Evolution of ‘Diseases’ in Florida 1980-2017

• Heel warts – mid to late 1980s
  – Severe acute foot rot that did not respond to traditional antibiotic therapy
  – Treats tried
    – Cautery – Yes, we applied a hot dehorning iron in these lesions!
    – Topical antibiotics – varying success (due to environmental conditions?)
    – Topical formalin gel
  – Enter Dr. Jan Shearer
    – Hoof spraying with tetracycline
    – Formaldehyde foot baths
    – Any foot baths

Evolution of ‘Diseases’ in Florida 1980-2017

• Otitis media (‘Ear infections’)
  – “What da heck is this!”
  – Early observations – trauma? ‘Hit by milk truck’
  – Parasites (ticks / mites)
Evolution of ‘Diseases’ in Florida 1980-2017

• Otitis media (‘Ear infections’)
  – Gina Temple, Jack Gaskins, Mary Brown
  – Caused by *Mycoplasma bovis*
  – Transmission – Predominantly through milk
  – Early clinical signs – Fever, head-shaking, ear-scratching
  – Treatment – Anything but the penicillins/cephalosporins and sulfas
  – Prevention – Avoid milk exposure, ventilation, nutrition, sanitation

Evolution of ‘Diseases’ in Florida 1980-2017

• Bloody gut
  – 1998 – ‘Dead cow syndrome’
  – Crash in milk followed by death

• Bloody gut
  – Followed 10 cows through a slaughter facility
  – Lung abscesses, hardware disease?
  – Lung abscesses, pneumonia
  – Resulting from bacterial escape from the small intestine after an episode of BG
Evolution of ‘Diseases’ in Florida 1980-2017

• **Bloody gut**
  – Earlier detection
  – Surgical treatment
  – Medical treatment
  – Cause
  – Prevention

• **Mastitis**
  – 1980s – I’d go to meetings and get laughed at by other veterinarians
  – Milk quality was keeping milk ‘legal’
Evolution of ‘Diseases’ in Florida 1980-2017

**Mastitis**
- 1980s – I’d go to meetings and get laughed at by other veterinarians
- Milk quality was keeping milk ‘legal’
- Milker schools, Parlor Checks (milking machine function), Cultures

“Time spent in parlor vs time spent in barns/pasture”

“5-6 min 2-3x/d vs ‘the rest of the day’”

---

Evolution of ‘Diseases’ in Florida 1980-2017

**Mastitis**
- Dave Bray and his ‘colorful’ farm analyses

“The germs that cause mastitis now are the same as the ones causing mastitis in the 1940s!”

“We’ve got to move out of 1940s level of management.”
Evolution of ‘Diseases’ in Florida 1980-2017

• **Mastitis**
  – Facilities were the 1st major step forward
  – How to manage those facilities
Evolution of ‘Diseases’ in Florida 1980-2017

- **Mastitis**
  - Facilities were the 1st major step forward
  - How to manage those facilities
  - Where are we now?
Evolution of Facilities in Florida 1980-2017

• Heat stress
• Cow housing
• Calf housing
• Maternity housing

Evolution of Facilities in Florida 1980-2017

• Heat stress
  – This might be big!
Evolution of Facilities in Florida 1980-2017

• Heat stress / Cow Housing

Evolution of Facilities in Florida 1980-2017

• Heat stress / Cow Housing / Cow Comfort
Evolution of Facilities in Florida 1980-2017

• Heat stress / Cow Housing / Cow Comfort

Welfare Assessments

<table>
<thead>
<tr>
<th>Table</th>
<th>Freestall Dimension</th>
</tr>
</thead>
<tbody>
<tr>
<td>Animal weight (lbs)</td>
<td>Freestall width (in.)</td>
</tr>
<tr>
<td>800-1,200</td>
<td>42-48</td>
</tr>
<tr>
<td>1,200-1,500</td>
<td>45-50</td>
</tr>
<tr>
<td>over 1,500</td>
<td>48-52</td>
</tr>
</tbody>
</table>

*An additional 12” to 18” in stall length (compared to side lunge stalls) is required to allow the cow to thrust her head forward during the lunge process.

