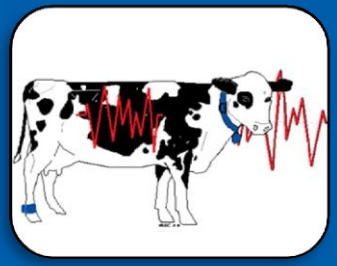
Using Technology to Enhance Profitability



Jeffrey Bewley

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Amanda Stone, Randi Black, Barbara Wadsworth, Di Liang, Karmella Dolecheck, Matthew Borchers, Lauren Mayo, Nicky Tsai, Maegan Weatherly, Melissa Cornett, Samantha Smith, Megan Hardy, Jenna Klefot, Juha Hietaoja, Barbara Wolfger, Elizabeth Eckelkamp, Savannah Meade, Carissa Truman, Alison DiGennaro, Emory Thomas, Amanda Lee, Michele Jones, Brittany Core, Joey Clark, Denise Ray, Amelia Fendley

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Technological Transformation

- Extension of other industries
- New dairy industry demands
  - Animal well-being
  - Consumer demands
  - Environmental pressure
  - Labor challenges
  - Economic competition

Cow Challenges

- Finding cows in heat
- Finding and treating lame cows
- Finding and treating cows with mastitis
- Catching sick cows in early lactation
- Understanding nutritional status of cows
  - Feed intake
  - Body condition (fat or thin)
  - Rumen health (pH/rumination time)

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Precision Dairy Monitoring

Cow-Focused Technologies

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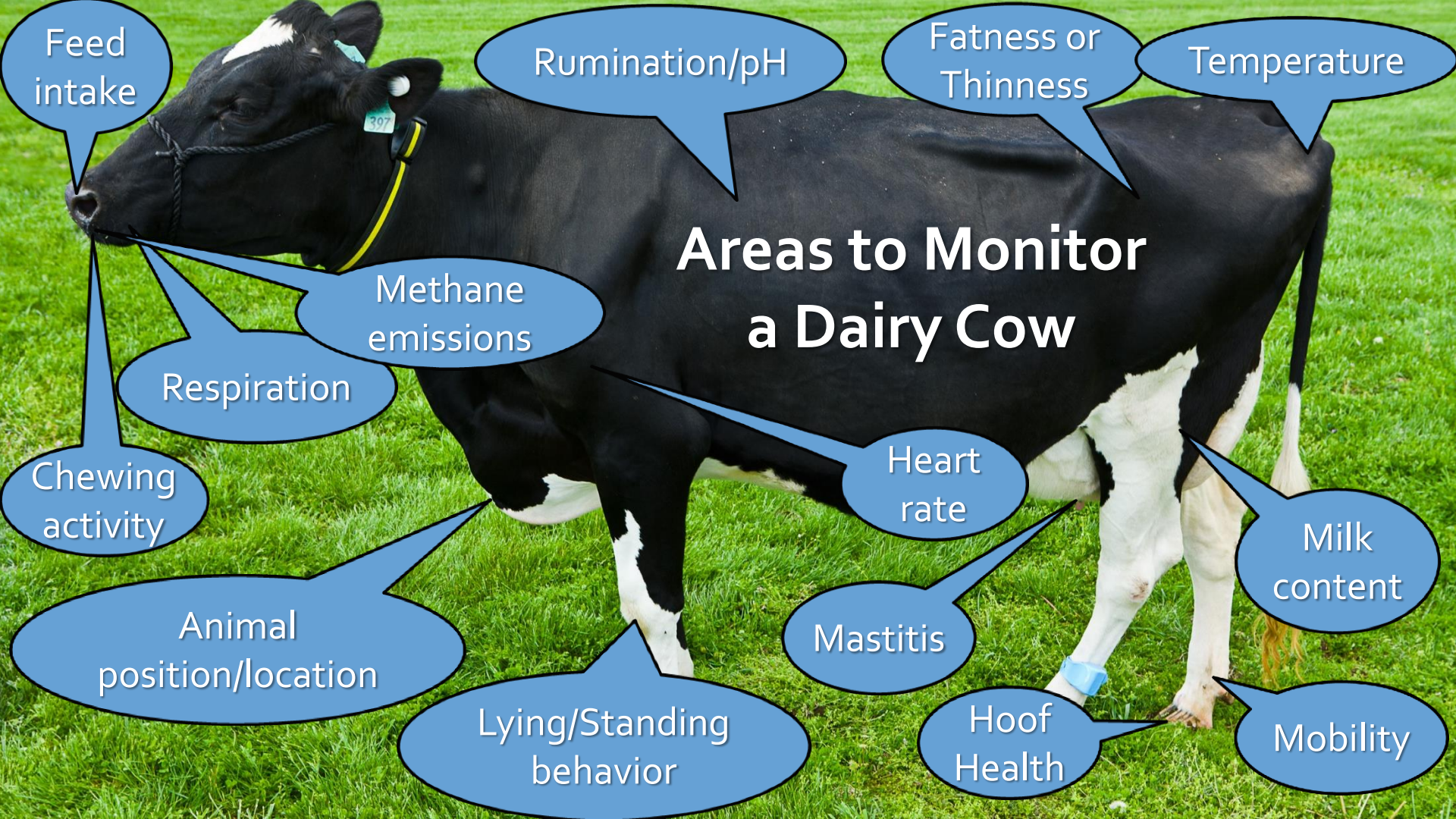
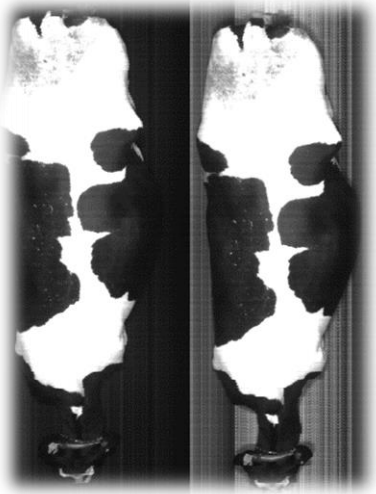

Areas to Monitor a Dairy Cow
Feed intake
Rumination/pH
Fatness or Thinness
Temperature
Methane emissions
Respiration
Chewing activity
Heart rate
Milk content
Animal position/location
Mastitis
Lying/Standing behavior
Hoof Health
Mobility

Happy Cows Via Technology?



