Can we overcome excessive post-calving inflammation?

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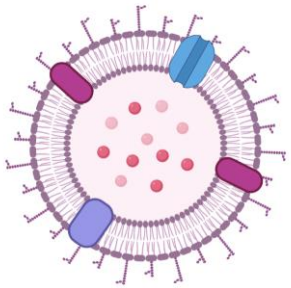
OUTLINE

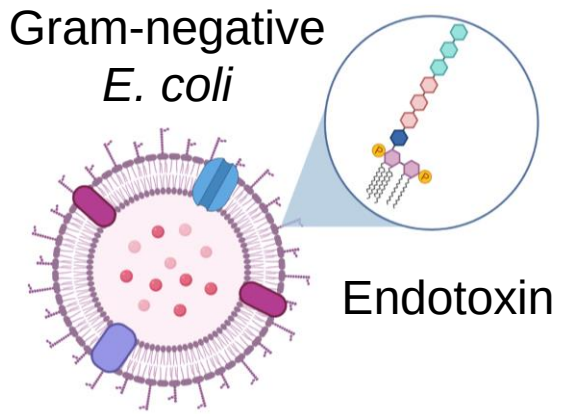
- Understanding inflammatory responses
- Consequences of excessive inflammation post-calving
- Assessing herd status
- Strategies for modulating inflammation

