# Managing and Monitoring Transition Challenges of Dairy Cattle

Michael Overton, DVM, MPVM

Elanco KNOWLEDGE SOLUTIONS

## The Transition Period(s)

- Traditionally considered from -21 to 21 DIM
  - Reality: cows go through a series of transitions that start at dry-off and continue into early lactation
- A Series of Transitions:
  - High progesterone and pregnant to high estrogen to open
  - Ample glucose to major deficiencies
  - Low Ca demands to very high demands
  - Lactation to mammary involution to colostrogenesis to lactation
  - Pen changes, ration changes
- These transitions span a longer period of time than simply -21 to 21 DIM

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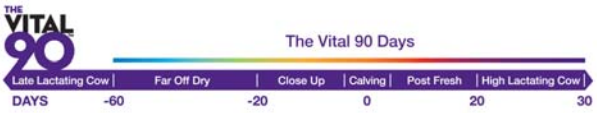
# The Vital 90™ Days

- Defined as the timeframe from two months before calving to one month after calving
- Management decisions during this high-risk period are key drivers of the success (or failure) for the next lactation
- The incidence and impact of many disease issues can be attributed to management during this period of time

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# Key Challenges Facing Transition Cows

- DMI declines; then rises slower than desired
  - Imbalance between glucose supply & demand
- Hormonal or metabolic issues
  - Hypocalcemia
  - Attenuation of somatotropic axis
- Immune dysfunction
  - Increased risk of infectious disease
- Dystocia – large potential challenge for heifers
- “Stress”

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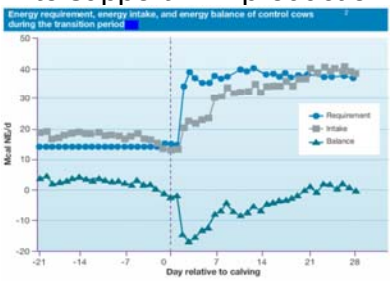
# Transition Period

Going Through a Change…

- Fetal growth
- DMI dropping
- Colostrum production
- Hormonal changes
- Calving
- Rapid increase in milk production

## Energy Balance

- Energy requirements for lactation essentially doubles after freshening
- Feed intake is inadequate to support milk production




1 Reynolds, C.K. et al., 2003. JDS 86 1201; 2 Grummer RR. 1995. JDS 73: 2820-2833



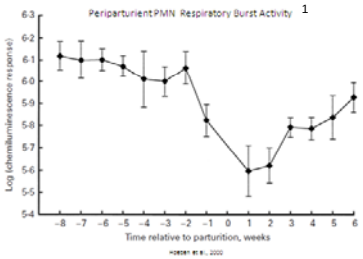
# Transition Period

Going Through a Change…

- Fetal growth
- DMI dropping
- Colostrum production
- Hormonal changes
- Calving
- Rapid increase in milk production

## Immune Function

- Delayed inflammatory response
- Decreased number of circulating neutrophils
- Impaired neutrophil function




1 Hoeben, G. et al. 2000. J Dairy Research 67 249-259

# Rapid Acceleration in Nutrient Needs Around Calving

- Within a few days of calving, mammary requirements increase as compared to uterine demands just before calving:
  - Glucose 2.7 X pregnant uterus
  - Amino acids 2.0 X pregnant uterus
  - Fatty acids 4.5 X pregnant uterus
  - ***Total "Energy"*** ***~3 X* pregnant uterus**
- Despite these needs, feed intake is low, resulting in…
  - Negative energy balance: -10 to -15 Mcal/d (or more)
  - Negative protein balance: - 500 to -600 g/d (or more)

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Bell, A. W. 1995. J Animal Sci 73(9):2804-2819.