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Precision Dairy Benefits

- Improved animal health and well-being
- Early detection
- Increased efficiency
- Improved product quality
- Minimized adverse environmental impacts
- More objective measures

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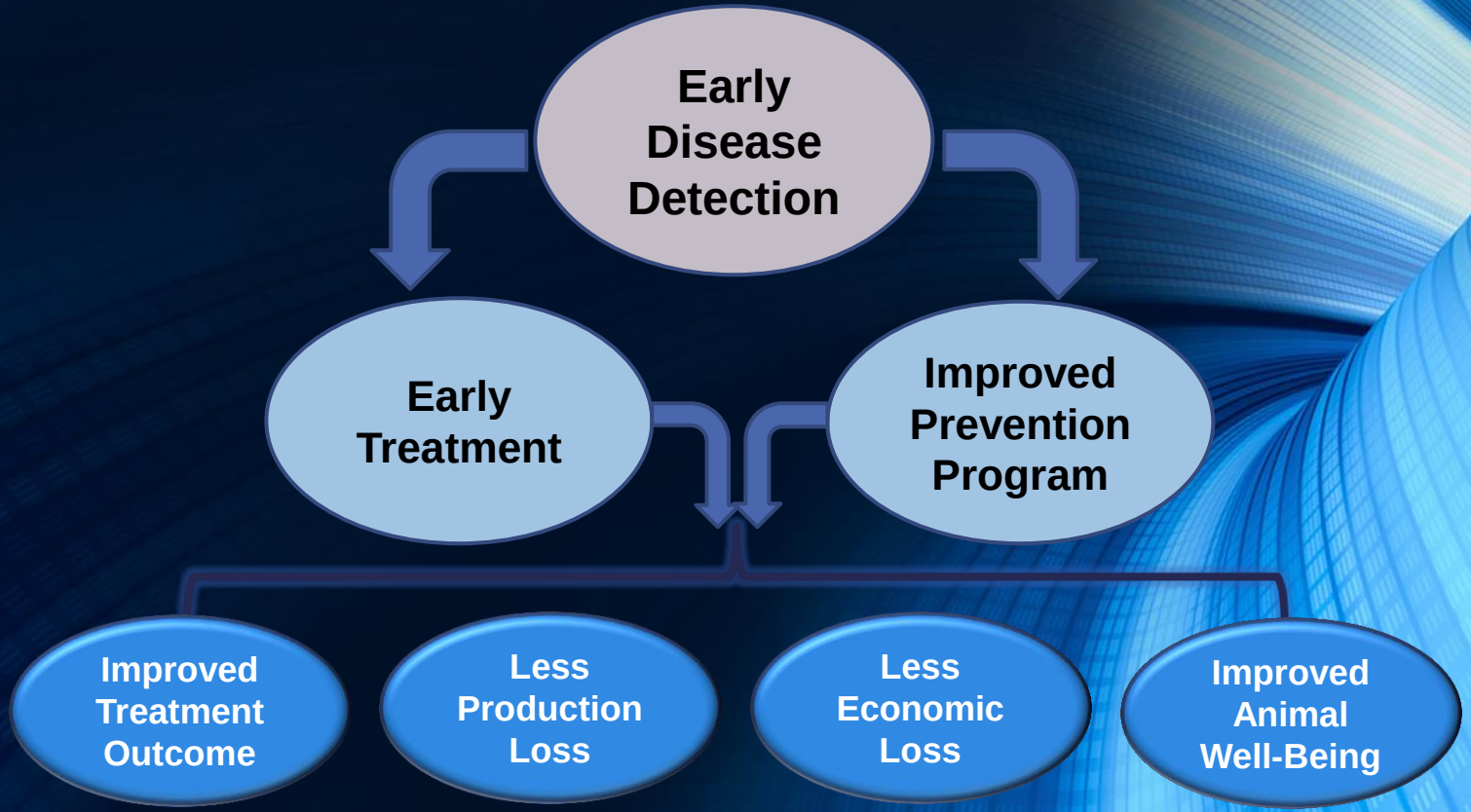
Disease Detection Benefits



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Precision Dairy Monitoring Applications

- Estrus Detection
- Mastitis Detection
- Fresh Cow Disease Detection
- Lameness Detection
- Calving Detection
- Genetic Traits
- Management Monitoring

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The Options Are Endless









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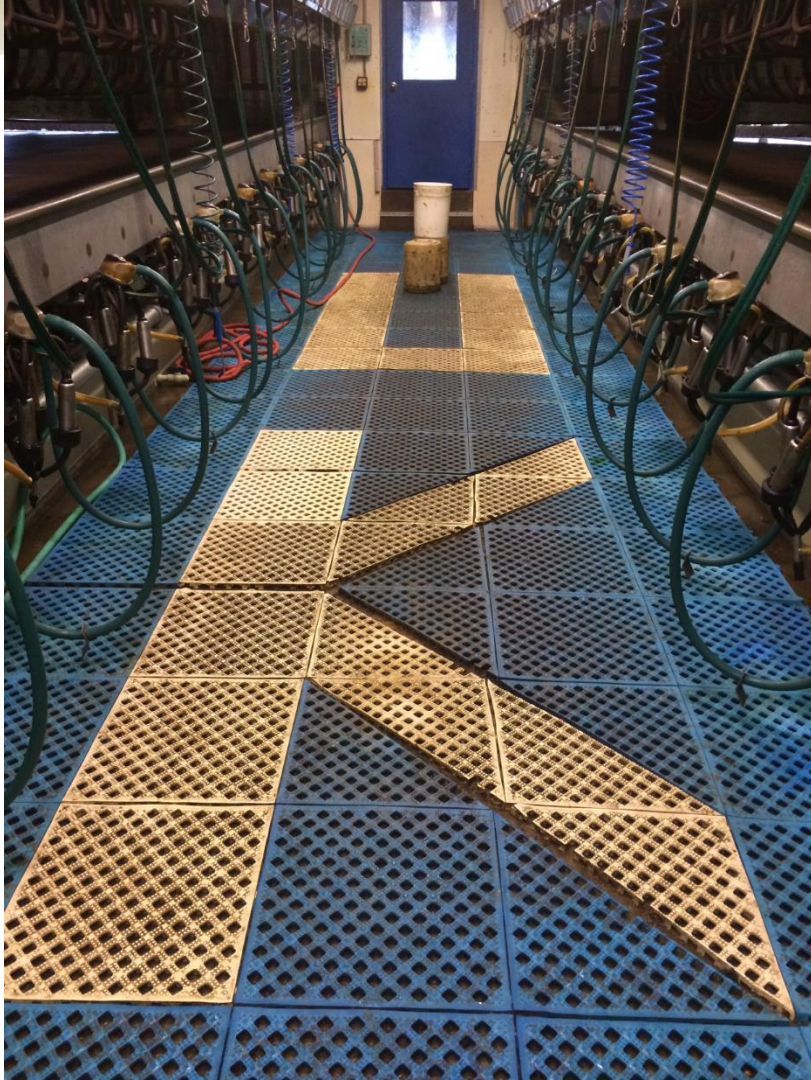
Parlor Precision



