.5	-23.0
Temp. (C), Max.	8.7	10.1	9.8
Temp. (C), Ave.	-4.9	-5.0	-8.3

Tube design is complex

- Not like the old style recirculation tubes
- Uniform discharge of air from one end to the other
- Precise “throw” distance to avoid cold drafts
- Requires sophisticated calculations

Positive Pressure Tube Calculator, Version 3.5
Ken Nordlund, DVM, Tom Bennett, BS, and Arturo Gomez, DVM
School of Veterinary Medicine, University of Wisconsin-Madison
August 18, 2011

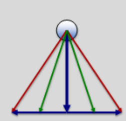
The Dairyland Initiative

Project ID

Name:
Barn ID:
Date: 11/7/2011

Dimensions of barn		
Length	120	ft
Width	32	ft
Minimal interior ht	10	ft
Maximum interior ht	18	ft
Interior volume of barn	53,760	ft³
Maximum # of animals	64	head
Tube specifications		
Length of tube	119	ft
Diameter of tube	21	in
Proximal tube air speed	973	ft/m
Length/Diameter Ratio	68	
Location of tube		
Height, bottom of tube	12.0	ft
Diameter of holes		
Still air, speed	60	ft/m
Coefficient of discharge	0.65	
Air speed from holes	1,800	ft/m

Fan sizing and selection		
Minimal Cfm per animal	20	cfm
Cfm based on animal #	1,280	ft³/m
Cfm for 4 air changes/hr	3,584	ft³/m
Fan cfm from catalogue	2,600	ft³/m
Estimated fan cfm at 0.25 "H₂O	2,380	ft³/m
# PP tubes in barn	2	fans
Total cfm from PP tubes	4,680	ft³/m
Air changes per hour	5.2	a/hr
Aperture ratio and static pressure		
Area, one "set" of holes	5.1	in²
Number of "sets" of holes	56	sets
Aperture ratio (a*n/A)	0.8	
$C_{complex}$	0.557744	
Static Pressure	39	Pa



Spacing of perforated holes	
Hole intervals	25 in

	Hole diameter	Target, horizontal from pt below tube	Trajectory to floor	"Throw" distance calculations: Trajectory to "still" air	Ht of "still" zone	Clock position of holes
Row 1 (wide rt) hole diameter	1.50 in	8 ft	14 ft	15 ft	-1 ft	5:00 o'clock
Row 2 (wide left) hole diameter	1.50 in	8 ft	14 ft	15 ft	-1 ft	7:00 o'clock
Row 3 (inside rt) hole diameter	1.00 in	4 ft	13 ft	10 ft	2 ft	5:30 o'clock
Row 4 (inside left) hole diameter	1.00 in	4 ft	13 ft	10 ft	2 ft	6:30 o'clock

Topics

Preferred features of calf barns (group or individual pen)

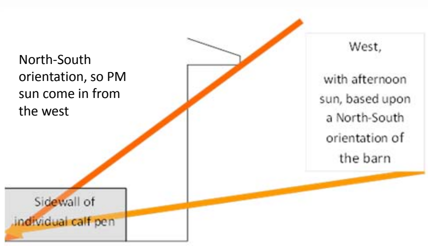
General comments about supplemental positive pressure tubes

Preferred features of individual calf pens

Key features if individual pens

1. East-west orientation of the barn to avoid extreme afternoon sun exposure in the pen
2. Optimal barns have one or two-rows of pens where the barn is limited to a width of 10 m (35 ft) or less
3. Pens separated from the outer wall by 1 m (3 ft) of space
4. Solid panels between each calf and open mesh front and the rear panel can be mesh or solid to about 0.6 m (2 ft) height with mesh above

Late pm sun and calf can't escape



Key features if individual pens

1. East-west orientation of the barn to avoid extreme afternoon sun exposure in the pen
2. Optimal barns have one or two-rows of pens where the barn is limited to a width of 10 m (35 ft) or less
3. Pens separated from the outer wall by at least 3 feet of space
4. Solid panels between each calf and open mesh front and the rear panel can be mesh or solid to about 2 foot height with mesh above

Key features if individual pens

1. East-west orientation of the barn to avoid extreme afternoon sun exposure in the pen
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Cover or "hover" protects from cold air drop, but air quality below the cover becomes extremely poor

Drafts along wall

- Move pens away from wall if possible
- If not possible, install tube system for 4 changes of air per hour and close curtain on windward side