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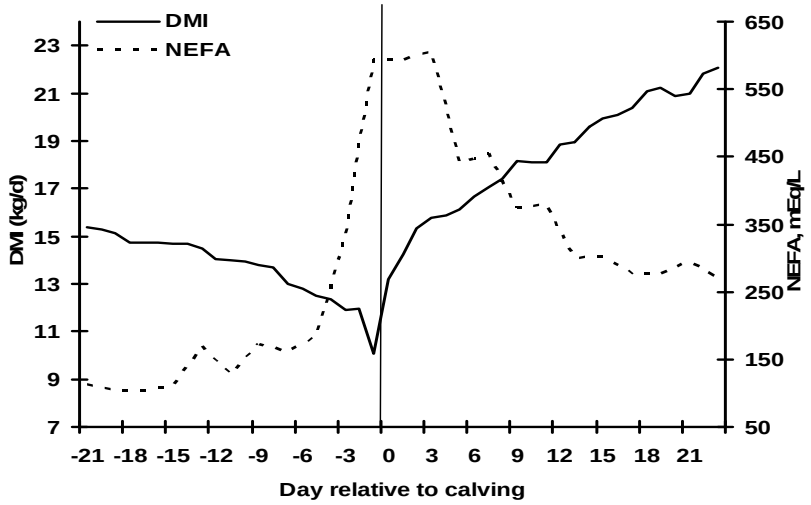
# What is Happening to Feed Intake?

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Overton TR.. 2000. http://vaca.agro.uncor.edu/~pleche/material/Material%20II/A%20archivos%20interne t/Alimentacion/transicion.pdf Accessed 1/19/13.

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## How Does the Modern Dairy Cow Do It?

- Two major ways:
  - Alters glucose metabolism
    - Glucose sparing
    - Increased gluconeogenesis from amino acids
  - Mobilizes body tissues (fat and protein)
    - Leads to increased NEFA's

**Mediated in part by somatotropin (growth hormone)**

- Liver is crucial in these adaptations

| | Day relative to calving | | |
|---|---|---|---|
| | -21 | 11 | 22 |
| Liver weight (lbs) | ~ 19 | ~ 19 | ~ 21 |
| Oxygen uptake (moles/d) | 35 | 76 | 80 |

Adapted from: Reynolds et al, 2003. J Dairy Sci 86(4):1201-1217.

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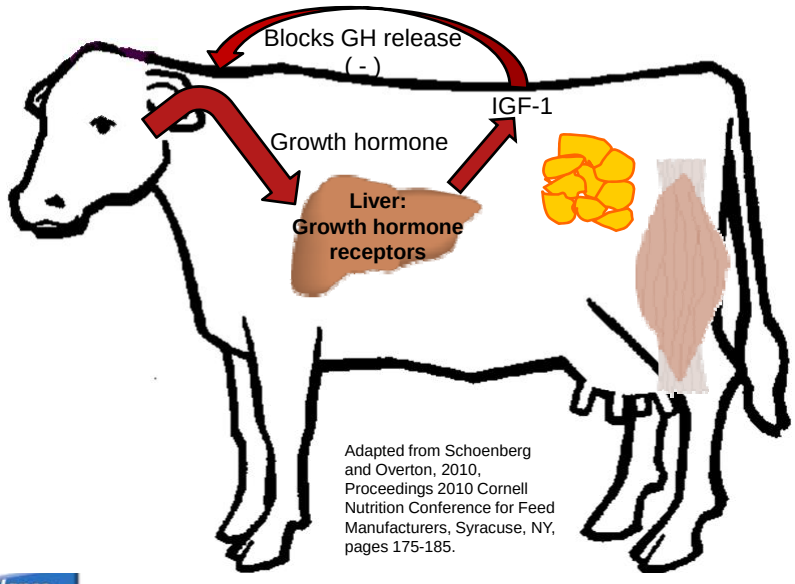
## Metabolic Adaptation




Adapted from Schoenberg and Overton, 2010, Proceedings 2010 Cornell Nutrition Conference for Feed Manufacturers, Syracuse, NY, pages 175-185.

