**Immunity, Inflammation, and the Transition Cow**

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**Outline**
- The immune system and inflammation
- Transition cow anomalies
- Balancing immunity and inflammation
- Opportunities to intervene

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**Roles of the immune system**
- Monitors and manages the normal and pathogenic microflora found in and around the body
  - Bacteria
  - Viruses
  - Fungi
  - Multicellular parasites
- Detects and clears rogue and compromised cells, tissue debris
- Many emerging regulatory roles

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**Innate immune response**
Inflammatory signals: a positive feedback loop

Acute phase proteins

A balancing act
Responding to an immune challenge ideally means...
• Eliminating the pathogen
• Fixing the damage
• Getting back to normal
Rapid resolution of an immune response is critical to minimize "collateral damage" associated with sustained and intense inflammation.

Transition cows have decreased immune function
Subacute liver inflammation is common in postpartum cows

Rapid shift from pro- to anti-inflammatory lipids

Inflammation is associated with transition disorders

Does inflammation cause disease? Or does disease cause inflammation?
Do repeated inflammatory signals alter metabolism?

- 33 Holstein cows were assigned to 1 of 3 treatments (n = 11) at calving.
- 3 treatments: 0, 1.5, or 3.0 μg TNFα/kg BW.

**Inflammation promotes ketosis**

<table>
<thead>
<tr>
<th>Day of lactation</th>
<th>Dry matter intake (Kg/d)</th>
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<tbody>
<tr>
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<tr>
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- Control: 9%
- 1.5 μg/kg TNF: 27%
- 3.0 μg/kg TNF: 27%

*p = 0.02, TNFα vs control (10% decrease)

...and decreases milk yield

<table>
<thead>
<tr>
<th>Day of lactation</th>
<th>Milk yield (L/d)</th>
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- Control
- 1.5 μg/kg TNF
- 3.0 μg/kg TNF

*p = 0.09, TNFα vs control (10% decrease)

Systemic inflammation
Inflammation: a double-edged sword

- Acute phase markers are linked to less milk, poor fertility, and greater risk of leaving the herd
- Acute phase markers are linked with enhanced neutrophil function

How is it that fresh cows have BOTH suppressed immunity and inflammation?

One possibility: Inflammation is a counter-measure against lactation-induced immunity problems

Long-term consequences of transition problems

A vicious cycle

Metabolic disorders promote infections
Metabolic disorders

Excessive lipid stores

Cytokine network

Pathogen challenge
Having your cake...

- Can we help transition cows achieve the optimal balance?
- Or do we risk shooting ourselves in the foot by tipping the scale out of balance?

Having your cake...

1. Early lactation strategies to combat inflammation and improve metabolism can be a net benefit for health.

Unexpected benefits?

Cows were fed 15 g choline per day from 25 days before calving to 80 days in milk.

![Graph showing the impact of choline on ketosis](image)

*P = 0.01*
Immediate postpartum anti-inflammatory
- Flunixin meglumine given 2 h and 24 h after calving
- Over 1,300 cows enrolled

Blocking inflammation on the day of calving may interfere with inflammatory signals needed to expel the placenta

Non-steroidal anti-inflammatory drugs (NSAID) after calving
1. Na salicylate
2. Meloxicam
- Administered orally starting 24 h postpartum
- 51 multiparous cows per treatment

Anti-inflammatories in early lactation (not approved for commercial use)

Time to Leave Herd
Too much milk?
Having your cake...

2. Immune stimulants don't necessarily cause metabolic/production problems, and may benefit if disease is reduced

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Immune stimulation

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Having your cake...

I propose that the starting point should be determined by the dominant issues on a given farm:

- Infections should draw the focus to immune support
- Metabolic problems suggest an anti-inflammatory feeding strategy may help

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Hypothetical impacts of unresolved inflammation

- Sustained metabolic challenges
  - Rapid resolution
  - Metabolic adaptation
  - Normal estrus cycles
- Infections
  - Infections
  - Metabolic disease
  - Infertility
THANK YOU!

Questions?
Comments?

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