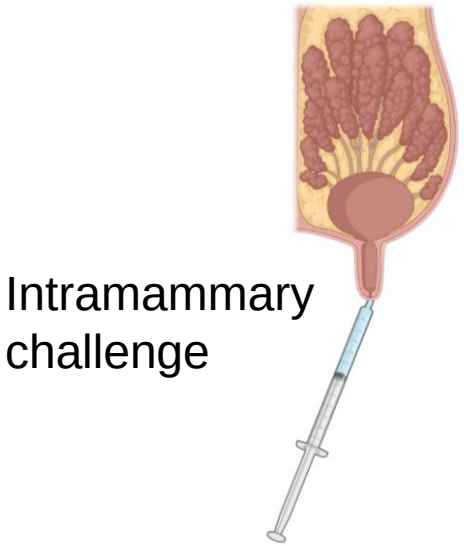
The classical inflammatory response

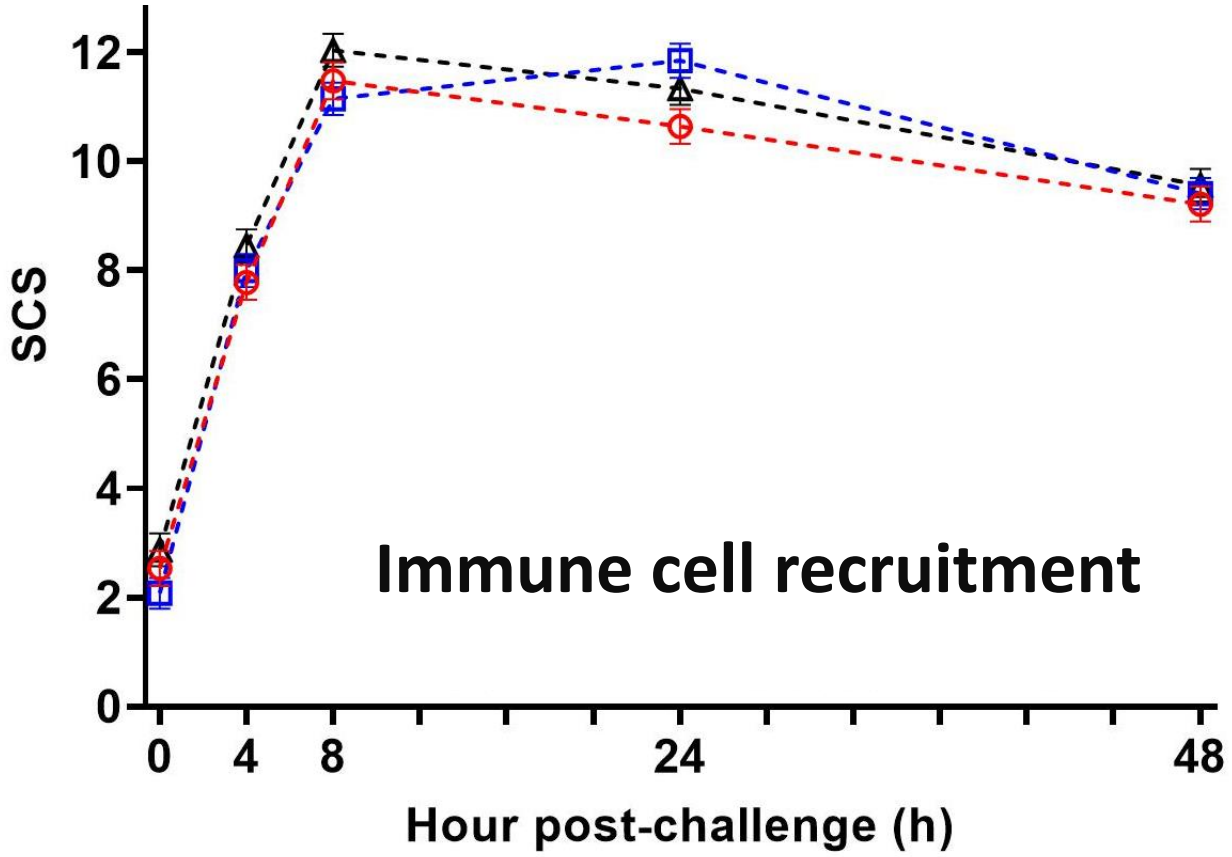
Gram-negative
E. coli



The classical inflammatory response

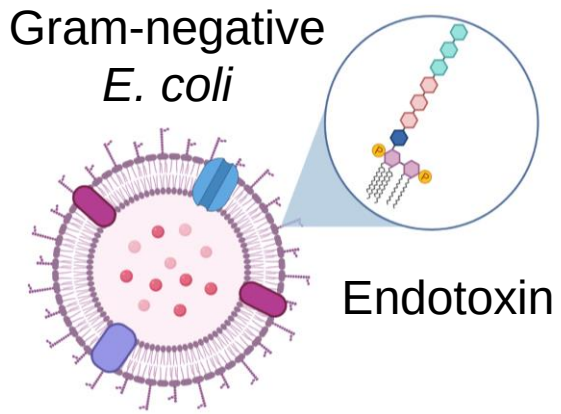


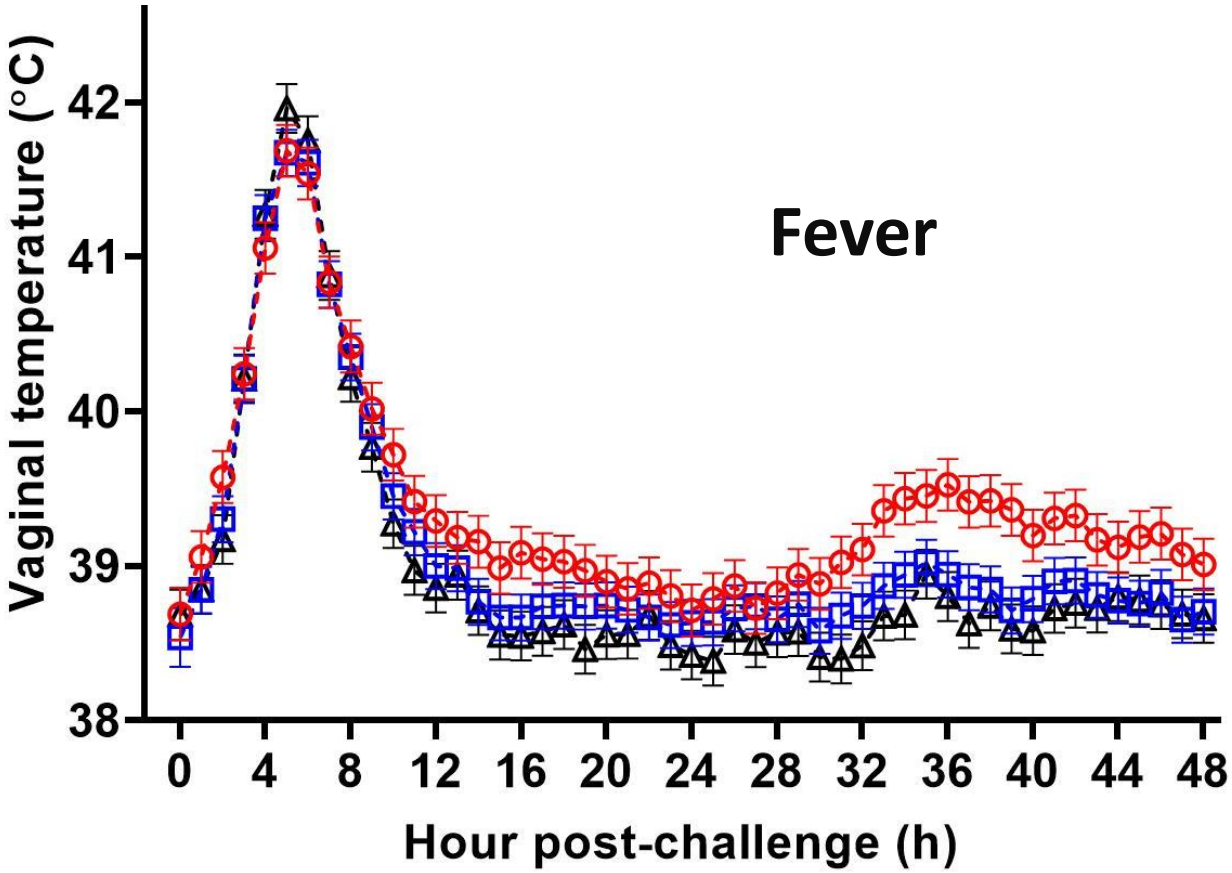




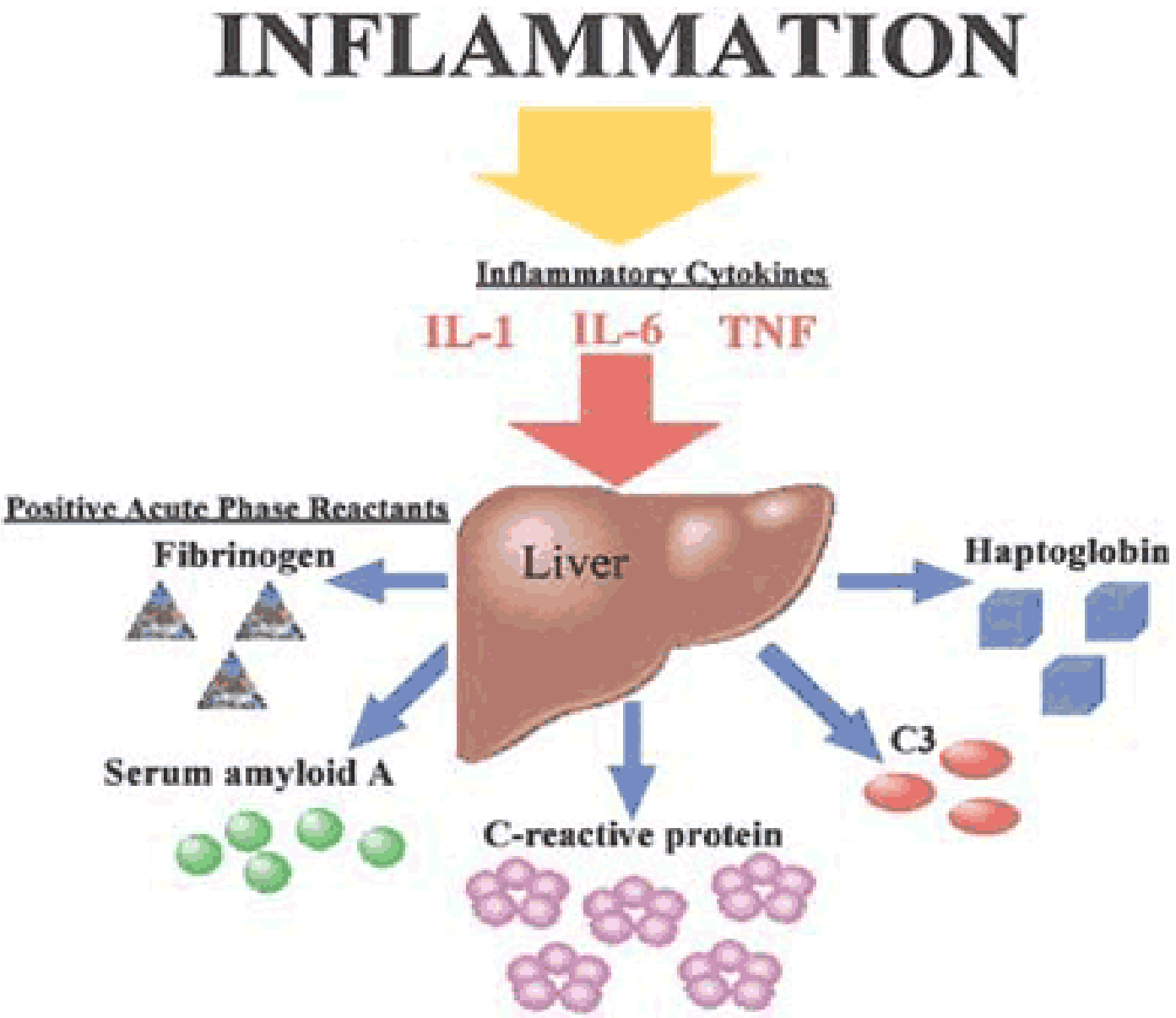
Swartz et al., ADSA 2022

The classical inflammatory response





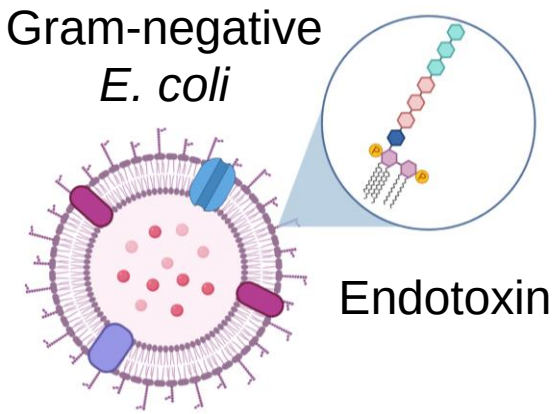
Swartz et al., ADSA 2022

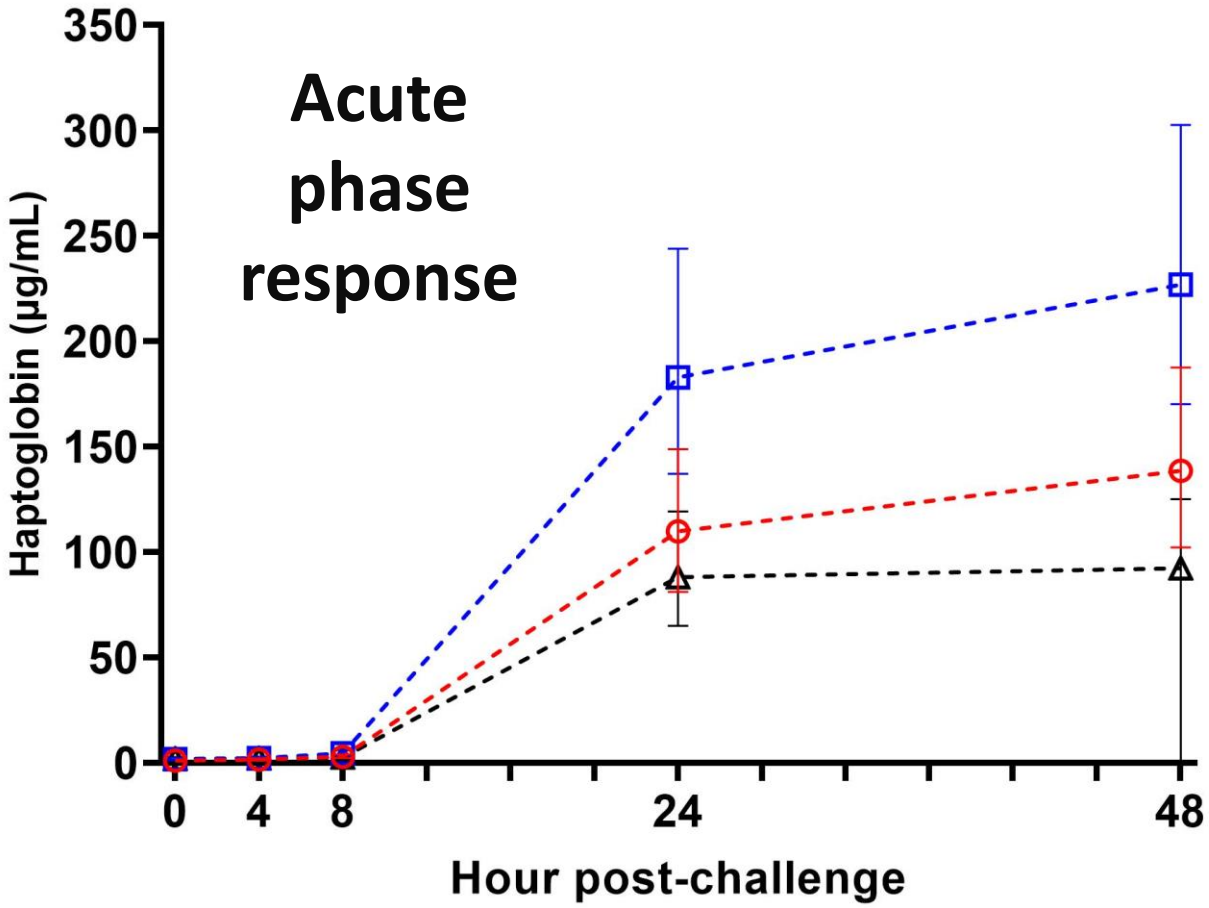