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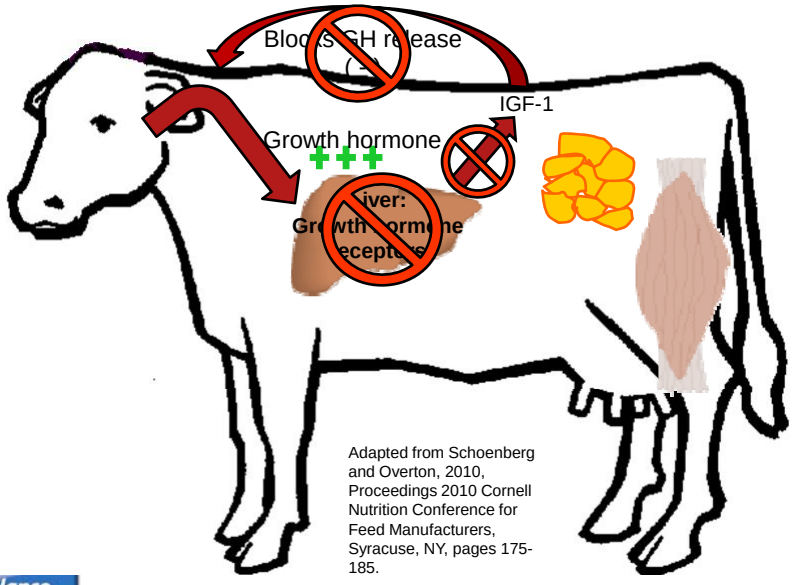
# Metabolic Adaptation

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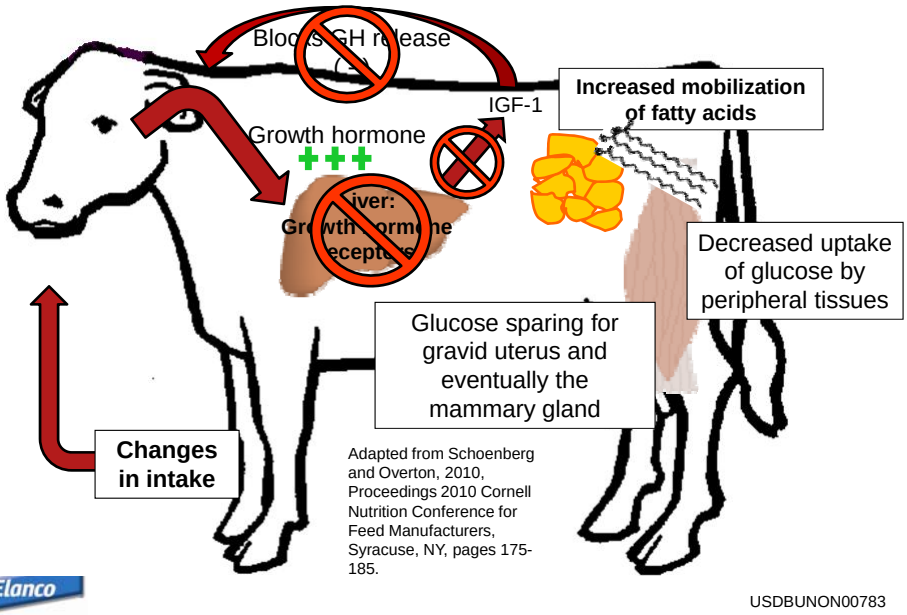
# Metabolic Adaptation

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## Calcium Needs Change Dramatically During the Periparturient Period[1]

- Dry cow Ca needs are only ~ 10-12 g/ day
- Around calving – cow must bring ≥ 30 g Ca/ d into the Ca pool
  - A cow producing ~ 10 liters of colostrum loses ~ 23 g Ca in a single milking
  - ~ 9 X the total plasma level of Ca in a cow
  - To make up the difference, cows need to absorb more from intestine or mobilize bone or both
  - Fresh cow can't turn the mechanism on that quickly

[1]Horst et al. 1997. *J Dairy Sci.80:1269-1280.*

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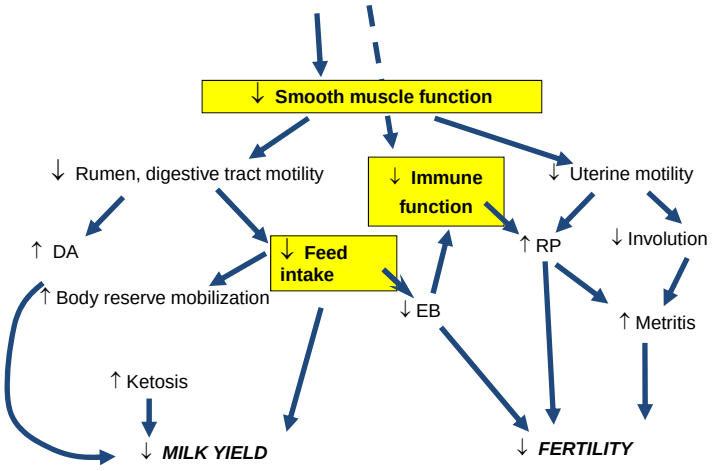
## HYPOCALCEMIA (clinical or subclinical)




Hypocalcemia, feed intake, and immune function are interrelated – All are critical for early lactation production and health

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# Peripartorient Immune Suppression

- Endocrine changes & physiologic stress during transition lead to compromised (i.e. suppressed) immune function.[1]
- This immune compromise is multifactorial and is related to:
  - Hypocalcemia
  - Glucocorticoids
  - Insufficient energy (glucose)
  - Elevated ketones and non-esterified fatty acids (NEFA)

- Adequate nutrition, a clean environment, and management decisions help manage immune function in the periparturient period.

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1. Goff J 2008. Tri-State Dairy Nutrition Conference. April 22-23, 2008.

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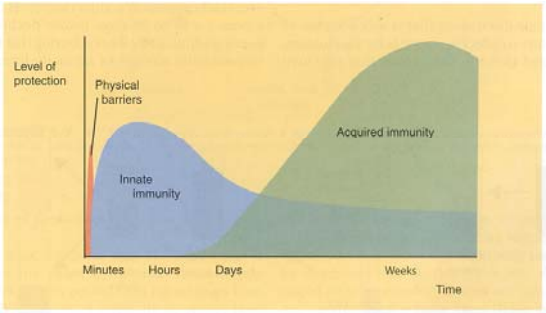
# The Big Picture

- The defense against infective microbes works as a series of layers of increasing levels of protection. When invading microbes overtake the first layer, the next layer attempts to stop them. This defense is possible by
  - Early reactions of the innate immune system (minutes to hours)
  - Later events of the acquired immune system (hours to days)
- Both systems work in a coordinated fashion and overlap to a certain degree

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Tizard IR. Veterinary Immunology - An Introduction. 8th ed. St. Louis, MO: Saunders Elsevier; 2009.

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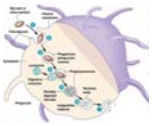
# The Innate Immune Response

- The innate immune system represents the first line of active defense against invading pathogens
- The non-specific or innate immune system consists of three major systems
  1. Physical barriers
  2. Inflammatory responses
  3. Phagocytic response

Physical Barriers

Inflammatory Response

Phagocytic Response[1]



[1](http://classes.midlandstech.edu/carterp/Courses/bio225/chap16/lecture3.htm , last accessed on 2/7/13)

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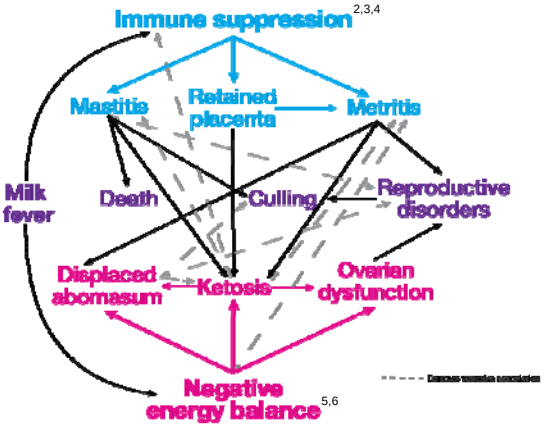
# Transition Cow Diseases: the Consequences

Very Complex Disease Inter-relationships[1]




[1]Mulligan and Doherty, 2008. Vet Journal *176(1):3-9;* [2] Kimura et al, 2002. J Dairy Sci 85:544-550; [3] Huzzey, et al, 2007. J Dairy Sci 90:3220-3233; [4] Sordillo 2005. *Livestock Prod Sci. 98(1–2):89-99;* [5] Duffield, et al, 2009 J Dairy Sci 92:571-580; [6] Loeffler, et al, 1999. J Dairy Sci 82:2589-2604.

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## What Can We Do During the Dry Period to Combat These Transition Challenges?

- Control the energy intake in far dry cows
  - Goldilocks approach – not too much, not too little
- Achieve adequate MP levels during far off and close up
- Manage risk of hypocalcemia during close up
- Manage environment to minimize stress and weight loss during dry period
- Provide adequate and comfortable resting access
- Remove other stressors (overcrowding, mixed parities, etc)
- Consider specific feed additives
- Be careful with pen moves
- Beware long days dry
- Optimize days in close up pen

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## What Can We Do in Early Lactation to Combat These Transition Challenges?

- Use high quality feed ingredients (properly balanced) to promote DMI
- Manage environment to minimize stress and weight loss during fresh period
- Provide adequate and comfortable resting access
- Remove other stressors (overcrowding, mixed parities, excessive standing times, excessive walking distances, etc)
- Consider specific feed additives
- Be careful with pen moves
- Promptly identify and appropriately treat fresh cow disorders

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# Monitoring the Vital 90 Days

- Leading vs. Lagging indicators
- Manage Risk
- Economics
  - Investment costs
  - Consequence costs


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# Vital 90 Risk Assessment Tool

**Monitoring Type:** (Leading) or Lagging

**Questions to Answer:**
"What conditions on my farm are most likely to lead to problems with periparturient cows? What are my best options to improve conditions?"

**Areas of the Vital 90 Evaluated:**

Far Dry Cow Environment
Close Up Dry Cow Environment
Fresh Cow Environment
Fresh Cow Management
Far Dry Cow Nutrition
Close Up Dry Cow Nutrition
Fresh Cow Nutrition


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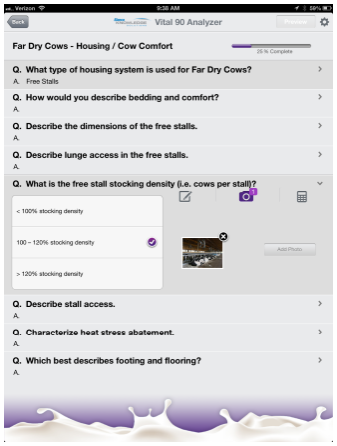
# The Vital 90 Days

- Physical Exam
  - Facility
  - Management
  - Nutrition
- Cow





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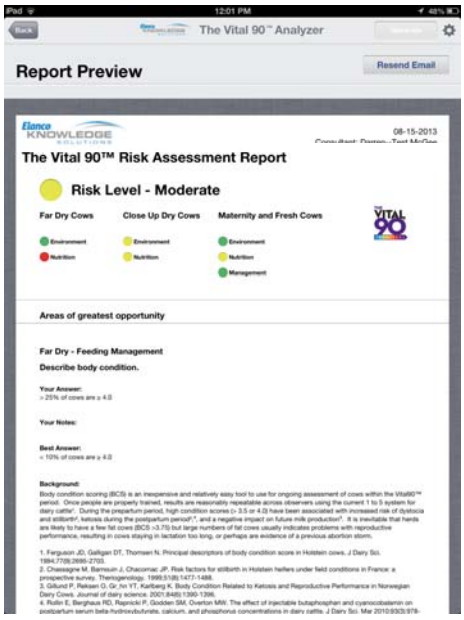
# Report From Risk Assessment Tool