Key features if individual pens

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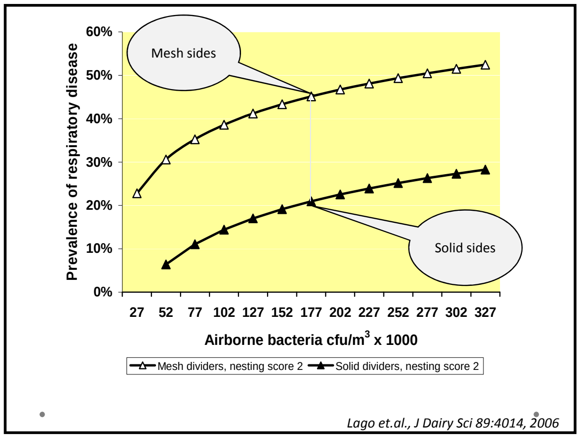
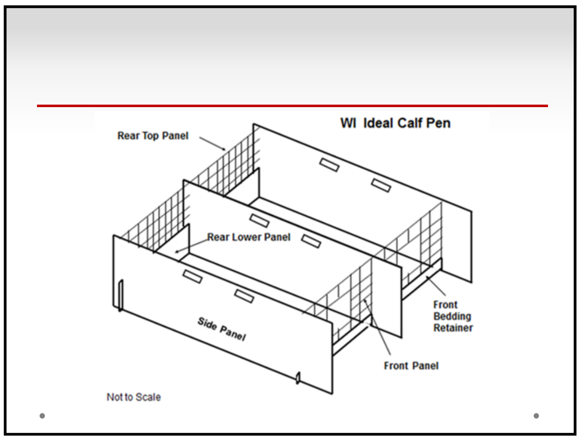
Key factors for respiratory health

1) Nesting in deep bedding P<0.002
2) Low pen airborne bacteria counts
   P<0.003
   Total bacterial counts significant
   Coliforms (EMB) not significant
3) **Solid panel between calves** ***P<0.003***

Lago et.al., J Dairy Sci 89:4014, 2006

Solid panel between calves


Mesh sides
Solid sides
Prevalence of respiratory disease
60%
50%
40%
30%
20%
10%
0%
27 52 77 102 127 152 177 202 227 252 277 302 327
Airborne bacteria cfu/m3 x 1000
Mesh dividers, nesting score 2
Solid dividers, nesting score 2
Lago et.al., J Dairy Sci 89:4014, 2006


WI Ideal Calf Pen
Rear Top Panel
Rear Lower Panel
Side Panel
Front Bedding Retainer
Front Panel
Not to Scale


Is this soon over?

Summary

- Calf barns are equaling hutches for calf health
- Emphasis on drainage, bedding, and fresh air, and allow barn to get cold
- Positive pressure ventilation to SUPPLEMENT natural ventilation has been very effective

Managing Respiratory Disease in Group Housing

Dr. Amy Stanton
University of Wisconsin-Madison

Dr. Amy Stanton has completed a Ph.D. in Epidemiology and Applied Animal Behaviour and a Bachelor of Science in Agriculture at the University of Guelph. Her specific interests are behavioural indicators of disease, the management of weaned dairy calves, and the long-term production and welfare effects of disease challenges in the young calf.

Amy is currently an assistant professor at the University of Wisconsin-Madison in the Department of Dairy Science. Her role at the University is Dairy Cattle Well-being Specialist and she splits her time between research and extension.

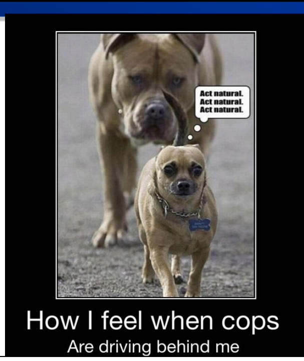
Managing Respiratory Disease in Group Housing

UW Extension
University of Wisconsin–Extension

Outline

- Stress!
- Disease prevention
- Identifying sick calves
- What is BRD?
- Preventing BRD
- Long-term impacts of BRD

STRESS!!!!!!!!!



Stress

- Stress is the body's reaction to a change that requires a physical, mental or emotional adjustment or response.
- Distress happens when adjustment or response is prevented or inadequate
  - Fear
  - Hunger
  - Thirst
  - Thermal

Stress- Fear system

- Fear
  - Energy systems kick in – lots of glucose and simple proteins and fats mobilized
  - Heart rate, blood pressure, breathing increases
  - Digestion inhibited
  - Decreased sex drive
  - Immunity is inhibited
  - Pain response decreased
  - Memory improves
  - More sensitive (sight, sound, smells)

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  - Immunity is inhibited
  - Pain response decreased
  - Memory improves
  - More sensitive (sight, sound, smells)

Ready to Run For Your Life!

Stress= Fear

- In the wild, great!

http://world-of-lions.blogspot.com

Stress= Fear

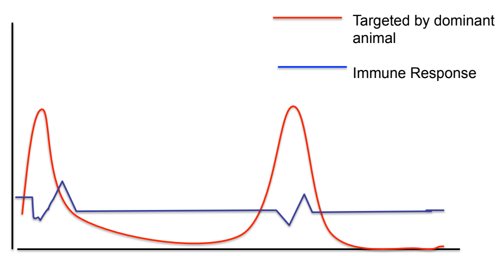
- In the wild, great!
- Not what we are looking for in animal agriculture

http://world-of-lions.blogspot.com

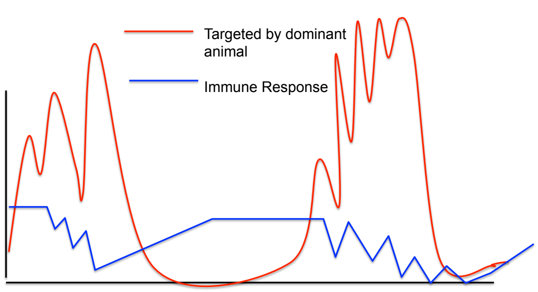
Fear

- Quickly return to baseline
  - Heart rate, breathing, blood pressure down
  - Immunity resumes (ramps up)
  - Sex, digestion returns to normal
  - Pain response, memory and senses settle down
- IF escape/avoidance occurs
- No escape?!
- Frequent fear
  - Response can be extended
  - Longer time of immune suppression

Social Stress – subordinate animal

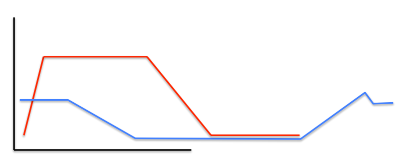


Social stress – hard to escape



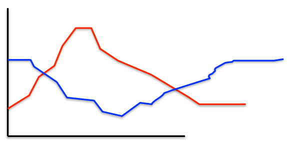
Other dangers

- Trigger + unable to immediately respond = BAD!



Other dangers

- Trigger + Trigger + Trigger + unable to respond= VERY bad!
- Multiple stressors
  - Hunger
  - Thirst
  - Pain
  - Fear
  - Heat/cold stress



Spiraling out of control

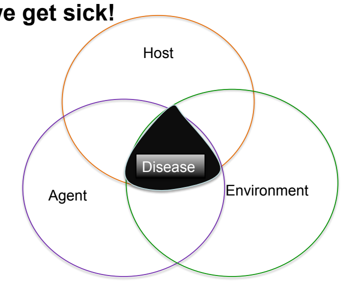
- Immune system suppressed
- Exposed to pathogen
- Slow to recover
- No recovery

Sickness

So, why don't we get sick EVERYTIME we are stressed?

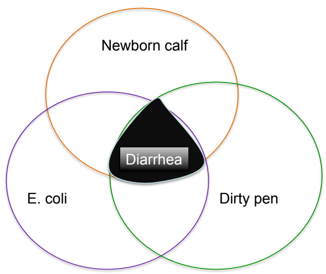
Epidemiological triad

i.e. why we get sick!



Epidemiological triad

Example



Avoidance

"It is well known that "problem avoidance" is an important part of problem solving. Instead of solving the problem you go upstream and alter the system so that the problem does not occur in the first place." Edward De Bono

How to Avoid Sick Calves

- **Make calf less susceptible**
  1. **Avoid stressors!**
  2. Nutrition
  3. Vaccination
- Get rid of pathogens
  - Vaccination
  - Cleanliness!
- Stop calf from being exposed to pathogens
  - Stall designs
  - Cleanliness
  - Separate cow/calf
  - Clean calving pen

Prevention

- **Colostrum**
- **Vaccination**
- **Diarrhea**
- **Clean calving area**
  - **(No manure meals!)**
- **Ventilation**
- **Nutrition**
- **Avoid stressors**

Colostrum Management

Low serum total protein: OR=3.98
Measure success or failure
- Talk to veterinarian about including sampling for total protein at herd health visit
- Sample all calves 2 - 5 days of age
- Simple blood sample
- Herd level
- Goal fewer susceptible calves

Clean, Quick, Quantity, Quality

Extension

Avoid Diarrhea

Occurrence of at least 1 episode of diarrhea: OR=3.00
Avoid manure meal at birth
- How often is new bedding added to the box stall?
- How does it look today?
- If you kneel down on the bedding in the calving pen today for 25 s, is your knee wet?