Source: Adv Neonatal Care © 2003 W. B. Saunders

Acute phase proteins are stable blood markers of inflammation

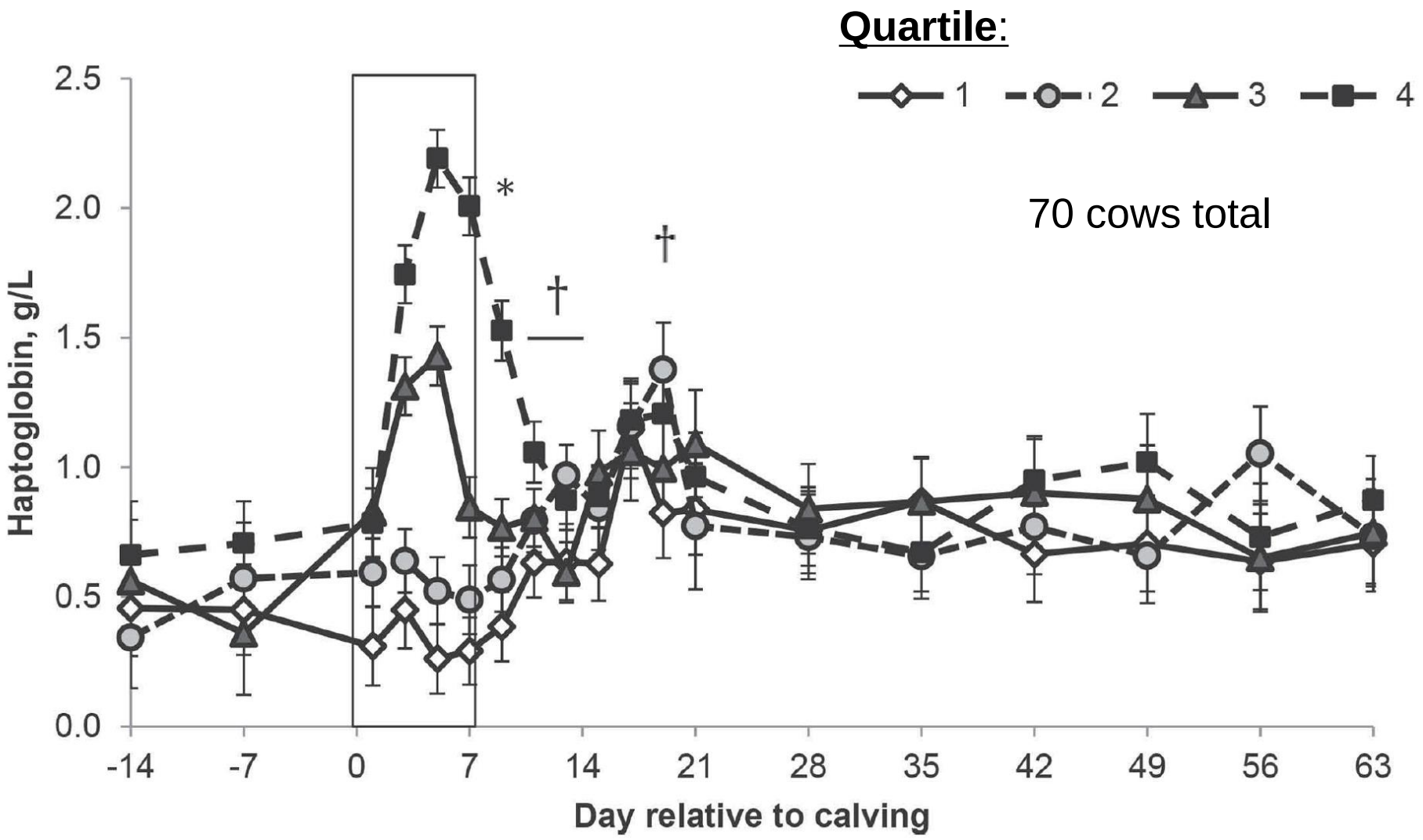
The classical inflammatory response





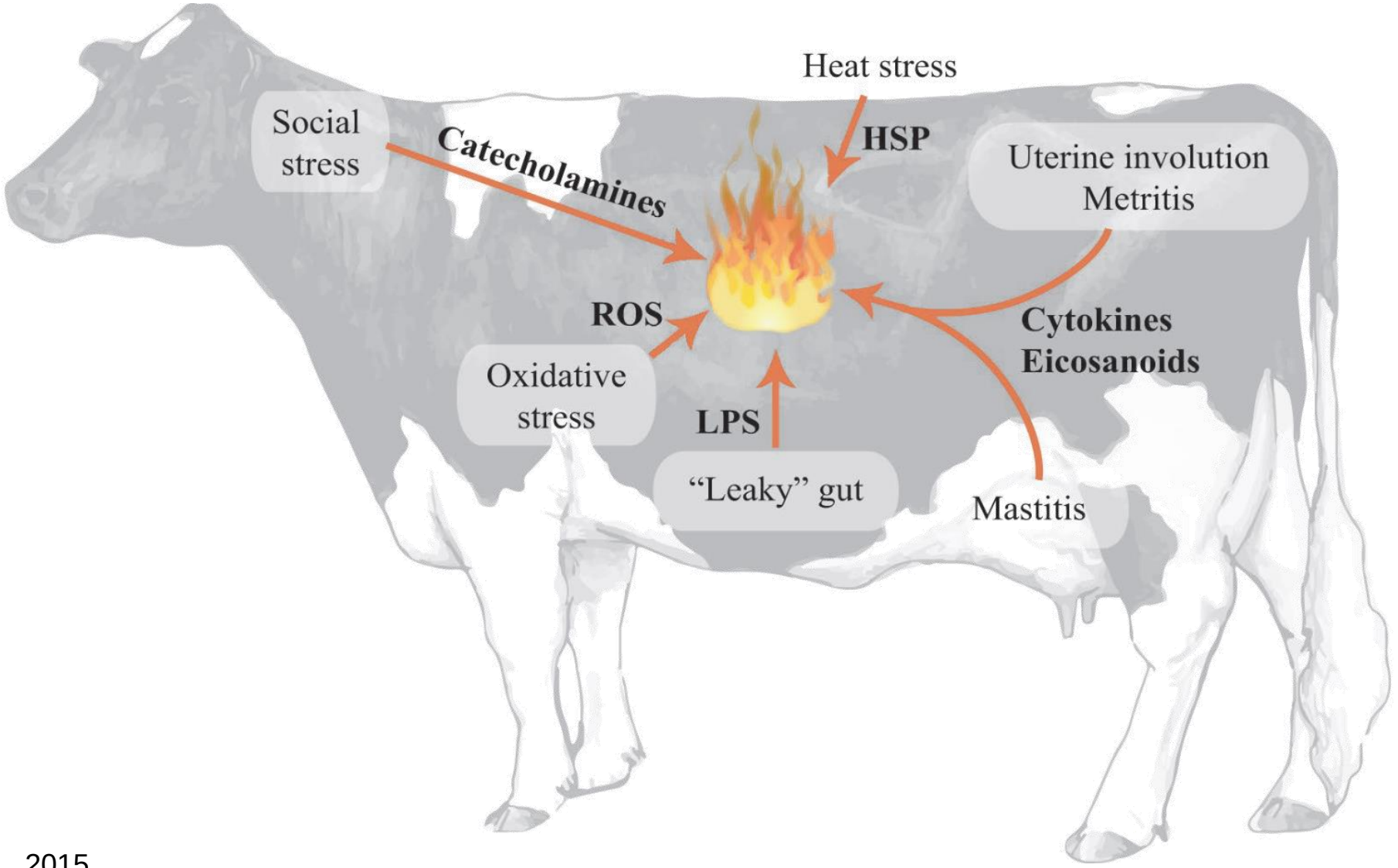
Swartz et al., ADSA 2022

Subacute inflammation is common in postpartum cows



McCarthy et al., 2016

Plausible causes of postpartum inflammation

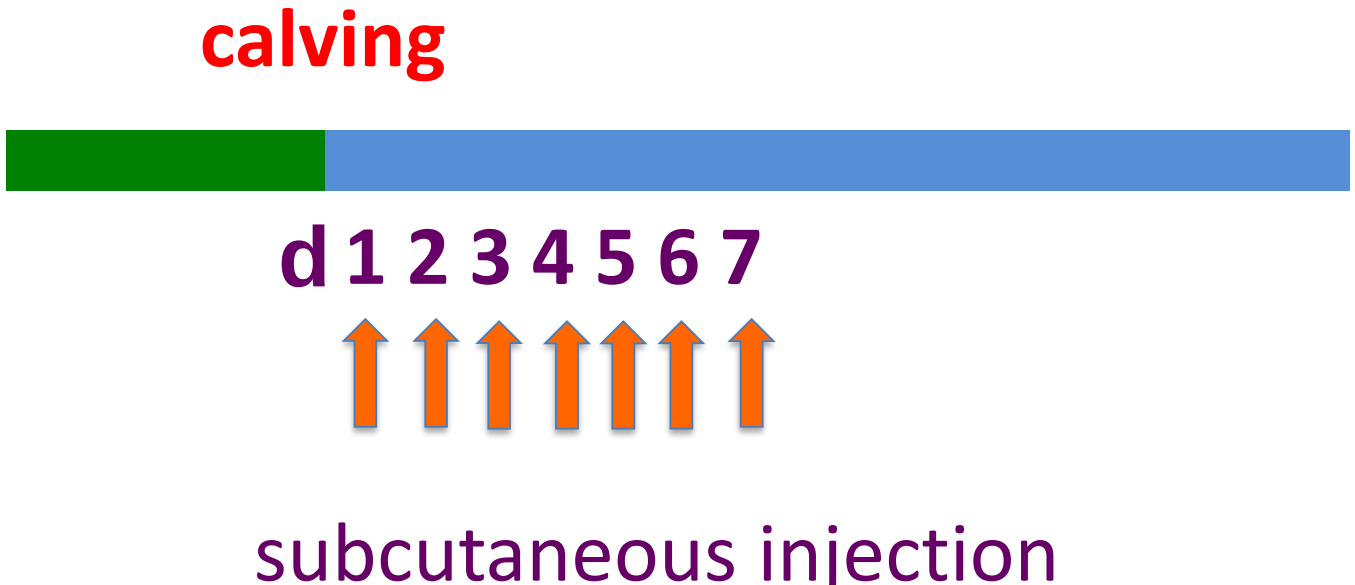


Bradford et al., 2015

Does elevated inflammatory tone influence metabolic function?

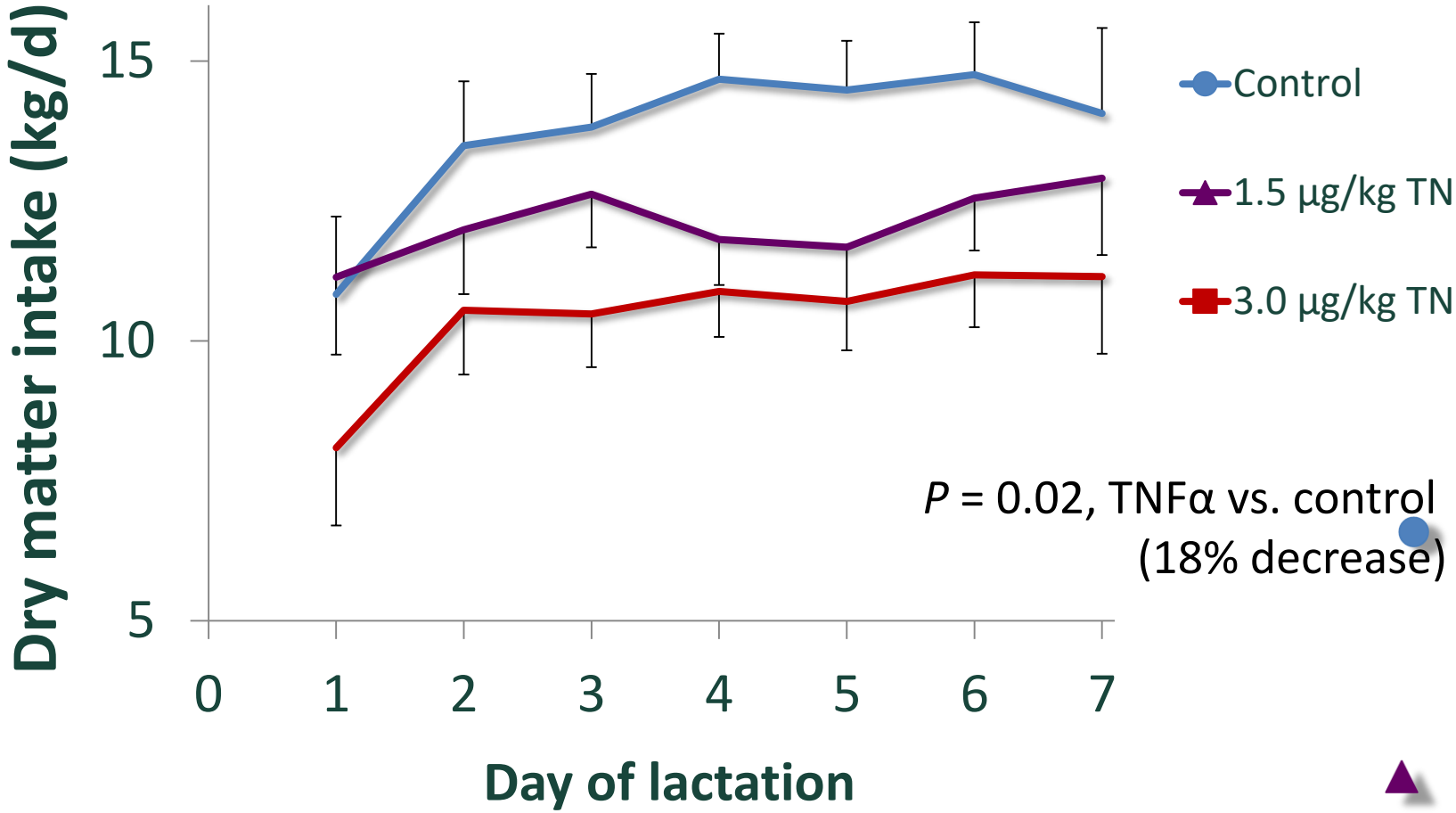
Do repeated mild inflammatory challenges promote disease?

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



Yuan et al., 2013

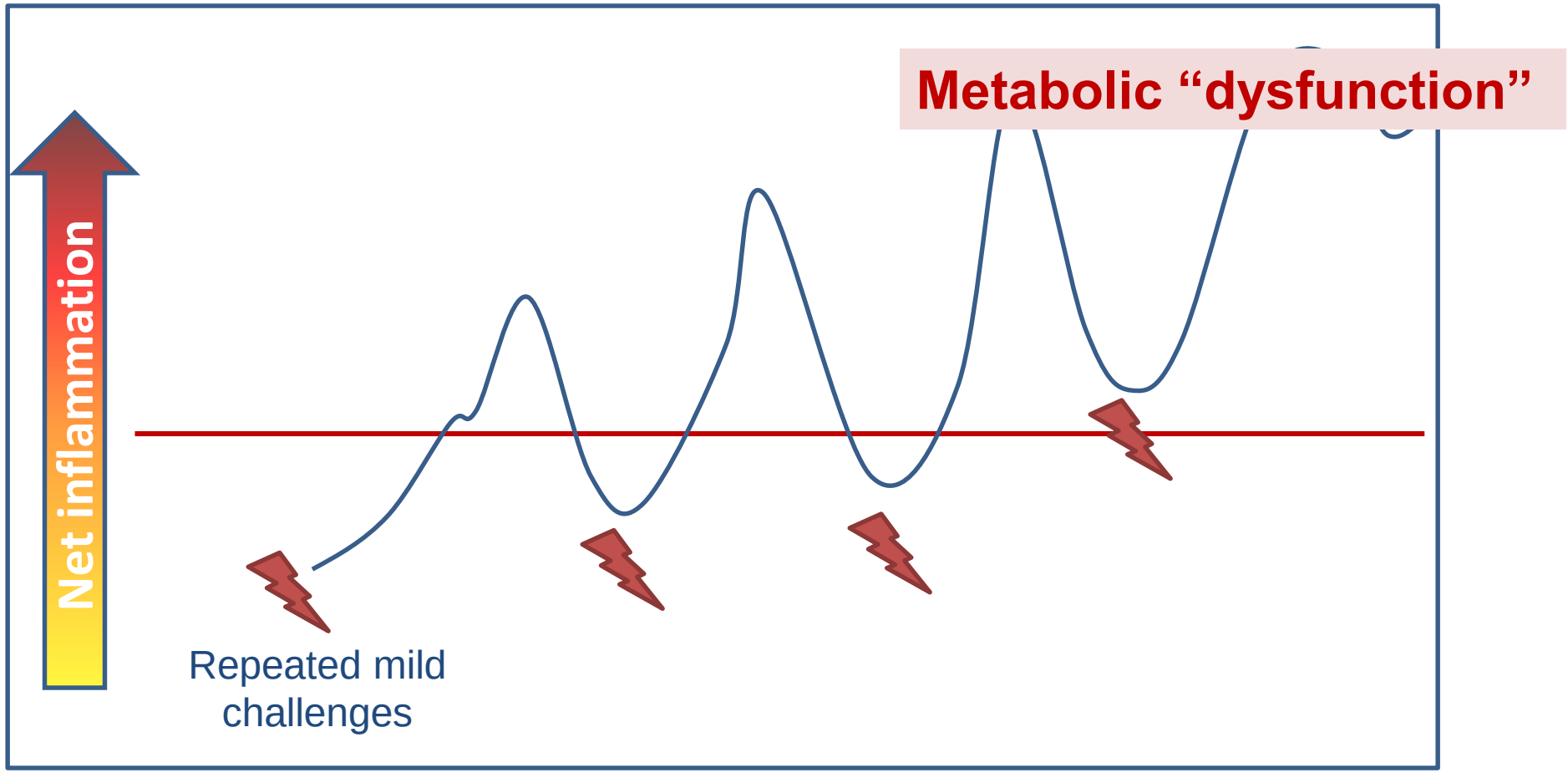
Inflammation suppresses intake



Subclinical Ketosis
9%
27%
27%

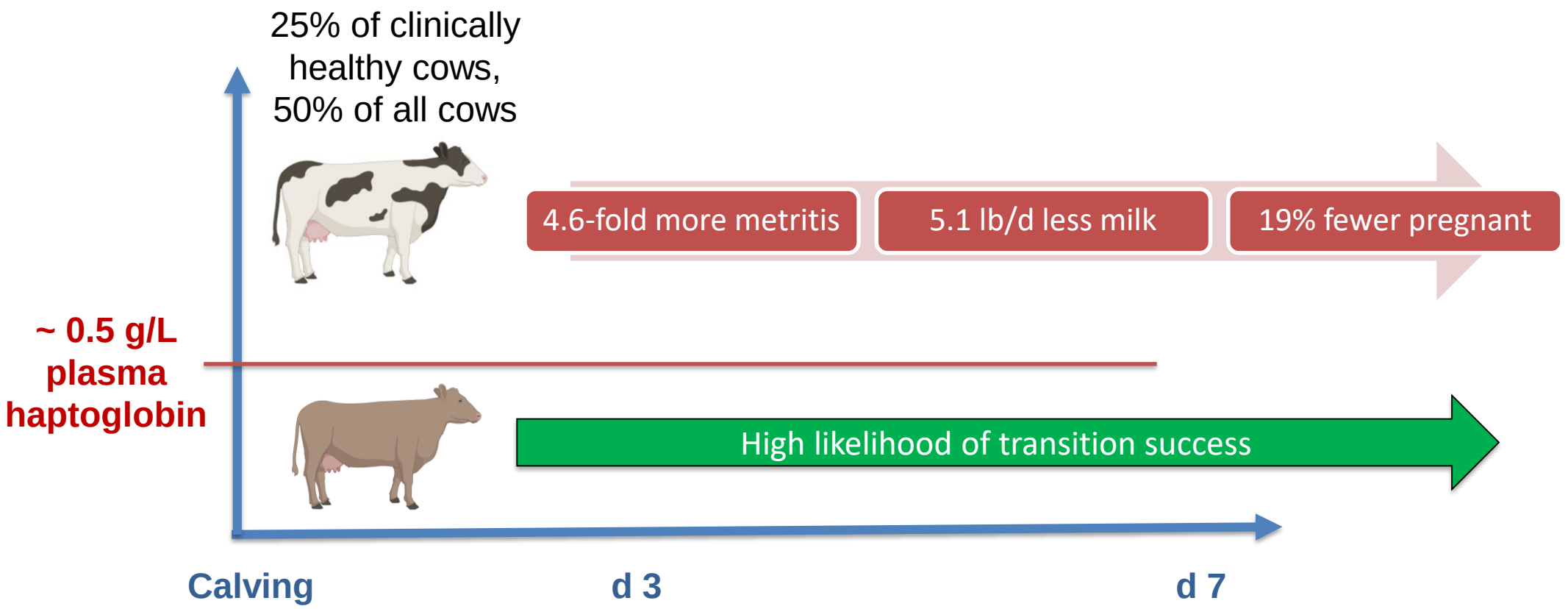
Yuan et al., 2013

Metabolic responses to inflammatory stimuli



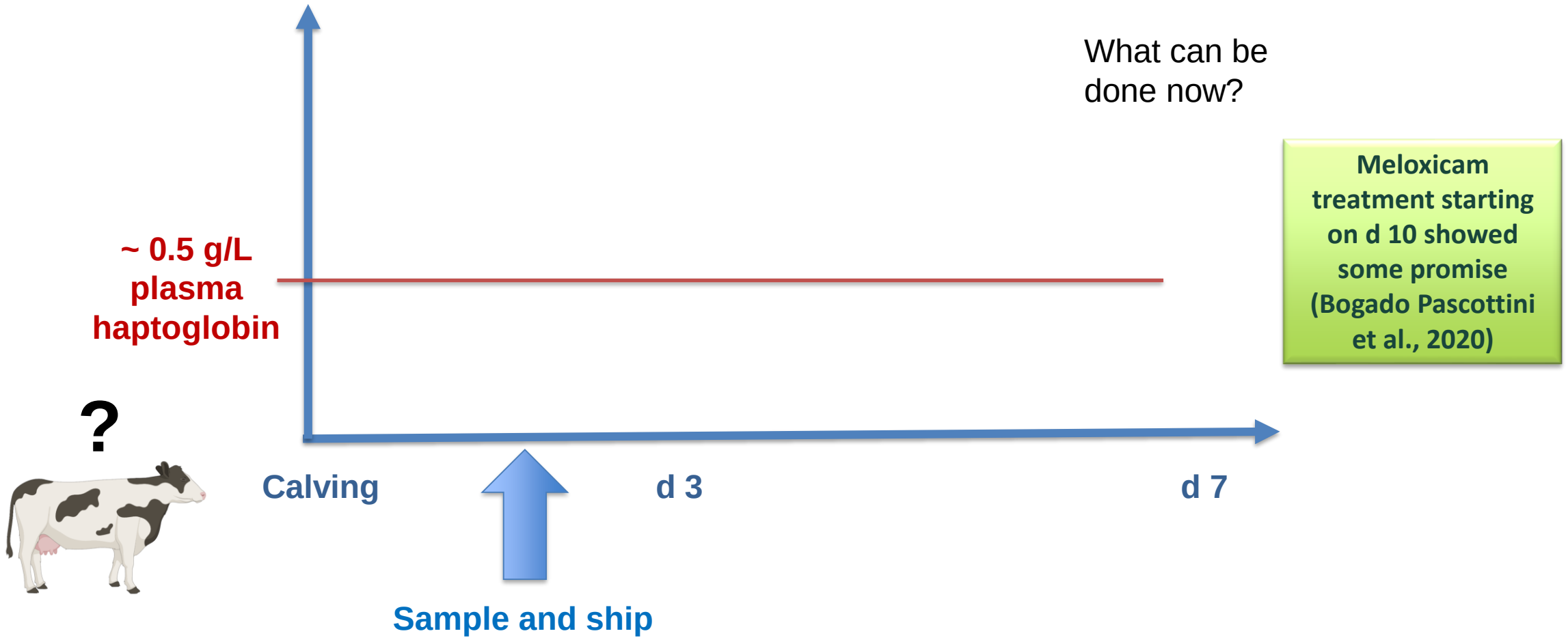
Bradford et al., 2015

Individual cow outcomes - haptoglobin



Combined findings of Huzzey et al. (2009), Huzzey et al. (2015), and Martins et al. (2021).

The problem with individual monitoring today



Ongoing study:

Determine a threshold for generally healthy / inflamed *herds*

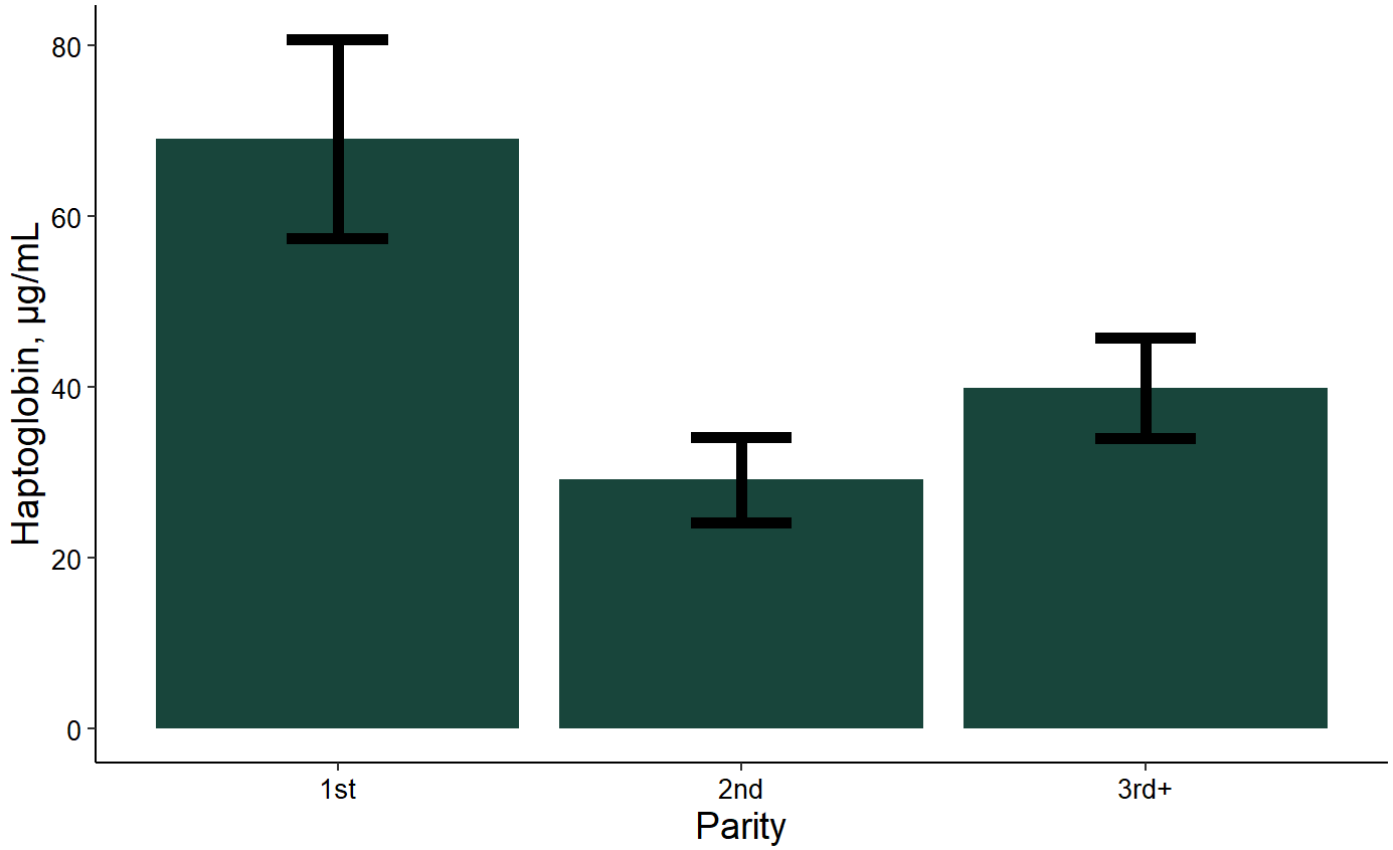
Fresh pen
Sample 40 cows
between 1 – 7 DIM

Fresh pen
Sample 40 cows
between 1 – 7 DIM

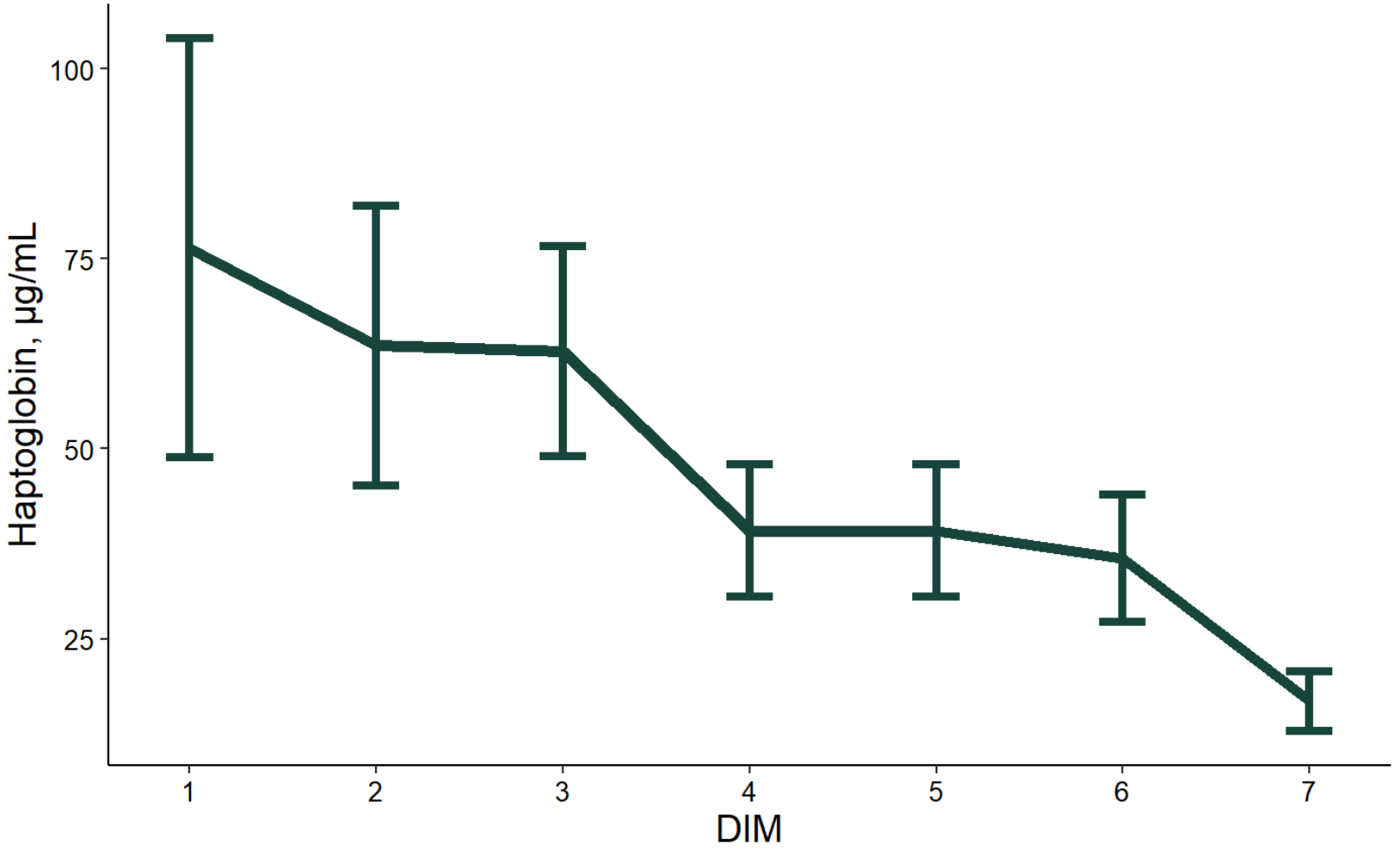
Are outcomes worse on farms with greater average inflammation scores?

Ongoing study: 1st lactation cows show greater inflammation

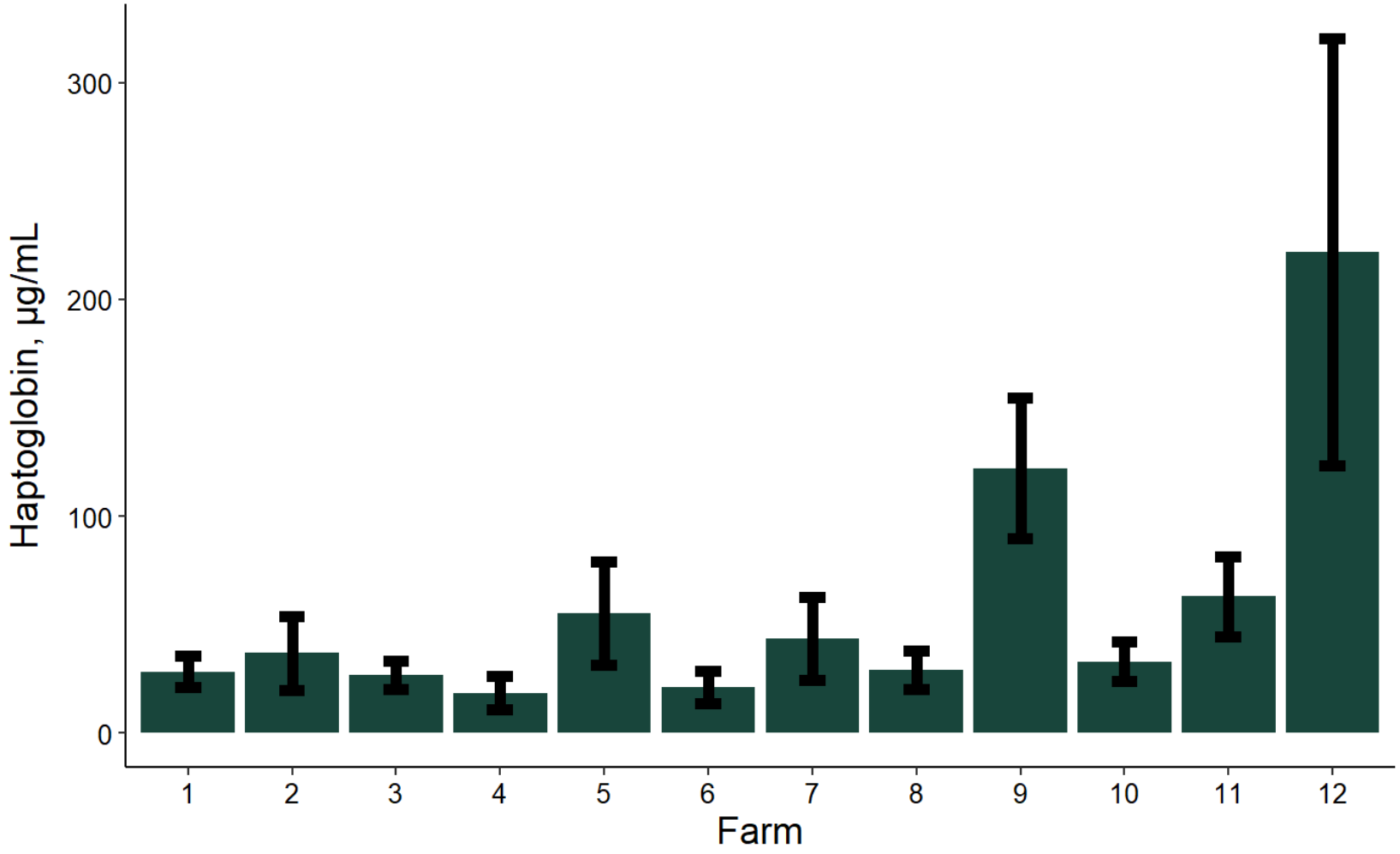
- Cows sampled in the first 7 days in milk
- 418 cows from 12 Michigan dairies



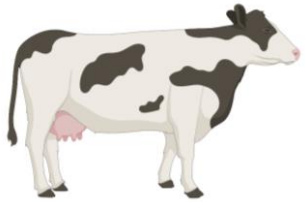
Ongoing study: Haptoglobin peaks on days 1 - 3



Ongoing study: Major variation across farms



What can we do?



Model: non-steroidal anti-inflammatory drugs (NSAID)

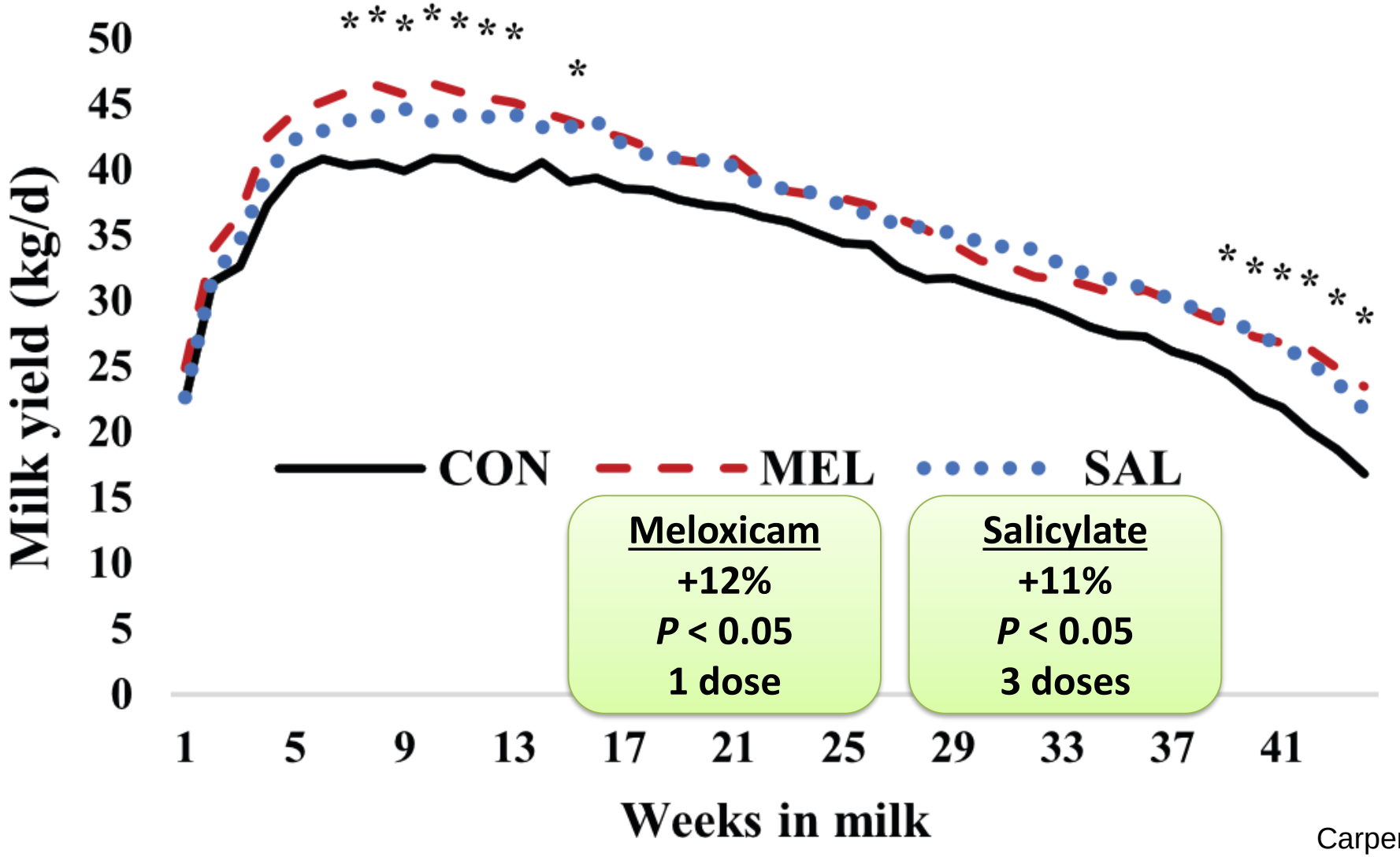
Postpartum NSAID study

1. **Na salicylate**
2. **Meloxicam**
3. **Placebo**

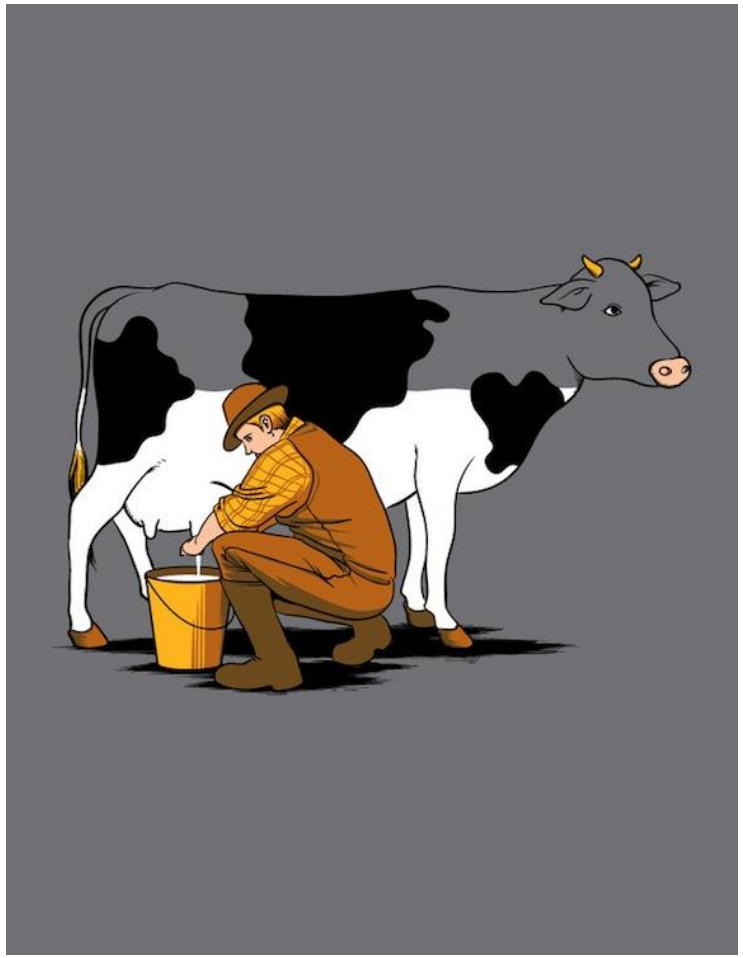
- Administered orally starting 24 h postpartum
- 51 multiparous cows per treatment

Carpenter et al., 2016

Anti-inflammatories in early lactation

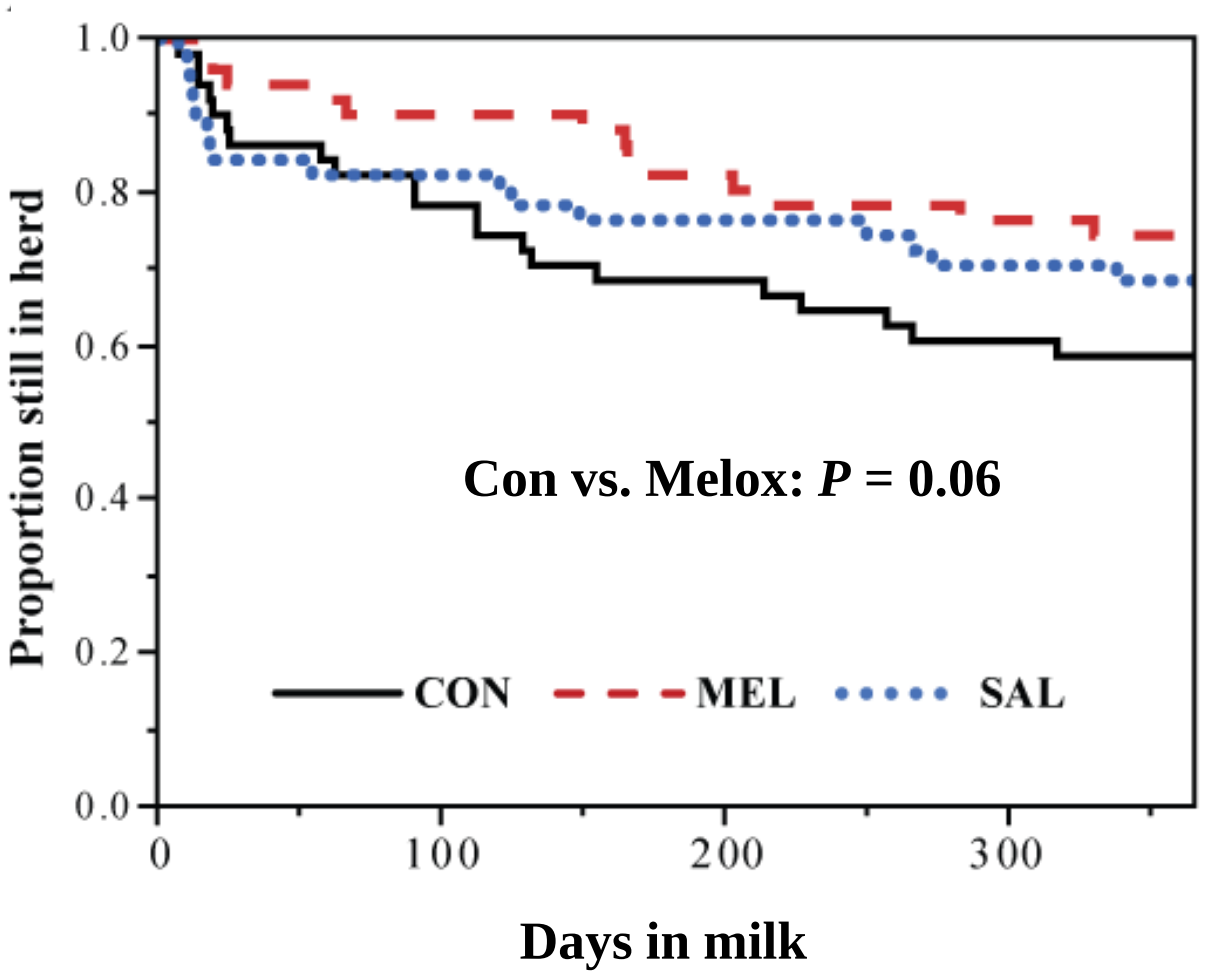


Carpenter et al., 2016



Too much milk?

Time to Leave Herd



Carpenter et al., 2016

NSAID and lameness

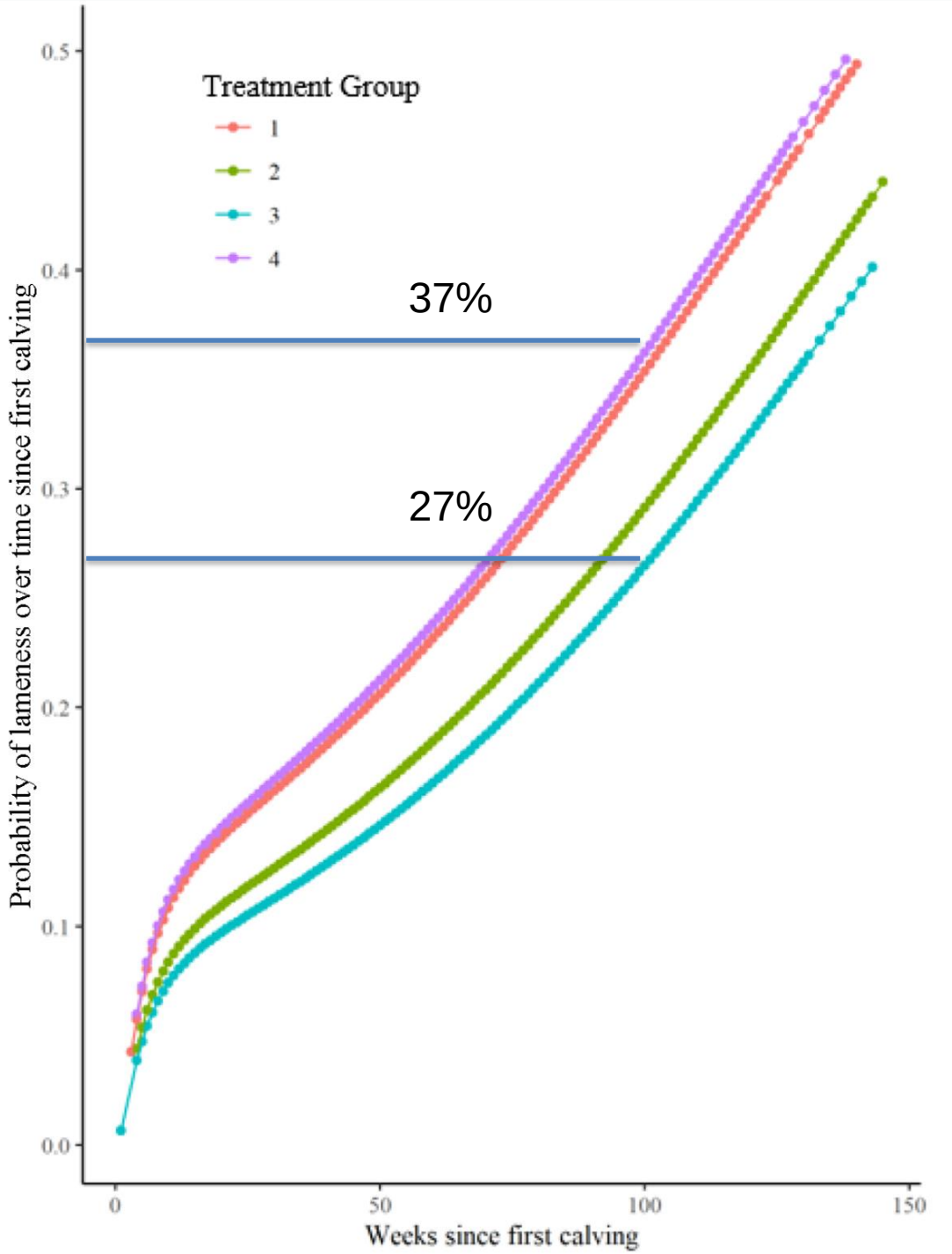
Treatment group	Treatment trim when identified lame	3-d course of NSAID when identified lame	3-d course of NSAID at first and subsequent calvings
1	Yes	No	No
2	Yes	Yes	No
3	Yes	Yes	Yes
4	No (unless severely lame)	Yes	No

- 438 heifers randomized to treatments prior to first calving
- Followed for 34 months

Wilson et al., 2022

NSAID and lameness

- Risk of lameness →
  and risk of severe lameness was significantly reduced by adding post-calving NSAID treatment to trim/treat protocol on lameness diagnosis
- The hazard of culling was reduced by 44% for this treatment compared to the trim-only protocol

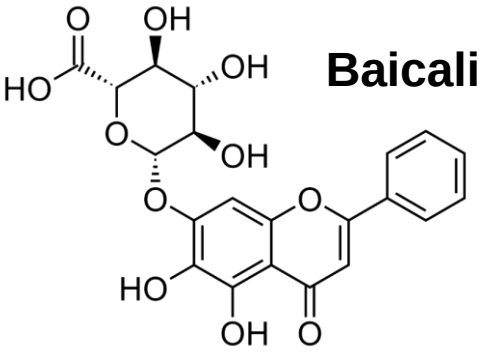


Wilson et al., 2022

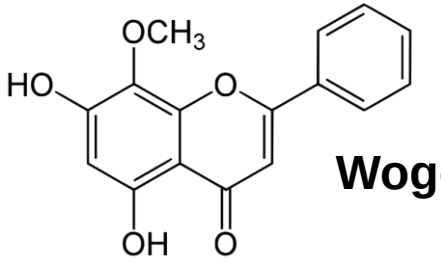
Are there dietary means to address inflammation?

Chinese skullap (*Scutellaria baicalensis*)

- Used in traditional Chinese medicine
- Liver-protective effects
- In vitro anti-tumoral effects
- Anti-inflammatory effects
- Effects in dairy cows?



Baicalin



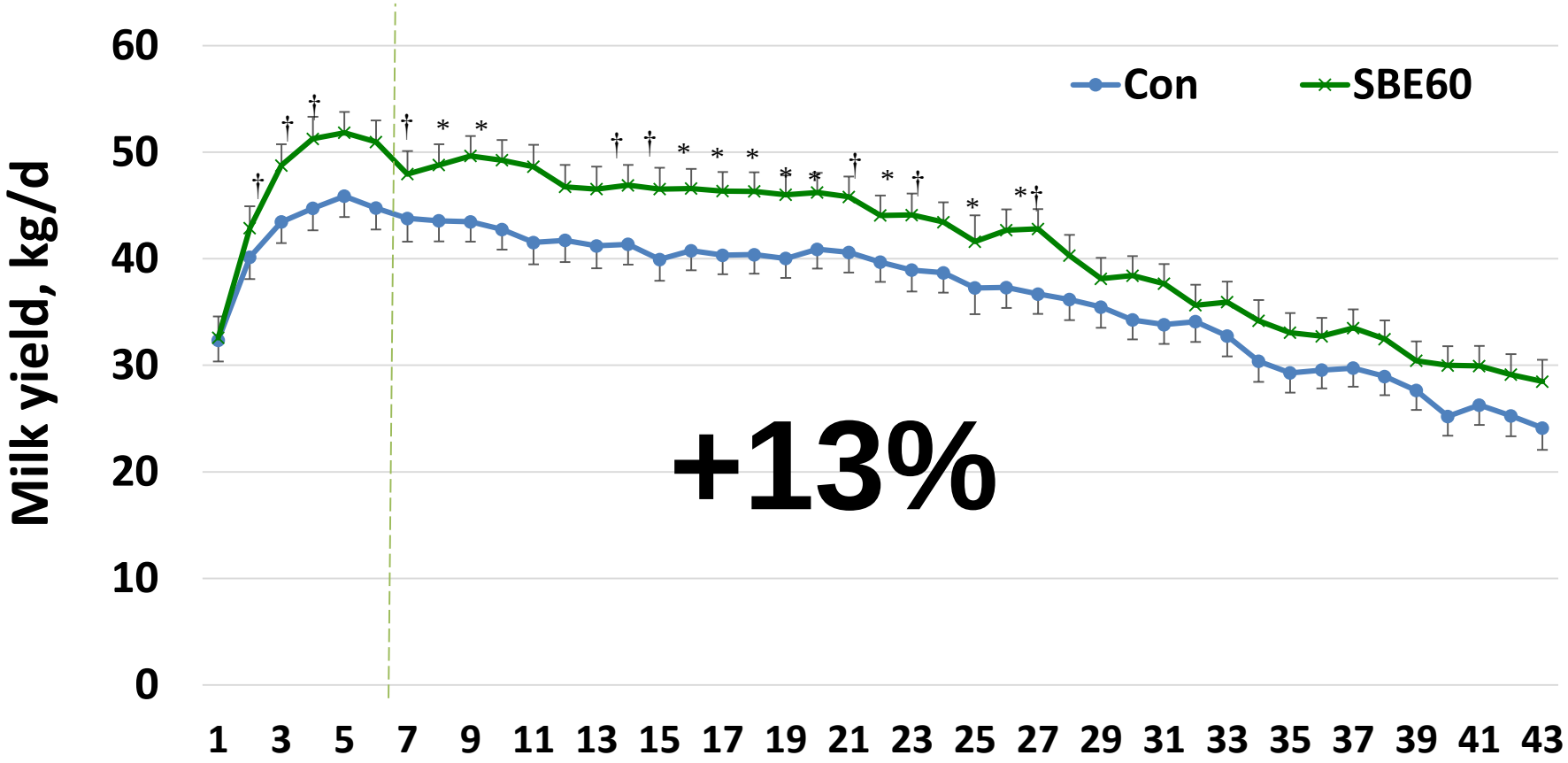
Wogonin

Chinese skullcap extract experiment

- 40 multiparous cows per treatment
- Randomized block design
- