Economic Benefits of Docility in Beef Cattle
Hereford Heritage

- Born and raised in Southern Colorado
  - Seedstock and commercial cow-calf ranch
- Am. Junior Hereford Association:
  - National Director: 1990-93
Overview

- Why is temperament important?
- Measures of temperament
- Genetic and phenotypic relationships
  - Growth
  - Feed intake, feed efficiency (RFI, FCR, FE)
  - Meat quality
  - Animal health and well being
  - Reproduction
- How does Hereford capitalize on attribute?
Why is temperament important?

- Animal well being
- Handler well being/safety
  - Mean age of operator increasing
  - Family operations
- Facility construction and maintenance
- Performance in correlated traits
  - Can we improve profitability?

July 14, 2012

World Hereford Conference-Calgary, AB, Canada
Measures of temperament

- Chute score (subjective)
  - Measured on individual animal
  - 1 (docile)-6 (very aggressive) (BIF Guidelines)

- Pen score (subjective)
  - 1-5 animals in pen
  - 1 calm, 5 very aggressive

- Exit velocity or flight speed (objective)

- Chute tensometer (g force) (objective)
Exit Velocity

Chute

6 ft

Infrared Eye

6 ft

Infrared Eye
Exit Velocity
Histograms of CS at Initial and Reimplant Processing

- CS Initial
- CS Reimplant

Chute Score

Frequency

1 2 3 4 5 6

Histories of CS at Initial and Reimplant Processing
Distribution of Exit Velocity (m/sec)

Exit Velocity at Initial and Reimplant Processing

- Initial Exit Velocity
- Reimplant Exit Velocity

Frequency

Exit Velocity (m/s)

0 0.5 1 1.5 2 2.5 3 3.5 4 4.5 5 5.5 6 More
Temperament is heritable

- **Chute Score** (subjective)  \( h^2 = 0.26-0.50 \)
  (Beckman et al., 2007; Weaber, 2007; Burrow and Corbet, 2000; Shafer, 2011)

- **Pen Score**  \( h^2 = 0.15 \)
  (Weaber & Creason, 2007)

- **Exit Velocity** (objective)
  - Single measure  \( h^2 = 0.35 \)
    (Weaber & Creason, 2007; Burrow, 2001)
  - Avg. of >=2 measures  \( h^2 = 0.44-0.50 \)
    (Burrow, 2001)
North American Limousin Foundation Docility Genetic Trend

\[ h^2 = 40\% \]
American Angus Association
Docility Genetic Trend

\[ h^2 = 37\% \]
$h^2 = 50\%$

Figure 1. Distribution of Disposition

Shafter, 2011

Figure 2. Genetic trend for disposition
<table>
<thead>
<tr>
<th>Estimate (Std Error)</th>
<th>EV</th>
<th>PS</th>
</tr>
</thead>
<tbody>
<tr>
<td>EV</td>
<td>0.35 (0.078)</td>
<td>0.20</td>
</tr>
<tr>
<td>PS</td>
<td>0.28 (0.825)</td>
<td>0.15 (0.058)</td>
</tr>
</tbody>
</table>

*Heritability on diagonal, phenotypic correlation above, genetic correlation below*
Breed differences exist

- *Bos indicus* more excitable than *B. taurus*  
  (Fordyce et al., 1988; Voisinet et al. 1997)
- Differences among *B. taurus* breeds  
  (Gauly et al., 2002; Morris et al., 1994; Hoppe et al., 2010)
- Within breed differences exist for a variety of parameters and are consistent across breeds.
Animals with faster flight times and higher pen score had phenotypically:

- Lighter weaning weights
- Less ADG during back grounding period (55 d)
- Lighter placement weights at induction to feed yard
- Less ADG, DMI ($p < 0.10$)

(Weaber and Creason, 2007; Creason and Weaber, 2007)
- Exit Velocity (flight speed) genetically correlated with:
  - Feeding duration: $0.42 \pm 0.26$
  - Dry matter intake: $-0.11 \pm 0.26 \ (r_p = -0.35)$
  - Residual feed intake: $-0.59 \pm 0.45 \ (r_p = 0)$
  - Feed conversion ratio: $0.40 \pm 0.26 \ (r_p = 0)$

Nkrumah et al., 2007
## Temperament and Meat Quality

<table>
<thead>
<tr>
<th>Trait</th>
<th>Genetic Correlation w/ Flight Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Carcass Wt.</td>
<td>0.05</td>
</tr>
<tr>
<td>Retail Yield</td>
<td>0.11</td>
</tr>
<tr>
<td>Marbling</td>
<td>-0.05</td>
</tr>
<tr>
<td>Shear Force</td>
<td>-0.48</td>
</tr>
<tr>
<td>Meat Color</td>
<td>-0.18</td>
</tr>
</tbody>
</table>