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# The Vital 90 Days

- Many inputs are made during **The Vital 90** days in an effort to maintain welfare and get the cow to the most profitable part of her lactation cycle
- **Investments** include:


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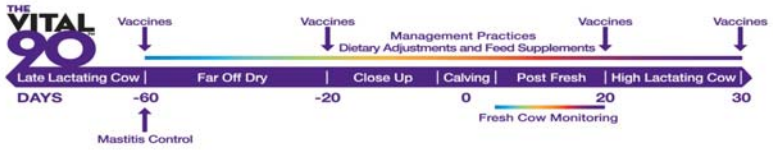
# The Vital 90 Days

- We invest in management, feed, additives, therapeutics, vaccinations, to try and mitigate two inevitable issues for all transition cows:

**Immune Suppression**
**(or dysfunction)**

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# Vital 90 Economic Assessment Tool

**Monitoring Type:** Leading or Lagging

**Questions to Answer:**
"What does it cost to get a cow in my herd through the Vital 90? How much do I invest in prevention? How much does disease cost me? What if my disease incidence were different?"

**Economic Inputs:**
General Herd Parameters
Preventive Protocols
Disease Incidence
Treatment Protocols

**Economic Outputs:**
Total Cost of the Vital 90
Investment Costs
Consequence Costs
Disease Costs
- Direct Disease Costs
- Indirect Disease Costs


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# Disease Recording Standardization

## Why Should I Care?

- More Effective Therapy
- Managing Work
- Analyzing Outcomes
- Expected Consequences
- Comparative Analysis


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# Disease Recording Standardization

- Define
- Monitor and Detect
- Record and Treat:  Protocols
  - Work with your consultant and record system
- Analyze
- Decide


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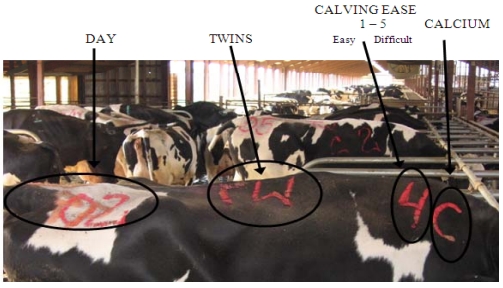
# The Vital 90 Days
# Management Strategies

- Monitoring
  - Early identification of sick cow
    - Appropriate therapy
    - Appropriate documentation/traceability
  - Protocols
  - Records

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# Disease Definitions

## Milk Fever (MF)

- Description: Milk fever occurs around calving and is caused by a sudden shortage of blood calcium. The first sign is staggering, then difficulty standing and finally lying down and not being able to stand. Cows are usually down with head turned back towards flank.
- Definition: MF is recognized within 3 days of calving with clinical signs of muscle weakness and/or recumbency caused by low calcium


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Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.

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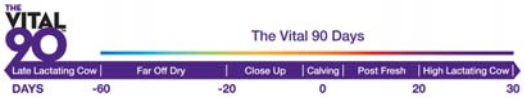
# Disease Definitions

## Retained Placenta (RP)

- Description: Retained placenta occurs when the fetal membranes fail to separate from the uterus. The single sign associated with RP is degenerating, discolored, ultimately fetid membranes hanging from the vulva.
- Definition: RP is usually defined as the failure to expel fetal membranes within 24 hours after calving.

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Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.

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# Disease Definitions

## Ketosis (KETOSIS)

- Description: Ketosis occurs when energy demands (e.g., high milk production) exceed energy intake and result in a more negative energy balance that results in an over production of ketone bodies. Ketosis results if ketone production exceeds ketone utilization by the cow.
- Definition: Ketosis is recognized when cows are identified with elevated ketone bodies in the absence of another concurrent disease.