*Above top of curb or top of nostrils (Ohio Beef Plan Service, 2008).
Evolution of Facilities in Florida 1980-2017

- Heat stress
- Cow housing
- Calf housing
Evolution of Facilities in Florida 1980-2017

• Calf housing
Evolution of Facilities in Florida 1980-2017

• Calf housing
Evolution of Facilities in Florida 1980-2017

- Calf housing

Pre-wean Calf Mort (%)

2013 2014 2015
Evolution of Facilities in Florida 1980-2017

- Calf housing

Group Feeding / Housing

- SANITATION
Group Feeding / Housing

• **SANITATION**
  – You’ve got to dot ’em & cross ’em in group housing systems

Evolution of Facilities in Florida 1980-2017

• Heat stress
• Cow housing
• Calf housing
• **Maternity housing**
Evolution of Facilities in Florida 1980-2017

- Heat stress
- Cow housing
- Calf housing
- Maternity housing

28-33% reduction in colostrum quality by delayed harvest of colostrum

Moore et al., 2005
Evolution of Facilities in Florida 1980-2017

• Maternity housing
Evolution of Facilities in Florida 1980-2017

• Maternity housing

![Graph showing the stillborn rate from 1996 to 1998. The graph indicates a decrease in the stillborn rate over the years.]
Evolution of Facilities in Florida 1980-2017

• Maternity housing

Evolution of Feeding in Florida 1980-2017

• ‘One shot’ cottonseed hull based diet
• ‘One shot’ with supplemental hay
Evolution of Feeding in Florida 1980-2017

- ‘One shot’ cottonseed hull based diet
- ‘One shot’ with supplemental hay
- Partial TMR
- TMR

Forage production
End Result 1980-2017

- Herd milk production >28,000 lb/cow/lct
- SCC <200,000 year round
- Clinical mastitis rate <2 cases/100 cows/mo
- Pregnancy Rates >22%
- Cull Rates <30%
- Calf Mortality Rates <3%

Why Not Reproduction?

- Change is slow
- I am slower!
Cryptosporidia aka ‘Crypto’
- Diarrheal disease of young calves
- Every calf in Florida gets infected with crypto
- Every calf in Florida becomes diseased
- “What can you do about it?”

‘Crypto’
- Antibiotics – Halofuginone, Amikacin, Paramamycin
- Antiparasiticides – Deccox, Bovatec
- Activated charcoal & wood vinegar – ‘First Choice’
- Herbals – Essential oils of oregano
- Aloe vera juice – “Cures everything!”
- Vaccine – Promises, Promises
- Disinfectants - ammonium hydroxide, hydrogen peroxide, chlorine dioxide, 10% formol saline, and 5% ammonia
‘Crypto’

“What can you do about it?”

• Maximize sanitation
• Supply >>>100% of energy and protein requirements for maintenance and growth
• High quality feed ingredients! Milk works pretty good!
• Keep ’em hydrated
• Kaolin-pectin, bismusol, probiotics

Improvise, Adapt, Overcome!
Thank you !!
Effects of Prepartum Acidogenic Salts on Calcium and Energy Metabolism in Transition Cows


Florida Dairy Production Conference
Gainesville, April 20, 2017

Consequences of Hypocalcemia

Risk of metritis increases with decreased post-partum calcium

Feeding Acidogenic Salts Prepartum Increases Postpartum Calcium

Santos, J.E.P, 2016, Proceedings Florida Ruminant Nutrition Symposium

Feeding Acidogenic Salts to Reduces Prepartum Intake

Charbonneau et al. (2006) J. Dairy Sci. 89:537-548

Gainesville, FL, April 20, 2017
**Hypothesis**

Reducing the negative DCAD from -70 to -180 mEq/kg and extending the duration of feeding from 21 to 42 days will not affect performance and metabolism in dairy cows

**Objective**

Evaluate the effects of two levels of negative DCAD, -70 vs. -180 mEq/kg, and two durations of feeding, 21 vs. 42 days, on performance and metabolism in parous Holstein cows

**Cows and Treatments**

- **114** parous Holstein cows at 233 d of gestation were enrolled in the experiment
- Randomized complete block design with a 2 x 2 factorial arrangement of treatments
  - 2 durations of feeding (**21 vs. 42 d**)
  - 2 levels of negative DCAD (**-70 vs. -180 mEq/kg**)
Measurements

- Acid-base status and urine pH
- Concentrations of minerals and metabolites in blood
- Colostrum yield and composition
- Prepartum DM intake and lactation performance
- Daily body weight and weekly body condition
Data Analyses

- Continuous data were analyzed by ANOVA with mixed models using SAS
- First 21 d of the dry period: positive DCAD vs. -70 vs. -180
  - Fixed effects: treatment, day, and treatment x day
  - Random effect: block, cow (treatment)
  - Orthogonal comparisons: Positive vs. Negative DCAD and -70 vs. -180 mEq/kg
- Day -21 to +42: 2 levels of DCAD (-70 vs. -180) and the two durations of feeding (21 vs. 42)
  - Fixed effects: DCAD, duration, DCAD x duration, day, DCAD x day, duration x day, DCAD x duration x day
  - Random effects: block, cow (DCAD x Duration)

Diet Composition

<table>
<thead>
<tr>
<th>Ingredient (% DM)</th>
<th>Diet</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Positive DCAD</td>
</tr>
<tr>
<td>Corn silage</td>
<td>34.2</td>
</tr>
<tr>
<td>Triticale silage</td>
<td>20.4</td>
</tr>
<tr>
<td>Bermuda hay</td>
<td>6.7</td>
</tr>
<tr>
<td>Straw</td>
<td>13.8</td>
</tr>
<tr>
<td>Citrus pulp</td>
<td>7.7</td>
</tr>
<tr>
<td>Soybean meal</td>
<td>13.1</td>
</tr>
<tr>
<td>Prepartum mineral</td>
<td>4.2</td>
</tr>
<tr>
<td>Bio-Chlor*</td>
<td>0</td>
</tr>
</tbody>
</table>

* Contains: condensed corn fermentation solubles, processed grain by-products, condensed extracted glutamic acid fermentation product and magnesium chloride hexahydrate
### Diet Composition

<table>
<thead>
<tr>
<th>Item, DM basis</th>
<th>Positive DCAD</th>
<th>-70 mEq/kg</th>
<th>-180 mEq/kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP, %</td>
<td>14.9 ± 0.8</td>
<td>14.7 ± 0.4</td>
<td>14.6 ± 0.6</td>
</tr>
<tr>
<td>ADF, %</td>
<td>29.4 ± 1.4</td>
<td>28.9 ± 1.2</td>
<td>29.1 ± 1.1</td>
</tr>
<tr>
<td>NDF, %</td>
<td>43.1 ± 1.7</td>
<td>43.7 ± 1.5</td>
<td>43.8 ± 1.5</td>
</tr>
<tr>
<td>Forage NDF, %</td>
<td>39.3 ± 1.7</td>
<td>39.3 ± 1.7</td>
<td>39.3 ± 1.7</td>
</tr>
<tr>
<td>Nonfiber CHO, %</td>
<td>31.7 ± 1.3</td>
<td>31.1 ± 1.6</td>
<td>31.1 ± 1.9</td>
</tr>
<tr>
<td>Starch, %</td>
<td>12.3 ± 0.4</td>
<td>12.6 ± 0.5</td>
<td>12.9 ± 0.6</td>
</tr>
<tr>
<td>Fat, %</td>
<td>2.8 ± 0.2</td>
<td>2.8 ± 0.1</td>
<td>2.8 ± 0.1</td>
</tr>
<tr>
<td>Ca, %</td>
<td>0.67 ± 0.07</td>
<td>0.64 ± 0.05</td>
<td>0.62 ± 0.05</td>
</tr>
<tr>
<td>P, %</td>
<td>0.33 ± 0.01</td>
<td>0.33 ± 0.02</td>
<td>0.33 ± 0.03</td>
</tr>
<tr>
<td>Mg, %</td>
<td>0.44 ± 0.06</td>
<td>0.47 ± 0.06</td>
<td>0.48 ± 0.03</td>
</tr>
<tr>
<td>K, %</td>
<td>1.54 ± 0.10</td>
<td>1.49 ± 0.09</td>
<td>1.46 ± 0.09</td>
</tr>
<tr>
<td>S, %</td>
<td>0.29 ± 0.03</td>
<td>0.40 ± 0.03</td>
<td>0.47 ± 0.03</td>
</tr>
<tr>
<td>Na, %</td>
<td>0.08 ± 0.03</td>
<td>0.11 ± 0.03</td>
<td>0.13 ± 0.04</td>
</tr>
<tr>
<td>Cl, %</td>
<td>0.50 ± 0.07</td>
<td>0.86 ± 0.07</td>
<td>1.11 ± 0.03</td>
</tr>
<tr>
<td>DCAD, mEq/kg</td>
<td>+109 ± 35</td>
<td>-66 ± 17</td>
<td>-176 ± 20</td>
</tr>
</tbody>
</table>

### Urine pH

- Short -70
- Long -70
- Short -180
- Long -180

**Before diet change**
- DCAD: $P < 0.01$
- Duration: $P < 0.01$
- Interaction: $P < 0.01$

**After diet change**
- DCAD: $P < 0.01$
- Duration: $P = 0.40$
- Interaction: $P = 0.35$

Day relative to calving:
-42 -38 -35 -32 -28 -25 -21 -18 -14 -10 -7 -3 -1
Serum Calcium

- Short -70
- Long -70
- Short -180
- Long -180

Calcium, mM

Day Relative to Calving

Prepartum
DCAD: P = 0.36
Duration: P = 0.16
Interaction: P = 0.76

Postpartum
DCAD: P = 0.61
Duration: P = 0.53
Interaction: P = 0.56

Serum Phosphorous

- Short -70
- Long -70
- Short -180
- Long -180

Phosphorus, mM

Day Relative to Calving

Prepartum
DCAD: P = 0.99
Duration: P = 0.84
Interaction: P = 0.03

Postpartum
DCAD: P = 0.53
Duration: P = 0.73
Interaction: P = 0.81
Serum Magnesium