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Inline Somatic Cell Count

Mastiline

Lely MQCC

DeLaval OCC

CellSense

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SPECTROSCOPY

- Visible, near-infrared, mid-infrared, or radio frequency
- Indirect identification through changes in milk composition
- AfiLab uses near infrared
  - Fat, protein, lactose

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DeLaval

Herd Navigator™

- Milk measurements
- Progesterone
  - Heat detection
  - Pregnancy detection
- LDH enzyme
  - Early mastitis detection
- BHBA
  - Indicator of subclinical ketosis
- Urea
  - Protein status

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Neck or Ear Based Behavior Monitoring

CowManager

SCR
PRECISE DAIRY FARMING

Cow with tag- 'HR Tag'

Silent Herdsman

DeLaval

DeLaval activity meter system
Keep control of your breeding

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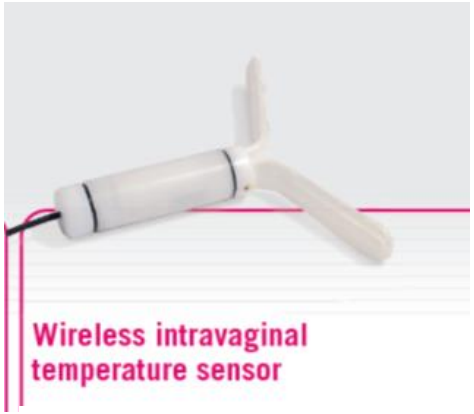
PHYSIOLOGY MONITORING



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Lying Behavior Monitoring

- On-farm evaluation of lying time:
  - Identification of cows requiring attention (lameness, illness, estrus)
  - Assessment of facility functionality/cow comfort
  - Assess animal well-being

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Real Time Location Systems

SmartBow®

YOUR COWS. YOUR BUSINESS.

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Calving Detection

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University of Kentucky Research
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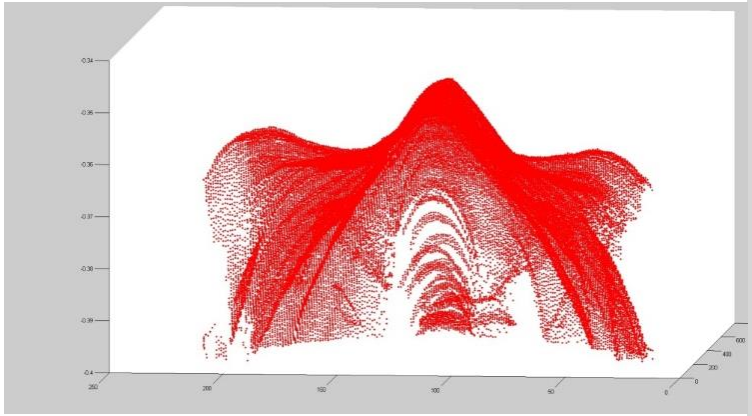
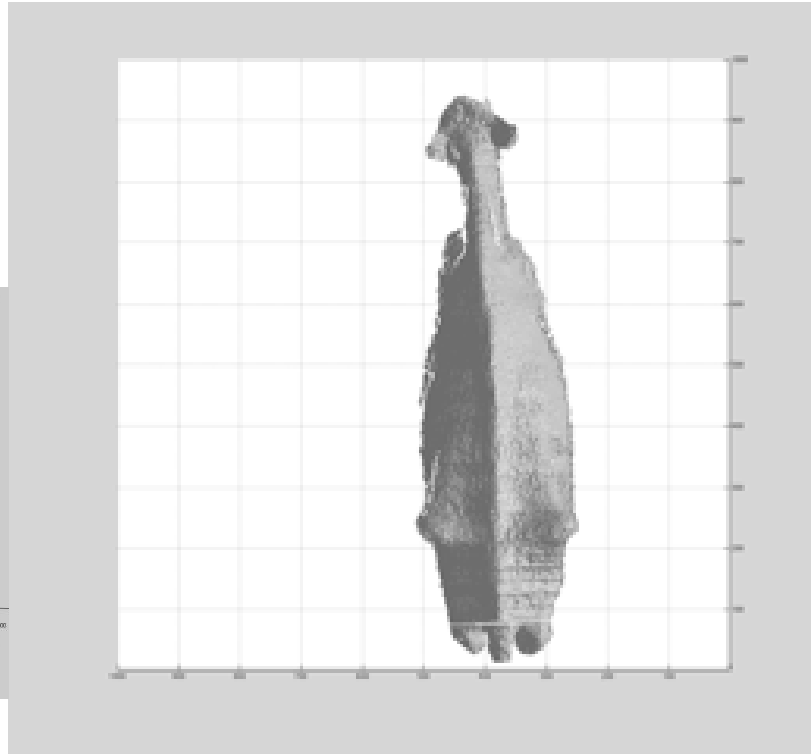
New Technology Development

3D BCS Automation

KINECT for XBOX 360.





Lau, Shelley, Stone, and Bewley, 2014

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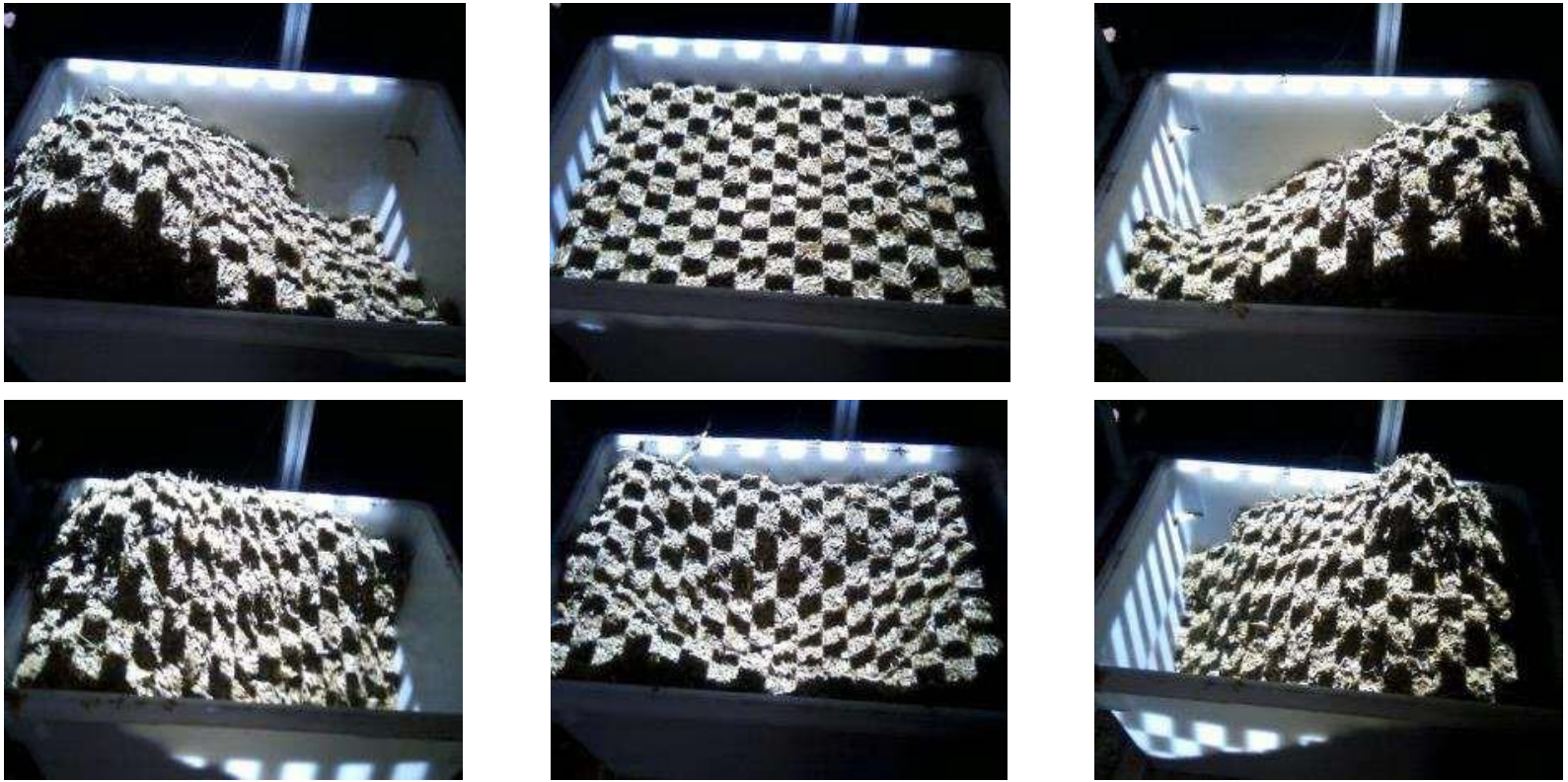
Feed Intake: 3D Imaging (99% R^2)



Shelley et al., 2013

Sleep Monitoring System

- Sleep importance-immune function, well- being, disease, facilities decisions
- Develop and test a non-invasive monitor using an accelerometer
- Measure head and neck movement to classify sleep/wake behaviors through human observation
- 92 to 93% agreement with human observations

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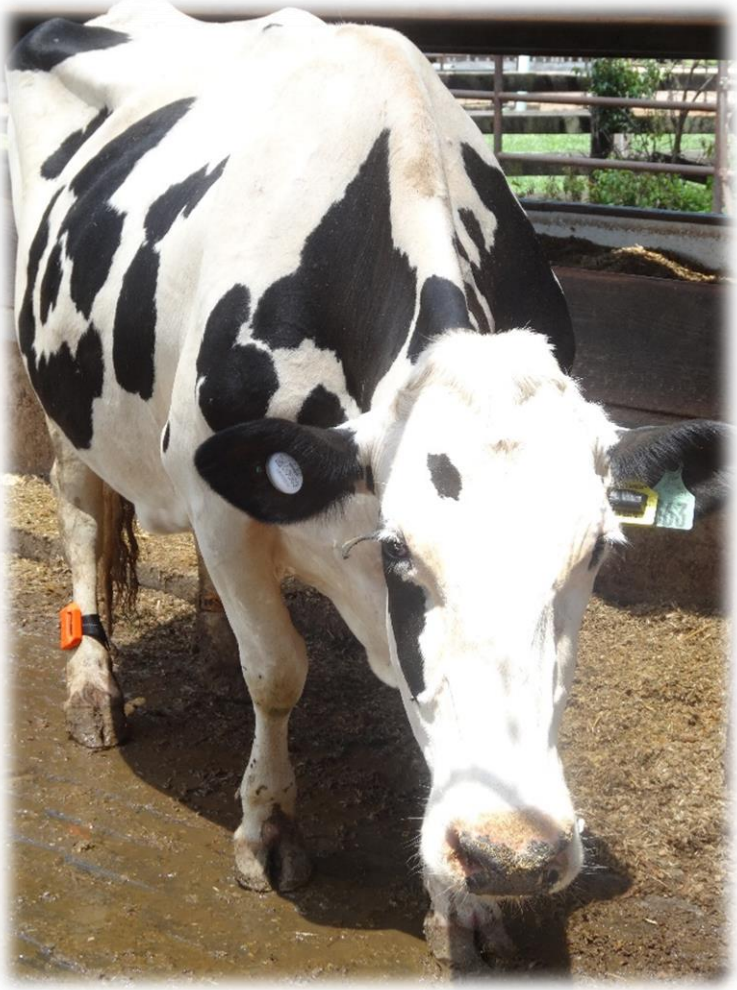
Klefot et al., 2013

“In God We Trust; All Others Bring Data”

William Edwards Deming



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Big Data

- Broad term for data sets so large or complex that traditional data processing applications are inadequate—Wikipedia
- Involves analysis, capture, data curation, search, sharing, storage, transfer, visualization, and information privacy
- 90% of the world's data created in the last 2 years

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Ideal Technology

- Explains an underlying biological process
- Can be translated to a meaningful action
- Cost-effective
- Flexible, robust, reliable
- Simple and solution focused
- Readily available information

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Economic Considerations

- Need to do investment analysis
- Not one size fits all
- Economic benefits observed quickest for heat detection/reproduction

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Introduction | Current Herd Informati... | Potential Technology Informati... | Results

Investment Analysis of Heat Detection Technologies

Heat detection is a major concern on many dairies today.

Technologies used to monitor activity levels and other cow parameters can be applied to manage heat detection.

This net present value tool can be used to compare up to three different heat detection technologies in order to determine which might work best economically on a specific dairy.