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Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.

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# Disease Definitions

## Metritis (METR)

- Description: Metritis is an infection of the uterus. Clinical signs of uterine infections vary with the severity of the infection. There is often a fetid, watery discharge that develops during the first 2-3 weeks after calving. In more severe cases of metritis where toxins have been absorbed from the infected uterus, cows show other signs such as high fever, depression, and lack of appetite.
- Definition: METR is recognized by an abnormal, fetid uterine discharge within 21-d of calving.


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Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.

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# Disease Definitions

## Clinical Mastitis (MAST)

- Description: Mastitis is an inflammation of the mammary gland. Clinical mastitis is characterized by visibly abnormal milk (e.g., clots or flakes and may be watery or discolored).
- Definition: MAST is recognized by visually abnormal milk from a quarter. Clinical mastitis is further classified as mild, moderate, or severe
  - Mild: Abnormal milk only
  - Moderate: Abnormal milk + inflammation of udder
  - Severe: Abnormal milk + inflammation of udder + sick cow


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Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.

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# Disease Definitions

## Displaced Abomasum (DA)

- Description: The abomasum normally lies on the floor of the abdomen, but can become filled with gas and rise to one or the other side of the abdomen, where it is said to be “displaced”. The abomasum is more likely to be displaced to the left (LDA) than the right (RDA). The majority of cases occur soon after calving.
- Definition: DA is recognized when a ping is produced by percussion of the abdominal wall between the 9$^{th}$ and 12$^{th}$ ribs on either the right or left side.


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Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.

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# Disease Definitions

## Lameness (LAME)

- Description: Lameness in dairy cattle is a multifactorial disease, closely related to the production system and environment in which the cows live. Foot rot or sole ulcers are common causes of lameness in dairy cattle.
- Definition: LAME is recognized when a cow is observed walking with an abnormal gait or body posture.


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Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.

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# Disease Definitions

## Pneumonia (PNEU)

- Description: Pneumonia is an infection and inflammation of the lungs. Clinical signs of pneumonia vary with the severity of the infection. Cows may show signs of troubled breathing, high fever, depression, and lack of appetite.
- Definition: PNEU is recognized when a cow is observed with altered breathing patterns/sounds and a fever most likely due to a respiratory infection.


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Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.

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# Disease Definitions

## Ovarian Dysfunction (OVDYSF)

- Description: Conditions that are caused by ovarian dysfunction can be lumped together and include cystic ovarian disease and anestrous anovulatory condition.
- Definition: OVDYSF is recognized when a cow is determined clinically to have dysfunction of the ovaries and a specific therapeutic approach is applied


Adapted from Kelton, 1998. J Dairy Sci 81:81:2502–2509.



# Vital 90 Cost per Cow Calving


For this herd,

- Investment cost = $164
- Consequence cost = $243
  - Direct disease cost = $113
  - Indirect disease cost = $130
- **Total Cost per Cow Calving = $407**

Elanco data on file; Economic Assessment Tool_101613

# To Summarize…

- There are a few sayings that bear repeating:
  - "You can't measure what you don't monitor"
  - "Garbage in…Garbage out"
  - "Measure what is measurable and make measureable what is not so" - Galileo
- Dairy records are full of recording bias
  - Inconsistent definitions of disease
  - Inconsistent detection of disease
  - Inconsistent recording of disease

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# **ALL** Transition Dairy Cows Experience Negative Nutrient Balance and Immune Dysfunction

- The key issues are:
  - The degree of each (how much) and
  - The success of adaptation (how long)
- The ability to maintain DMI and energy intake prepartum and to increase each one rapidly (in a safe manner) postpartum helps:
  - Limit immunosuppression
  - Improve liver health
  - Achieve optimal performance, thus reducing the consequence cost
- EKS tools are designed to help prevent transition issues and to identify opportunities and motivate change

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# Thanks For Your Attention!

Michael Overton, DVM, MPVM

(706) 248-4664

moverton@elanco.com

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