- Short -70
- Long -70
- Short -180
- Long -180

Day Relative to Calving

Prepartum
DCAD: $P = 0.84$
Duration: $P = 0.99$
Interaction: $P = 0.03$

Postpartum
DCAD: $P = 0.73$
Duration: $P = 0.53$
Interaction: $P = 0.81$

Serum β-Hydroxybutyric Acid (BHBA)

- Short-70
- Long-70
- Short-180
- Long-180

Day Relative to Calving

Prepartum
DCAD: $P = 0.87$
Duration: $P = 0.12$
Interaction: $P = 0.29$

Postpartum
DCAD: $P = 0.85$
Duration: $P = 0.82$
Interaction: $P = 0.11$
### Serum Non-Esterified Fatty Acids (NEFA)

- Short-70
- Long-70
- Short-180
- Long-180

#### Day Relative to Calving

- **NEFA, mM**
- **Day Relative to Calving**

#### Blood pH, mm Hg, mM, and Other Measures

<table>
<thead>
<tr>
<th>Item</th>
<th>Short</th>
<th>Long</th>
<th>SEM</th>
<th>Dur</th>
<th>DCAD</th>
<th>Inter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blood pH</td>
<td>7.419</td>
<td>7.382</td>
<td>0.007</td>
<td>0.80</td>
<td>&lt; 0.01</td>
<td>0.58</td>
</tr>
<tr>
<td>Blood PCO₂, mm Hg</td>
<td>40.4</td>
<td>38.1</td>
<td>0.75</td>
<td>0.50</td>
<td>0.12</td>
<td>0.14</td>
</tr>
<tr>
<td>Blood HCO₃⁻, mM</td>
<td>26.2</td>
<td>22.6</td>
<td>0.5</td>
<td>0.49</td>
<td>&lt; 0.01</td>
<td>0.13</td>
</tr>
<tr>
<td>Base excess, mM</td>
<td>1.62</td>
<td>-2.40</td>
<td>0.63</td>
<td>0.75</td>
<td>&lt; 0.01</td>
<td>0.21</td>
</tr>
<tr>
<td>Blood iCa, mM</td>
<td>1.26</td>
<td>1.29</td>
<td>0.01</td>
<td>0.44</td>
<td>&lt; 0.01</td>
<td>0.93</td>
</tr>
</tbody>
</table>
### Postpartum Performance: Colostrum Yield and Components

<table>
<thead>
<tr>
<th>Item</th>
<th>Short -70</th>
<th>Short -180</th>
<th>Long -70</th>
<th>Long -180</th>
<th>SEM</th>
<th>Dur</th>
<th>DCAD</th>
<th>Inter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colostrum, kg/d</td>
<td>4.56</td>
<td>3.49</td>
<td>4.43</td>
<td>4.26</td>
<td>0.42</td>
<td>0.45</td>
<td>0.14</td>
<td>0.29</td>
</tr>
<tr>
<td>Fat yield, %</td>
<td>4.31</td>
<td>4.92</td>
<td>4.46</td>
<td>4.63</td>
<td>0.40</td>
<td>0.85</td>
<td>0.33</td>
<td>0.58</td>
</tr>
<tr>
<td>Protein yield, %</td>
<td>11.77</td>
<td>12.61</td>
<td>12.57</td>
<td>12.57</td>
<td>0.44</td>
<td>0.38</td>
<td>0.34</td>
<td>0.34</td>
</tr>
<tr>
<td>Lactose yield, %</td>
<td>3.62</td>
<td>3.50</td>
<td>3.55</td>
<td>3.51</td>
<td>0.08</td>
<td>0.68</td>
<td>0.33</td>
<td>0.66</td>
</tr>
<tr>
<td>SNF yield, %</td>
<td>16.66</td>
<td>17.37</td>
<td>17.45</td>
<td>17.37</td>
<td>0.44</td>
<td>0.37</td>
<td>0.47</td>
<td>0.37</td>
</tr>
<tr>
<td>SCC yield, %</td>
<td>6.05</td>
<td>6.65</td>
<td>6.74</td>
<td>6.51</td>
<td>0.27</td>
<td>0.31</td>
<td>0.49</td>
<td>0.12</td>
</tr>
<tr>
<td>Colostrum NE, Mcal/kg</td>
<td>1.21</td>
<td>1.31</td>
<td>1.26</td>
<td>1.28</td>
<td>0.04</td>
<td>0.77</td>
<td>0.22</td>
<td>0.36</td>
</tr>
</tbody>
</table>