Extension

Housing

Ammonia levels in calf housing environment greater than 5ppm: OR=2.39
Draft-free pen: OR=0.27
Very important!
For more information:
- Dairy Land Initiative by University of Wisconsin Extension
- http://thedairylandinitiative.vetmed.wisc.edu/prv_tools.htm

Extension

What stressors are your calf facing?

- Hunger
  - While on milk
  - During weaning
  - On average calf will drink 10 L of milk per day (C. Todd)
- How can you tell if a calf is hungry?

Extension

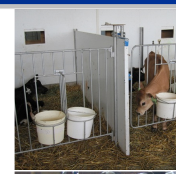
What stressors are you calves facing?

Movement to group housing
- Nutrition
- New food
- Social




What stressors are you calves facing?

Moving calves
- New food apparatus
  - How to use it?
  - Where is it?
- New water source
  - How to use it?
  - Where is it?




Cold and Heat

- What happens if ... thermoneutr...
  - Spend...
  - U... ...or immune system

Need more nutrients in cold weather!

Weaning - Avoid major changes

Take it slow
- Step down weaning the most effective
  - Cut volume by 1/3- 1/2 each week
- Provide warm water as replacement for milk
- Lots of fresh water + grain
  - At least 2lbs/day prior to last milk meal
- Do not vaccinate or dehorn at this time

Social Changes

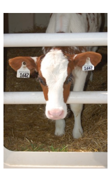
- Minimize mixing and regrouping at this time
- Treat this group as all in all out
- Lots of space resting + feed bunk space
- Competition = variability

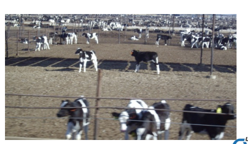
It's too late!

- Unfortunately, things go wrong
  - Some in our control
  - Some not
  - Now we need to respond

Disease Detection & Monitoring

- Finding the sick calves in the crowd
  - Understanding sickness behavior
- Stopping an outbreak before it starts or gets out of control



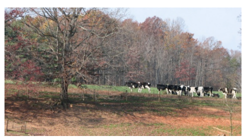


Disease Detection

1. Observe calves several times a day
2. Don't observe calves immediately after handling/pen cleaning or other potentially frightening situations

Disease Detection

3. Look at each calf as an individual
    1. Nose
    2. Respiratory effort
    3. Diarrhea



Disease Detection

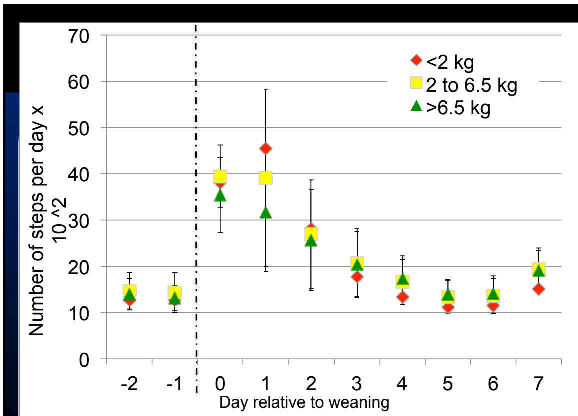
4. Look for sick behaviors

Disease Detection

4. Look for sick behaviors

Disease Detection

4. Look for sick behaviors
    - Slow to stand
    - Does not explore/approach people or novelty



Disease Detection

Characteristics of a 'clueless loser'

- Lying while group mates are standing
- Standing when group mates lying
- Isolated
- Standing with group at feed bunk but not eating
- Slow to adjust to change

- **Poor growers and at risk for disease or are sick**

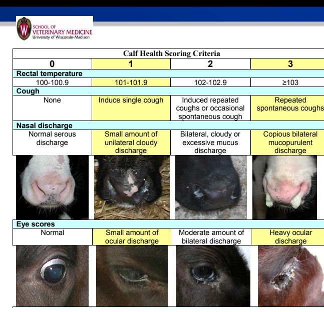
Evaluate your skills

Use Calf Health Scoring Sheet to track incidence and make sure you are catching calves early

Monthly assessment

Important for training new staff!

Calf Health Scoring Sheet

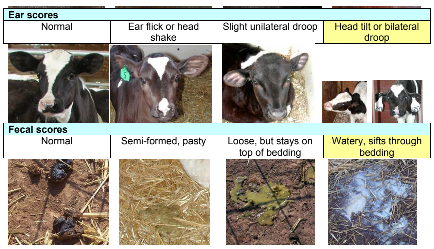


Calf Health Scoring Criteria

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

http://www.vetmed.wisc.edu/dms/fapm/fapmtools/8calf/calf_health_scoring_chart.pdf

Calf Health Scoring Sheet



http://www.vetmed.wisc.edu/dms/fapm/fapmtools/8calf/calf_health_scoring_chart.pdf

Calf Health Scoring Sheet

- By going through each calf individually you can determine if you are picking the right ones out of the group
- Clean rectal thermometer well between calves
- Clean gloves between calves

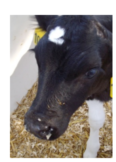
Getting specific……

BOVINE RESPIRATORY DISEASE

What is BRD?

Bovine Respiratory Disease COMPLEX

- Multiple viral and bacterial organisms
- Work together
- Usually need a stressor to trigger disease



BRD – why is it important

- BRD is highly contagious
- May impact large proportion of group
- Clinical and subclinical impacts
- Economic impacts
- Welfare of calves
- Well-being of caretakers

Calf Effects

Short term (acute)	Long term (chronic)
Anorexia	Prolonged clinical signs
Depression	Death
Lethargy	Dystocia
Coughing	Other infections?
Shortness of breath	

Economic Factors

Short term	Long term
Detection (Labour)	Decreased growth
Treatments (Drugs & Labour)	Decreased survival
Mortality	Increased age at first calving
	Dystocia
	Milk production?

Prevention and Control

- In beef industry, use long-acting antibiotics to protect and treat animals at high risk of disease
  - Just after entry into feedlot
  - Similar risk as first movement to group housing in dairy calves

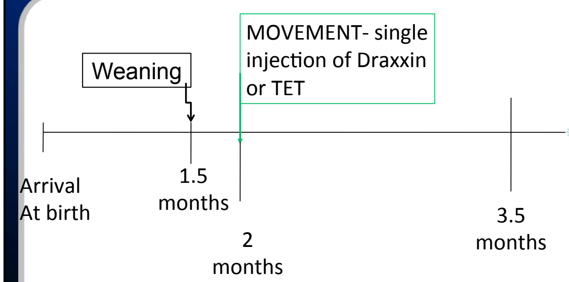
Metaphylaxis

For periods when management changes can not overcome challenge
- Primarily seasonal
- While correcting housing or management

Observed most commonly after first movement to group housing

Study results…..

Timeline



Results – first 60 days

- Biomycin: 22.4% (156/695)
- Draxxin: 13.2% (92/697)
- Biomycin calves were 2.0 {1.5 - 2.6} times more likely than Draxxin calves to be treated for BRD in the 60 days following enrolment at movement.

Weight at 3.5 months

Calves with no pre-weaning BRD:

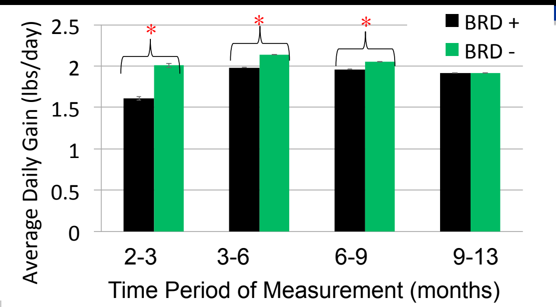
Draxxin successfully treated calves with an associated increase in weight of 11 ± 1 lbs

Pre-Weaning BRD	Draxxin	Biomycin
Yes	230 ± 3.6	228 ± 3.6
No	240 ± 2.9	230 ± 2.9

Long-term impacts

TRUE COST OF BRD

Effect of BRD on ADG



Survival to first calving

- Study treatment and BRD post-movement to group housing tended to interact ($P < 0.05$)

	BRD +	BRD -	OR
Probability of calving	63 - 73% n = 238	84% n = 1105	2.7

Mortality Prior to Calving

7% (93/1,293) of heifers died between enrolment (8 weeks of age) and calving

Producer Attributed Cause of Death	Proportion of Total Deaths
Respiratory Disease	**47% (44 /93)**
Injury	27% (25/93)
Non-respiratory Diseases	14% (13/93)
Other	1% (1/93)
Unknown	11% (10/93)

Culling

12% (162/1,392) of heifers were removed from herd prior to calving

Culling

Primary Reason	Proportion Herd Removals
Poor Reproduction	32% (51/162)
Poor Growth	22% (36/162)
Dairy	22% (35/162)
Non-respiratory diseases	15% (26/162)
Injury	4% (6/162)
BRD	2% (3/162)
Other or unknown	3% (5/162)

Age at First Calving

Post-movement BRD

- **YES: 27% (42/157) calved after 25 months**
- **NO: 17% (159/929) calved after 25 months**

The odds of a heifer calving prior to 25 months of age was 40% lower for calves treated for BRD compared to calves without BRD

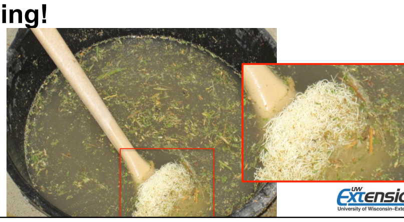
Calving Difficulty

	BRD +	BRD -
Proportion with calving score ≥2	**55%** (85/155)	**46%** (424/912)
Proportion with calving score ≥3	**27%** (42/155)	**23%** (208/912)
	OR = 1.3-1.5	

Summary

Key to preventions

- Clean Environment
- Lots of clean fresh food
- Bedding!



Summary

- Avoid Stress
  - Minimize changes
  - Don't stack stress

Summary

- Identify sick calves
  - Clueless
  - Slow to rise
  - Does not approach
  - Statue Standing

Summary

- Bovine Respiratory Disease
  - Prevent through management when possible
  - Consider long-acting antibiotic at entry to new barn if needed

Having BRD as a calf

- ↓ ADG until 9 months of age
- ↓ Probability of entering milking herd
- ↓ Probability of calving <25 months
- ↑ Probability of having difficulty calving

Thank you for your time

Contact information:
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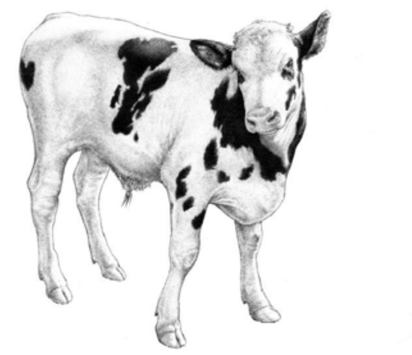
University of Wisconsin-Madison
alstanton@wisc.edu

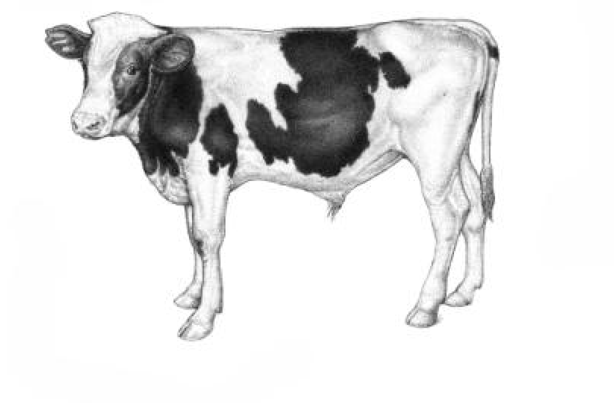
Exploring Early Calf Management: What's New and What's Important to Review

Kathleen Shore, M.Sc.,
Grober Nutrition

Kathleen is a graduate from the University of Guelph with an undergraduate Science degree majoring in Animal Science, and a post graduate degree in Ruminant Nutrition. Throughout her university career she worked on various dairy farms performing the every day tasks of feeding calves and heifers while maintaining their health records.

In 2006, she started with Grober as a nutritionist with a focus on milk replacer formulation, research and development in young animal nutrition and leading the Quality Assurance Lab and HACCP program. In 2009, Grober embarked on a new initiative: The Young Animal Development Centre where Kathleen has been one of the project leaders. Through this initiative, young animals (calves, lambs and kids) have been employed for nutritional and management research purposes in order to provide current and practical information for producers.





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The Ontario Veal Association is a producer organization dedicated to promoting and enhancing a viable and competitive Ontario veal industry through innovation, marketing, advocacy and education.

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