To use, change information in the "Current Herd Information" and "Potential Technologies" tabs, then review the outcome

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Dairy Decision Support
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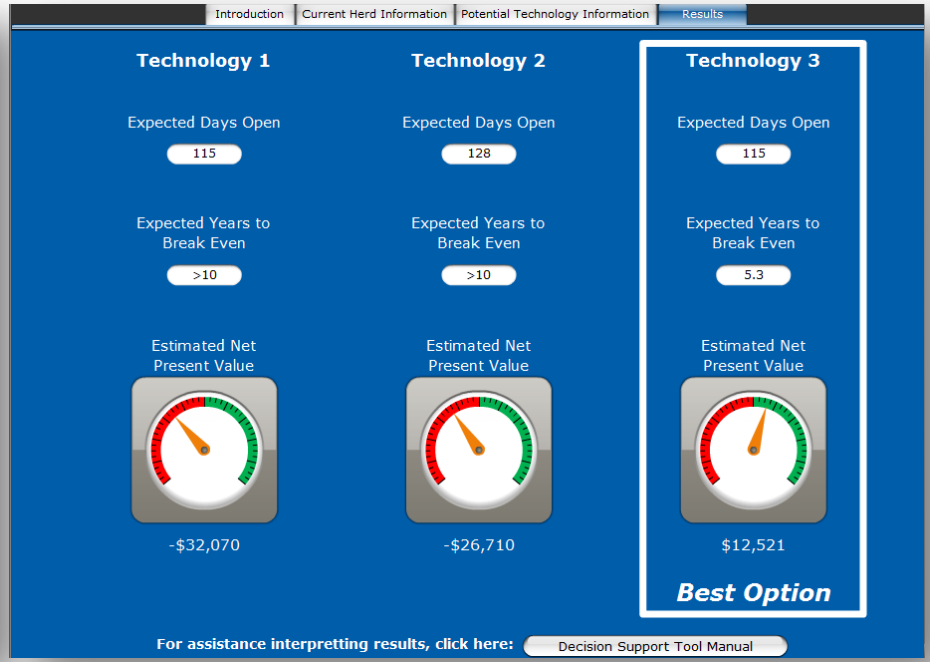
Developed by Karmella Dolecheck and Jeffrey Bewley
Animal and Food Sciences Department
University of Kentucky College of Agriculture

For assistance using this decision support tool, click here: Decision Support Tool Manual

Dolecheck et al., 2014

Investment Analysis of Estrus Detection Technologies



Online decision support tool available at:
http://afsdairy.ca.uky.edu/HeatDetectionTechnologies

Dolecheck et al., 2014

The Intangible Value of Information

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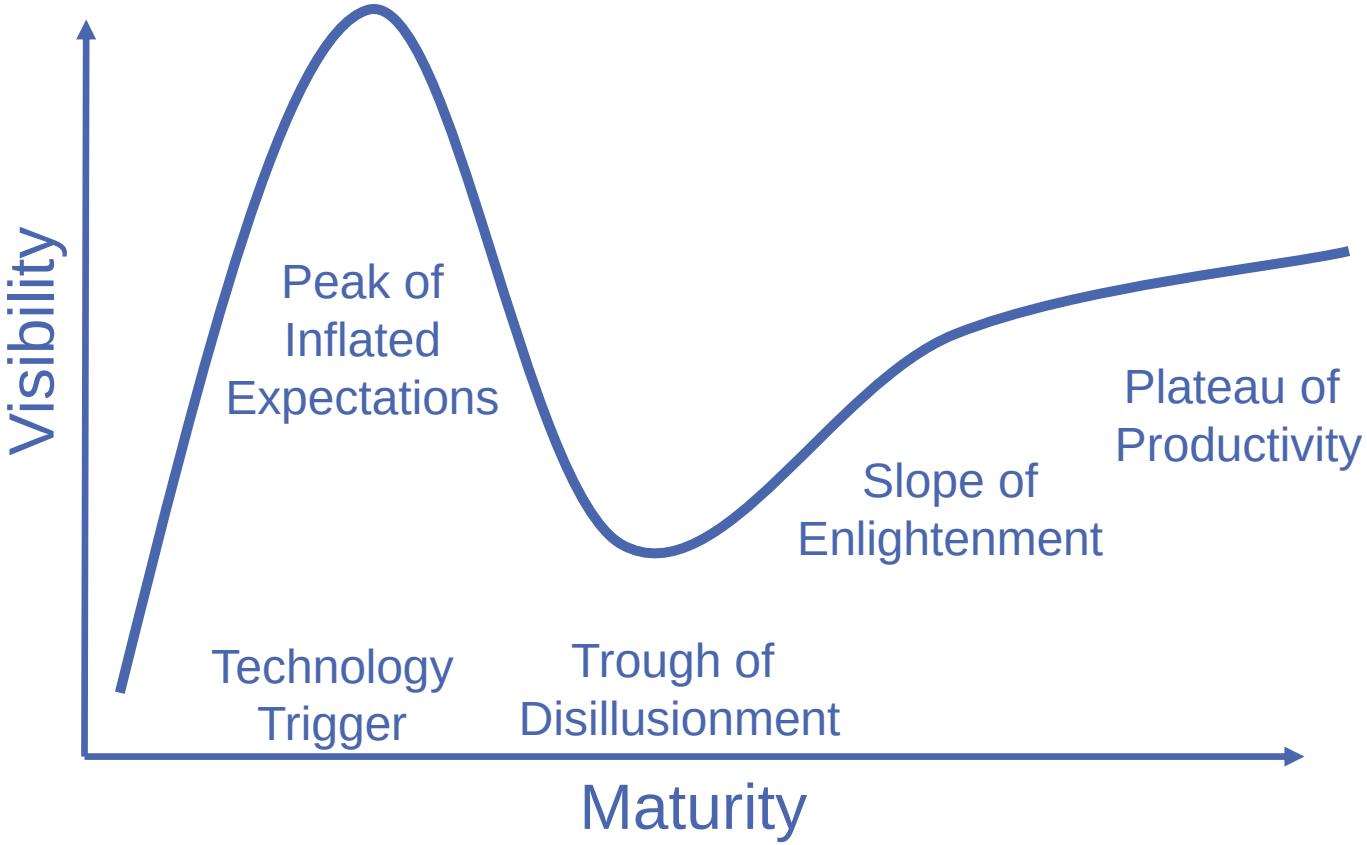
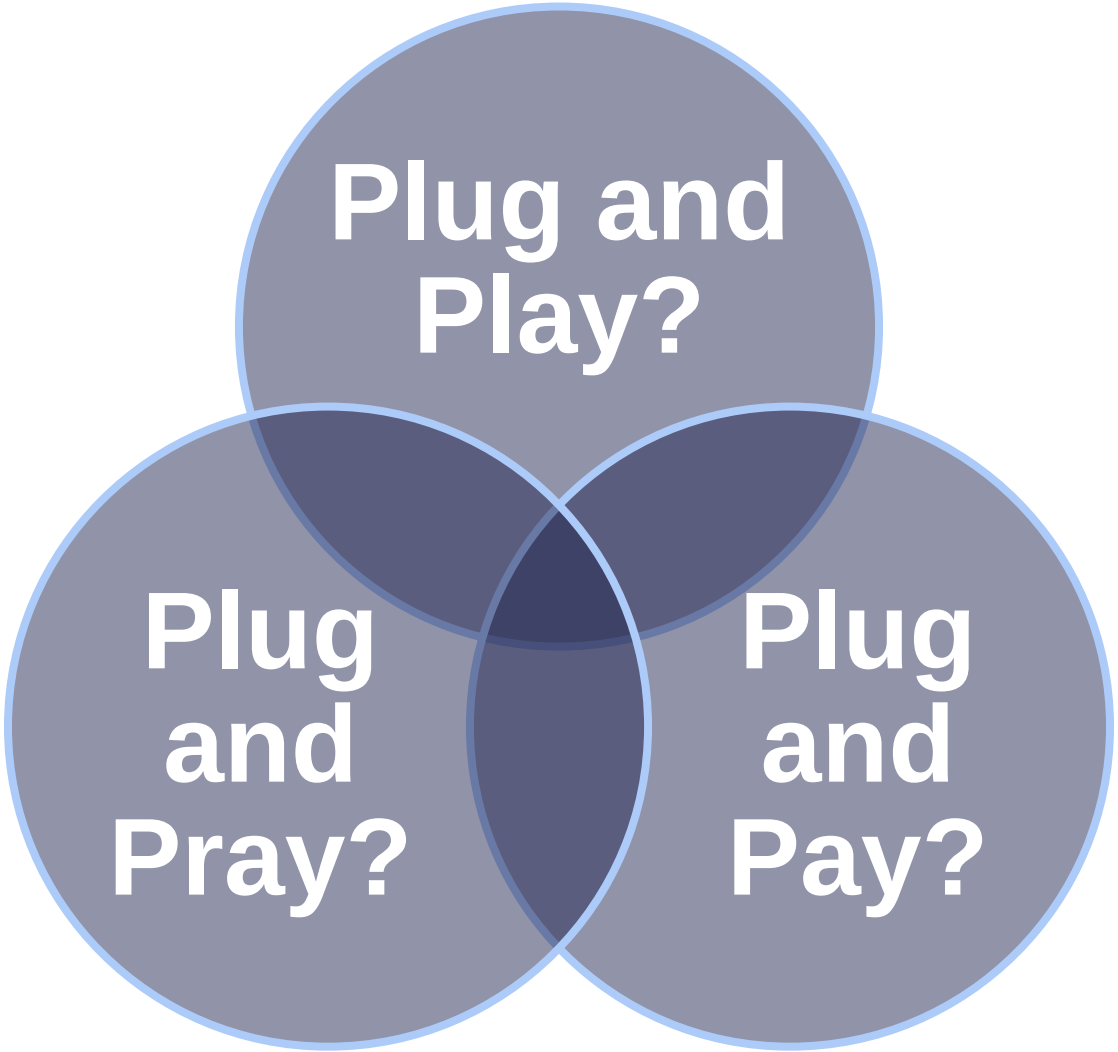
Gartner Product Life Cycle