### Postpartum Performance: Milk Yield and Components

<table>
<thead>
<tr>
<th>Item</th>
<th>Short -70</th>
<th>Short -180</th>
<th>Long -70</th>
<th>Long -180</th>
<th>SEM</th>
<th>Dur</th>
<th>DCAD</th>
<th>Inter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Milk, kg/d</td>
<td>43.1</td>
<td>41.7</td>
<td>39.1</td>
<td>41.1</td>
<td>1.1</td>
<td>0.04</td>
<td>0.79</td>
<td>0.13</td>
</tr>
<tr>
<td>3.5 FCM, kg/d</td>
<td>46.7</td>
<td>46.0</td>
<td>43.9</td>
<td>45.8</td>
<td>1.3</td>
<td>0.23</td>
<td>0.63</td>
<td>0.31</td>
</tr>
<tr>
<td>ECM, kg/d</td>
<td>45.2</td>
<td>44.5</td>
<td>42.4</td>
<td>44.3</td>
<td>1.2</td>
<td>0.21</td>
<td>0.62</td>
<td>0.30</td>
</tr>
<tr>
<td>Fat yield, kg/d</td>
<td>1.73</td>
<td>1.73</td>
<td>1.66</td>
<td>1.73</td>
<td>0.06</td>
<td>0.52</td>
<td>0.57</td>
<td>0.51</td>
</tr>
<tr>
<td>Protein yield, kg/d</td>
<td>1.27</td>
<td>1.25</td>
<td>1.18</td>
<td>1.24</td>
<td>0.04</td>
<td>0.18</td>
<td>0.64</td>
<td>0.30</td>
</tr>
<tr>
<td>Lactose yield, kg/d</td>
<td>2.00</td>
<td>1.94</td>
<td>1.82</td>
<td>1.91</td>
<td>0.06</td>
<td>0.05</td>
<td>0.78</td>
<td>0.19</td>
</tr>
<tr>
<td>SNF yield, Kg/d</td>
<td>3.64</td>
<td>3.55</td>
<td>3.34</td>
<td>3.50</td>
<td>0.10</td>
<td>0.08</td>
<td>0.72</td>
<td>0.22</td>
</tr>
<tr>
<td>Milk NE, Mcal/kg</td>
<td>0.731</td>
<td>0.748</td>
<td>0.757</td>
<td>0.753</td>
<td>0.009</td>
<td>0.10</td>
<td>0.50</td>
<td>0.26</td>
</tr>
</tbody>
</table>
**Body Weight**

- Long -180
- Long -70
- Short -180
- Short -70

![Graph showing body weight over weeks relative to calving.](#)

**Dry Matter Intake**

- Short -70
- Long -70
- Short -180
- Long -180

![Graph showing dry matter intake over days relative to calving.](#)
Conclusions

- Feeding a negative DCAD reduced DMI by 1 kg/d in the first 21 d of the dry period
- Reducing the level of negative DCAD from -70 to -180 mEq/kg in the last 21 d of gestation:
  - Reduced DMI by 1.8 kg/d
  - Induced a more exacerbated metabolic acidosis prepartum
  - Increased the concentration of iCa in blood prepartum

Conclusions

- Extending the duration of negative DCAD had minor impacts on blood iCa and measures of acid-base status postpartum.
- Extending the duration of negative DCAD feeding decreased the milk yield 2.4kg/d, and lactose yield when fed for a longer time.
- Concentrations of minerals or metabolites were not significantly affected by level or duration of DCAD.
- Data suggest that extended feeding of negative DCAD is not detrimental to performance when fed at -180 mEq/kg.
Thank You!

Graduate Students:
Camilo Lopera Higuita
Roney Zimpel
William Ortiz
Francisco Lopez
Achilles Vieira-Neto
Bolivar Faria
Maria Lucia Gambarini

Funding:
Southeast Milk Checkoff
Arm and Hammer Animal Nutrition
Genetic and non-genetic effects on embryo production technologies

PJ Hansen
Dept. of Animal Sciences, University of Florida

Survey of 17 states
79.5% of US dairies
82.5% of US cows
n. Operation average percentage of cattle pregnancies conceived during the previous 12 months by breeding method, and by herd size:

<table>
<thead>
<tr>
<th>Breeding Method</th>
<th>Small (Fewer than 100)</th>
<th>Medium (100-499)</th>
<th>Large (500 or More)</th>
<th>All Operations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Natural service (bull-bred)</td>
<td>29.1 (3.3)</td>
<td>22.0 (2.8)</td>
<td>19.7 (4.0)</td>
<td>26.8 (2.4)</td>
</tr>
<tr>
<td>AI (after detected estrus or timed)</td>
<td>70.3 (3.2)</td>
<td>77.0 (2.8)</td>
<td>79.9 (3.9)</td>
<td>72.5 (2.4)</td>
</tr>
<tr>
<td>Embryo transfer (superovulated or in vitro embryo)</td>
<td>0.6 (0.2)</td>
<td>1.0 (0.4)</td>
<td>0.4 (0.2)</td>
<td>0.7 (0.2)</td>
</tr>
<tr>
<td>Total</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

EMBRYO TRANSFER CAN TEACH US ABOUT FERTILITY GENETICS AND IMPORTANCE OF MATERNAL ENVIRONMENT

Enhance genetic selection for embryo transfer
Enhance genetic selection for fertility in general

How does life in the uterus affect adult life?
DO CSF2-TREATED CALVES HAVE A DIFFERENT POSTNATAL PHENOTYPE?

Day 5-7
CSF2 or vehicle

Day 7 ET to recipient cows

ET calves sired by bulls for both treatments
ET-Control (n=5)
ET-CSF2 (n=10)

Body weight
Withers height

Age (mo)
0 1 2 3 4 5 6 7 8 9 10 11 12 13

Body weight (kg)
0 100 200 300 400

ET - Control
ET - CSF2

Age x treatment, P<0.001

Control vs CSF2, P < 0.05

13 mo of age
EMBRYO TRANSFER CAN TEACH US ABOUT FERTILITY GENETICS AND IMPORTANCE OF MATERNAL ENVIRONMENT

PART 1
GENETIC ASPECTS OF EMBRYO TRANSFER RESULTS

Enhance genetic selection for embryo transfer
Enhance genetic selection for fertility in general

How does life in the uterus affect adult life?
Evaluation of genetic components in traits related to superovulation, in vitro fertilization, and embryo transfer in Holstein cattle

K. L. Parker Gaddis,‡ S. Dikmen,‡ D. J. Null,‡ J. B. Cole,‡ and P. J. Hansen*  
*Department of Animal Sciences, University of Florida, Gainesville 32611  
‡Department of Animal Science, Faculty of Veterinary Medicine, Uludag University, Bursa, 16059 Turkey  
‡Animal Genomics and Improvement Laboratory, Agricultural Research Service, USDA, Beltsville, MD 20705-2350
Heritabilities for Embryo Yield and Pregnancy Success After Transfer

<table>
<thead>
<tr>
<th>Trait</th>
<th>Heritability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superovulation (n=926)</td>
<td></td>
</tr>
<tr>
<td>Total structures recovered</td>
<td>0.32</td>
</tr>
<tr>
<td>Total no. good embryos</td>
<td>0.21</td>
</tr>
</tbody>
</table>

| In Vitro Fertilization (n=628)  |              |
| Total structures recovered      | 0.15         |
| No. of cleaved embryos          | 0.12         |
| No. of high quality embryos     | 0.01         |
| Proportion of embryos high quality | 0.04        |

| Embryos Transferred (n=12,089) |              |
| Pregnancy success, recipient   | 0.03         |
| Pregnancy success, embryo      | 0.02         |

Genetic Markers for Total No. of Structures and Good Embryos Could Be Identified

Figure 2. Proportion of SNP variance explained by 10-SNP windows associated with total structures recovered in the superovulation data set with Anscombe transformation. Color version available online.
Take-Home Messages

• There is a significant genetic component to number of structures and embryos recovered from both superovulation and IVF procedures --could be used to identify and select for donors that do well in embryo transfer programs --those genes controlling embryo yield are probably not related to fertility to AI (since they probably control follicle number)

• There was low heritability for embryo quality and embryo survival on both the recipient and embryo side --just like AI, most of the variation in whether a cow gets pregnant to AI depends on environment and not genetics

---DOES NOT MEAN THAT GENETICS ARE NOT IMPORTANT---

<table>
<thead>
<tr>
<th>Location</th>
<th># Dairies</th>
<th>High DPR</th>
<th>Low DPR</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Florida</td>
<td>6</td>
<td>677</td>
<td>137</td>
<td>814</td>
</tr>
<tr>
<td>California</td>
<td>5</td>
<td>394</td>
<td>1129</td>
<td>1523</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>1071</td>
<td>1266</td>
<td>2337</td>
</tr>
</tbody>
</table>

Genetic information (PTA values)
- Daughter pregnancy rate (DPR)
- Heifer conception rate (HCR)
- Cow conception rate (CCR)

Phenotypic information (Farm data)
- Pregnancy rate at first service
- Services per conception
- Days open
## Differences in fertility between high and low DPR groups

<table>
<thead>
<tr>
<th>Trait</th>
<th>N</th>
<th>LSMEANS (%) (SEM)</th>
<th>P value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>High DPR</td>
<td>Low DPR</td>
</tr>
<tr>
<td>Preg. rate first service (Lact1)</td>
<td>2213</td>
<td>53.1 (1.69)</td>
<td>28.6 (2.32)</td>
</tr>
<tr>
<td>Preg. rate first service (Lact2)</td>
<td>1969</td>
<td>43.9 (1.77)</td>
<td>23.0 (2.38)</td>
</tr>
<tr>
<td>Preg. rate first service (Lact3)</td>
<td>1321</td>
<td>41.0 (1.88)</td>
<td>25.0 (2.53)</td>
</tr>
<tr>
<td>Services /conception (Lact1)</td>
<td>2213</td>
<td>1.93 (0.06)</td>
<td>3.26 (0.07)</td>
</tr>
<tr>
<td>Services /conception (Lact2)</td>
<td>1969</td>
<td>2.09 (0.07)</td>
<td>3.30 (0.07)</td>
</tr>
<tr>
<td>Services /conception (Lact3)</td>
<td>1321</td>
<td>2.20 (0.08)</td>
<td>3.20 (0.10)</td>
</tr>
<tr>
<td>Days open (Lact 1)</td>
<td>2213</td>
<td>98 (2.59)</td>
<td>163 (2.94)</td>
</tr>
<tr>
<td>Days open (Lact 2)</td>
<td>1969</td>
<td>112 (2.80)</td>
<td>167 (3.13)</td>
</tr>
<tr>
<td>Days open (Lact 3)</td>
<td>1321</td>
<td>110 (3.24)</td>
<td>158 (3.81)</td>
</tr>
</tbody>
</table>

## Daughter Pregnancy Rate

\[
PR = \frac{\text{Number of cows that became pregnant during a given 21-day period}}{\text{Number of cows that were eligible for breeding}}
\]

- National average for PR ~16%
- DPR = PR of a bull’s daughters
- PR (DPR) = \( \frac{21}{(\text{days open} - \text{voluntary waiting period} + 11)} \)

- A 1% increase in DPR = ~4 days open
- 1% PR = 400 lb milk
- Welcome Super Petrone-ET
  (Dec 2016)
  + 639 milk
  +6.9 (~28 days open)
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PART 2 – EFFECTS OF ENVIRONMENT DURING EARLY PREGNANCY ON POSTNATAL FUNCTION

-249 SUPEROVULATION CALVES

-345 CALVES BORN BY IVF-CONV-SEmen

-658 CALVES FROM IVF-REVERSE SORTED SEMEN
**REVERSE-SORTING**

**SEX SORTING OF FROZEN-THAWED SEMEN**

---

**Genetic Merit**

<table>
<thead>
<tr>
<th></th>
<th>AI</th>
<th>IVF-conv</th>
<th>IVF-sexed</th>
<th>Superov.</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Genomic PTA for milk (lb)</td>
<td>$447\pm12^a$</td>
<td>$638\pm37^b$</td>
<td>$625\pm26^b$</td>
<td>$516\pm40^ab$</td>
<td>$&lt;0.0001$</td>
</tr>
<tr>
<td>Genomic PTA for fat (lb)</td>
<td>$19.6\pm0.4^a$</td>
<td>$32.6\pm1.5^b$</td>
<td>$31.5\pm1.1^b$</td>
<td>$32.1\pm1.5^b$</td>
<td>$&lt;0.0001$</td>
</tr>
<tr>
<td>Genomic PTA for protein (lb)</td>
<td>$16.1\pm0.2^a$</td>
<td>$24.4\pm0.9^b$</td>
<td>$23.3\pm0.7^b$</td>
<td>$21.1\pm0.9^b$</td>
<td>$&lt;0.0001$</td>
</tr>
<tr>
<td>Dam PTA for milk (lb)</td>
<td>$152\pm13^a$</td>
<td>$477\pm73^b$</td>
<td>$401\pm61^b$</td>
<td>$45\pm66^a$</td>
<td>$&lt;0.0001$</td>
</tr>
<tr>
<td>Sire PTA for milk (lb)</td>
<td>$727\pm14^a$</td>
<td>$762\pm41^a$</td>
<td>$1015\pm29^b$</td>
<td>$807\pm46^a$</td>
<td>$&lt;0.0001$</td>
</tr>
<tr>
<td>Net merit dollars ($)</td>
<td>$321\pm3^a$</td>
<td>$456\pm9^b$</td>
<td>$464\pm6^b$</td>
<td>$420\pm10^c$</td>
<td>$&lt;0.0001$</td>
</tr>
<tr>
<td>Genomic PTA for DPR</td>
<td>$1.9\pm0.03^a$</td>
<td>$2.0\pm0.09^a$</td>
<td>$2.4\pm0.06^b$</td>
<td>$2.1\pm0.1^ab$</td>
<td>$&lt;0.0001$</td>
</tr>
</tbody>
</table>
### Adult Performance – First Lactation

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>Reproduction traits</th>
<th>Production traits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Age at first calving (months)</td>
<td>Days open, first lactation (d)</td>
</tr>
<tr>
<td></td>
<td>23.5±0.1</td>
<td>100.0±2.1</td>
</tr>
<tr>
<td></td>
<td>23.8±0.3</td>
<td>108.3±5.5</td>
</tr>
<tr>
<td></td>
<td>23.2±0.2</td>
<td>102.7±3.9</td>
</tr>
<tr>
<td></td>
<td>23.3±0.3</td>
<td>87.5±7.6</td>
</tr>
<tr>
<td></td>
<td>0.4520</td>
<td>0.1479</td>
</tr>
</tbody>
</table>