(Burrow, 2003)

- Increased bruise trim
- Increased frequency of dark cutters
Temperament and Tenderness

Animals (n=3,042); WBSF (n=2,819); EV1 (n=917); EV2 (n=976); Pedigree (n=13,418); CG (n=176)

<table>
<thead>
<tr>
<th>Variable</th>
<th>( V_P )</th>
<th>Std. Error</th>
<th>( V_G )</th>
<th>Std. Error</th>
<th>( h^2 )</th>
<th>Std. Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Force</td>
<td>57.24</td>
<td>1.70</td>
<td>11.11</td>
<td>3.70</td>
<td>0.19</td>
<td>0.06</td>
</tr>
<tr>
<td>Velocity</td>
<td>0.23</td>
<td>0.03</td>
<td>0.09</td>
<td>0.03</td>
<td>0.39</td>
<td>0.09</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Correlation (SE)</th>
<th>Shear Force</th>
<th>Velocity 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Shear Force</td>
<td></td>
<td>-0.10 (0.20)</td>
</tr>
<tr>
<td>Velocity 1</td>
<td>-0.08 (0.06)</td>
<td></td>
</tr>
</tbody>
</table>

Genetic Correlation  Phenotypic Correlation

Taxis and Weaber, 2010
Animals with poor temperament
- High exit velocity (small flight time)
- High chute (or crush) scores

Typically have higher
- Serum cortisol (at weaning, placement in feed lot, and during feeding period) (Fell et al. 1999; Curley et al. 2006; Oliphint et al. 2006)
- Higher morbidity (Fell et al., 1999)
- Lower ADG (Fell et al., 1999; Nkrumah et al., 2007; Weaber and Creason, 2007)

Temperament thought to contribute to chronic stress
Figure 1. Mean concentrations of plasma epinephrine and serum cortisol for both the calm (open bars) and temperamental (solid bars) steers prior to transportation to the feedyard.

Curley et al., 2006
Figure 2. Mean concentrations of plasma epinephrine and serum cortisol for both the calm (open bars) and temperamental (solid bars) steers upon arrival (following transportation of ~ 650 miles) to the feedyard.

Curley et al., 2006
Figure 3. Mean concentrations of plasma epinephrine and serum cortisol for both the calm (open bars) and temperamental (solid bars) steers during a routine weighing at d 70 of the feeding period.

Curley et al., 2006
Figure 4. Mean concentrations of plasma epinephrine and serum cortisol for both the calm (open bars) and temperamental (solid bars) steers prior to shipment to the packing plant.

Curley et al., 2006
Figure 2. Least-squares means for cortisol concentrations for entire length of vaccination trial in calm (n = 10) and temperamental (n = 10) bull calves (Interaction P = 0.10). Values within day differ (P < 0.05) unless noted by symbols of * (P < 0.10) or ** (P > 0.10).
Figure 3. Log transformed values of serum IgG concentrations after primary and secondary vaccinations in calm (n = 10) and temperamental (n = 9) bull calves (Interaction $P = 0.86$). Vaccinations were given at day 0 and 42. Actual stimulation indices reported in text.
- Hypothalamic-Pituitary-Adrenal Axis
- Increased Cortisol
  - Inhibit reproductive functions
  - Inhibit innate and adaptive immunity
  - Inhibit feed intake and digestion
  - Increase blood flow to heart, lungs and brain
  - Increase respiration rate

_Burdick et al., 2011_
Increased cortisol

- Compromise reproductive hormone secretion in follicular phase
- Suppression of LH pulse frequency
- Interferes with timely propagation of estradiol rise
- Delayed or blocked LH and FSH surge responsible for ovulation
- Cortisol acts centrally to suppress pulsatile GnRH secretion in follicular phase

(Breen et al., 2004)
Conclusions...

- **Temperament**
  - Negatively associated with:
    - Handler and animal safety
    - Growth (placement weights, ADG)
    - Meat quality (WBSF, meat color)
    - Immune function
    - Reproduction??
  - Positively associated with:
    - Metabolic indicators of stress
    - Morbidity
How does Hereford capitalize on breed strength?

- Breed has reputation for being gentle
  - Frequently cited by producers returning to the breed as a core competency
- Performance recording to demonstrate strength and breeders commitment to trait
- Genetic evaluation to eliminate bad actors
- Get a new customer, keep a customer...
- Make sure every bull sold has acceptable docility
Questions

Thank You!