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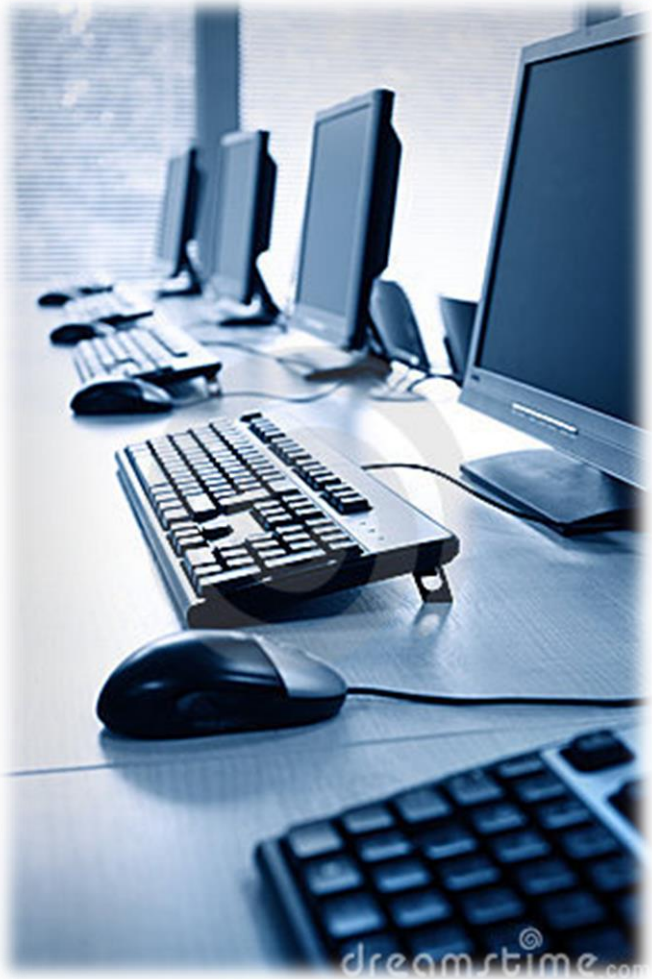
UK Dairy Office



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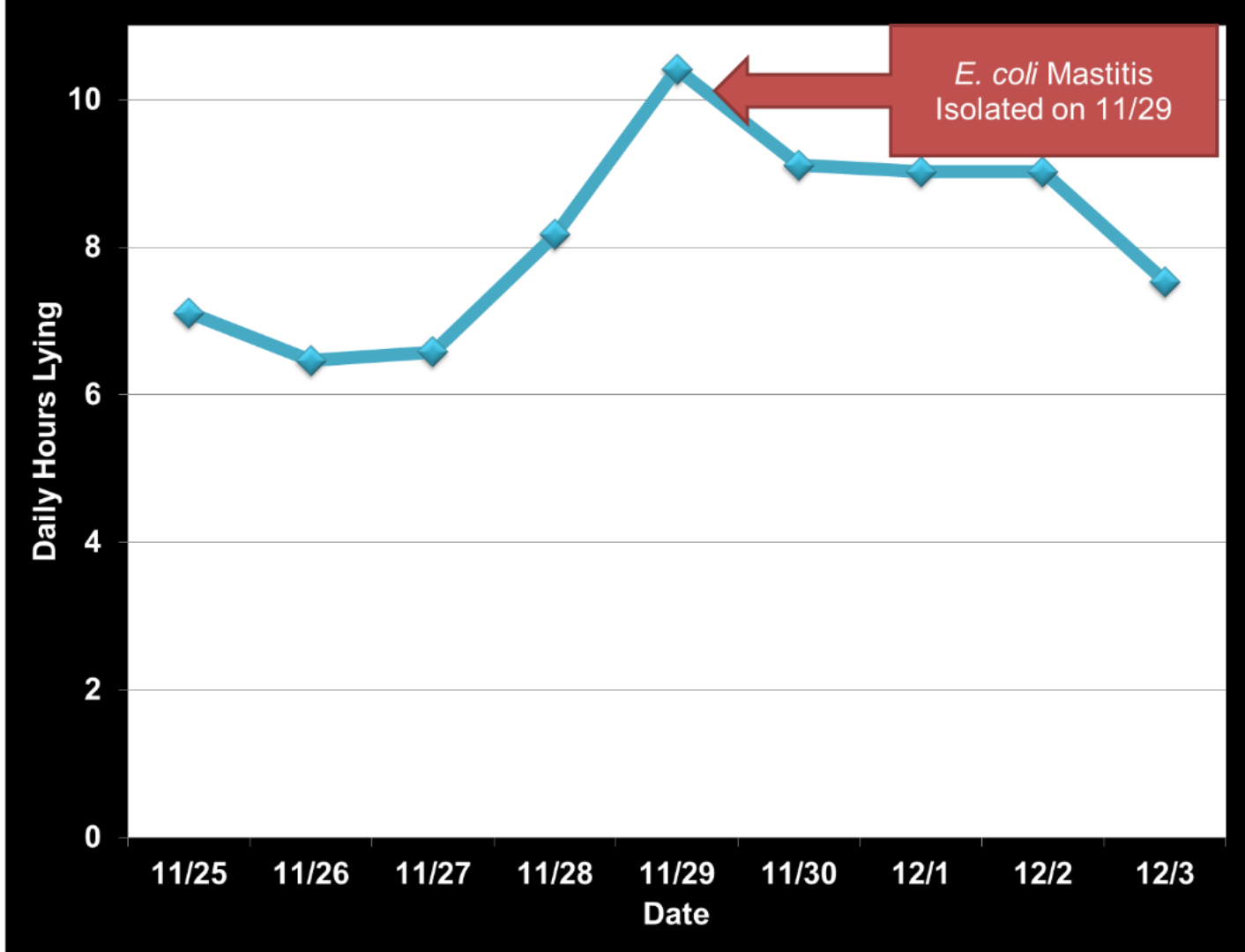
Graph Marketing Approach



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Sensitivity and Specificity

Sensitivity (true positive rate):
alert with an observed mastitis case

$$Sensitivity = \frac{true\ positives}{true\ positives + false\ negatives}$$

Specificity (true negative rate): no alert with no mastitis

$$Specificity = \frac{true\ negatives}{true\ negatives + false\ positives}$$

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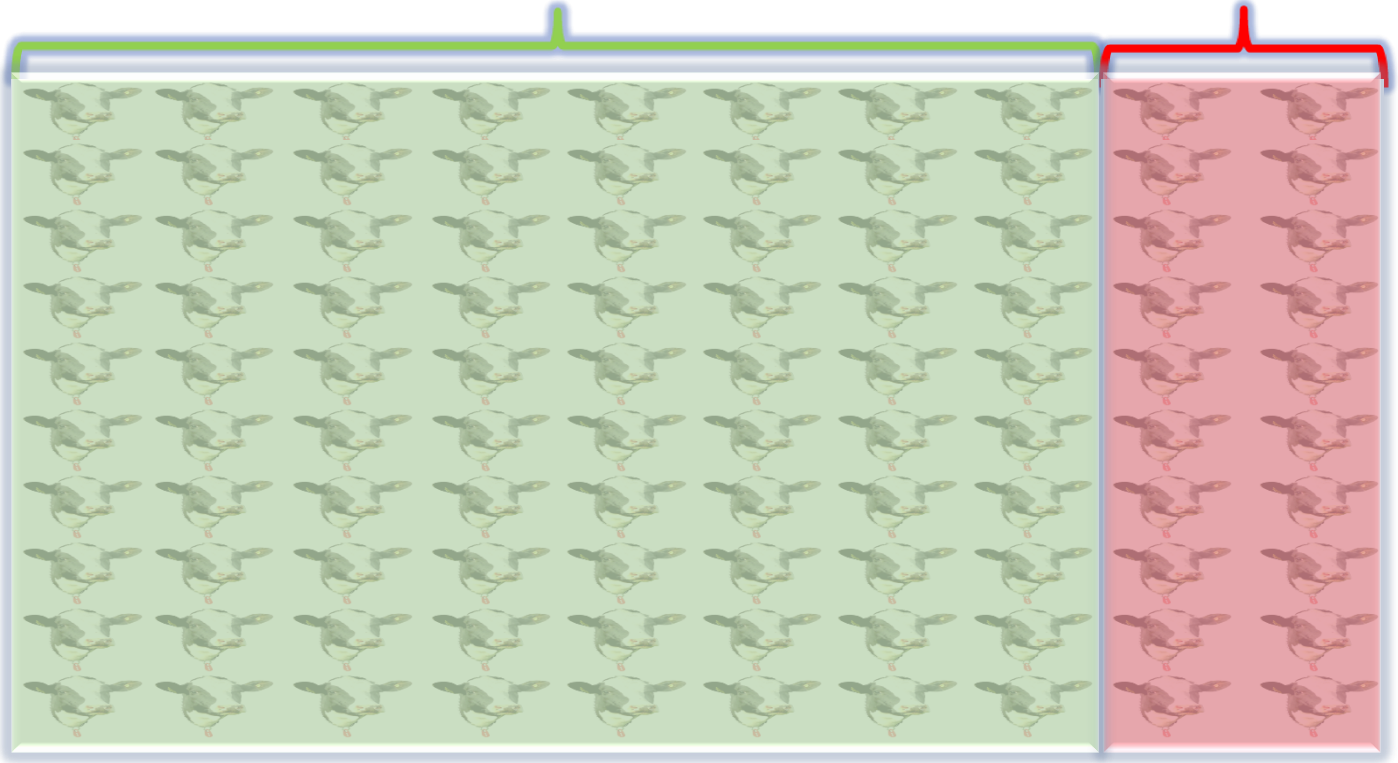
How Many Cows With Condition Do We Find?

80 Estrus Events Identified by Technology

20 Estrus Events Missed by Technology



Example: 100 estrus events

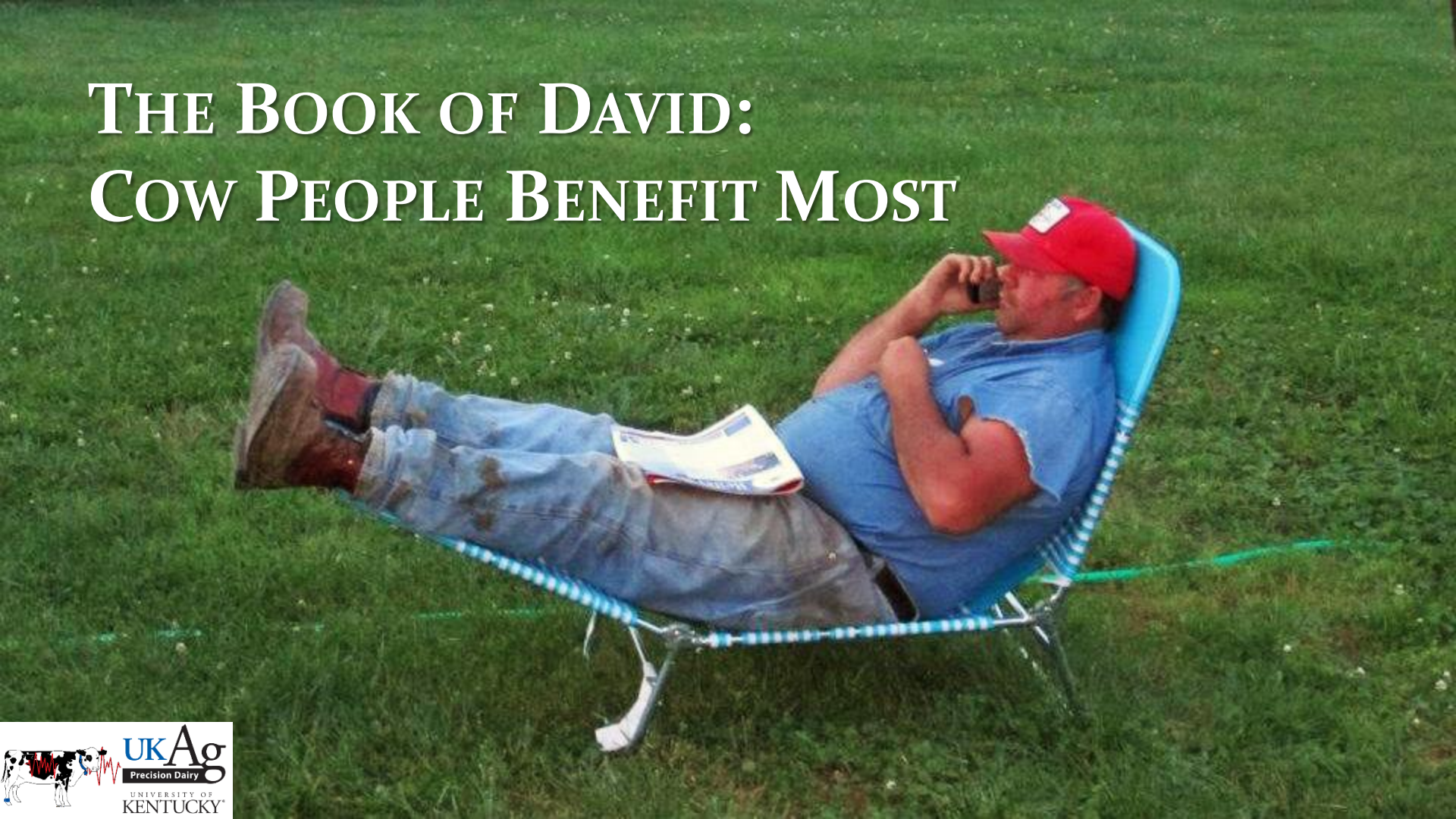
How Many Alerts Coincide with an Actual Event?

Example: 100 estrus alerts

Handling Data

- Examine/Treat/No Treat Alert Decisions
- Protocols for Handling Alerts
- Natural Reactions of Healthy Cows
- Repeat Alerts
- Failed Devices
- Backup Plan for System Outage

The Book of David: Cow People Benefit Most



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Simple Oversights

- Heat detection systems only catch cows in heat
- When a system picks up a sick cow, she's still a sick cow
- If you don't do anything with the information,
  it was useless
- Sometimes, you are the guinea pig

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Raccoons love the taste of cat5 Cable

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6 Technology Questions to Ask

- What are the sensitivity/specificity for condition of interest?
- What percent of devices fail per year?
- What is your warranty policy?
- What is your policy for upgrading to new versions of devices?
- What are full costs
  (hardware, devices, maintenance, data storage)?
- Can you get me in touch with existing users?

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Customer Service is Key

- More important than the gadget
- Computer literacy
- Not engineers
- Time limits
- Failure of hardware and software

Looking Forward

- More sensor systems
  - Milk and image based
- Well-being/Environmental Impact ≥ Reproduction/Health
- Multi-parameter systems
- Machine learning (i.e. neural networks, fuzzy logic)
- Individual farm algorithms

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Looking Forward

- Cloud-based data integration
- User groups
- Open source hardware (i.e. Raspberry Pi)
- Increased farmer demand for quality alerts
- Purchase decisions beyond gut feel

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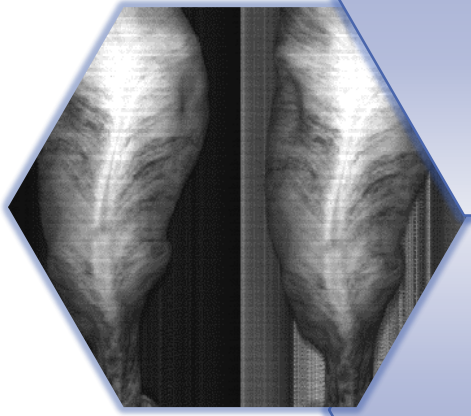
Big Data



Realistic Expectations

Exciting Opportunities

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QUESTIONS?

Jeffrey Bewley, PhD, PAS

407 W.P. Garrigus Building

Lexington, KY 40546-0215

Office: 859-257-7543

Cell: 859-699-2998

Fax: 859-257-7537

jbewley@uky.edu

www.bewleydairy.com

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