### Potential Mechanisms

#### Damage to sperm during sex-sorting (?)
- DNA labeling (chromatin staining)
- Exposure to a laser beam
- Positive or negative charge on membrane
- Intensive manipulation

#### Delayed fertilization?
- Aged oocyte ➔ Fertility

#### Paternal contribution upon fertilization
- **Dogma:** only genomic DNA
- **Reality:** much more!

- miRNA ➔ mRNA ➔ siRNA ➔ Sperm-borne proteins
Effect of Dam Parity on Offspring Phenotype

<table>
<thead>
<tr>
<th>Endpoints</th>
<th>Dam parity</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Nulliparous (parity = 0)</td>
<td>Parous (parity ≥1)</td>
</tr>
<tr>
<td>Age at first calving (mo)</td>
<td>23.3±0.2</td>
<td>23.6±0.2</td>
</tr>
<tr>
<td>Days open, first lactation</td>
<td>96.0±4.2</td>
<td>103.3±3.2</td>
</tr>
<tr>
<td>Production traits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected actual milk yield,</td>
<td>23674±154</td>
<td>24277±136</td>
</tr>
<tr>
<td>305 d (lb)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected actual fat yield,</td>
<td>829±6</td>
<td>860±5</td>
</tr>
<tr>
<td>305 d (lb)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Projected actual protein yield,</td>
<td>721±5</td>
<td>742±4</td>
</tr>
<tr>
<td>305 d (lb)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Conclusions

• Procedures used for IVP with reverse-sorted semen have consequences that extend to adult life

• IVP-sexed offspring are characterized by:
  – Reduction in milk, fat, and protein production

• The consequences of IVP-conv and MOET were minimal for postnatal function

• Dam parity while carrying a calf causes alterations in fetal programming
  – Performance of offspring from nulliparous heifers was inferior than those born from parous cows (parity ≥1)
### Developmental Programming Occurs in Cattle

<table>
<thead>
<tr>
<th>Type of cattle</th>
<th>Treatment</th>
<th>Altered Adult Phenotype</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First trimester</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>♀ Lighter</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>♀ Higher blood pressure</td>
<td></td>
</tr>
<tr>
<td><strong>Second trimester</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Third trimester</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
I’m An Artificial Calf

Ralph A. Porterfield

I’m a little heifer, I’m an artificial calf,
Some people think it’s funny, but go ahead and laugh.
When I grow up to be a cow and join the milking herd
I’ll bet I’ll be a big success — perhaps the latest word.

You seldom find a little calf as beautiful as me,
If I could be your pin-up girl I’d be happy as can be,
Now I’ll tell you my ambition which is not to fly or sail
But to always be on duty and to put ’er in the pail.

I want to be a glamour girl and take in every fair,
I want to win blue ribbons, at least to win my share.
In just another year or two I’ll have symmetry and style
And to this I’m looking forward for I think it well worth while.

When people come to see me they tell me I have type,
And off they go just feeling fine without a single gripe.
It’s always nice to please them for I’m sure that they can see
That artificial breeding is worth its modest fee.

Think it over, brother, for I know I’ll pay my way
By eatin’ and producin’ and consumin’ lots of hay.
Enroll your little herd of cows and be the last to laugh
’Cause you’ll never go astray with an artificial calf.
Challenges, Opportunities, & Prospects of US Dairy Production

Gordie Jones DVM

53rd Florida Dairy Production Conference
April 20th 2017

Dr. Gordie Jones

• 15 years Dairy Practice
• 10 years Dairy Nutrition / Facility /Cow Comfort consulting
• 3 years Monsanto (BST) consulting
• 6 years designed & managed Fair Oaks Dairy Farms (20,000 cows)
• 5 years building and managing my dairy farm!
• Consulting again
Remember we are here because we love cows!
“Pleistocene Mega fauna”

– Born during the last Ice Age

The First Farmers

• Were in Mesopotamia
• Modern day Iraq
• Large headed grains
• Wheat, Barley, Triticale
• A stick in the sand
• A little water and we were farmers!
The First Farmers

- Our First fences
- Were to keep the wild cows out!!
- She opened the gate
- And we now had a cow!

Only 11 species were able to be domesticated.

- Our Cow is the star!
- She Provided POWER, Protein, & Fertilizer
- She truly is the foundation of civilization.
- The foster mother of the human race
- All of the domesticated animals are “herd” species - looking for a leader
- Except the Cat!!
Covenant;

To care for, and keep

The Star of the show!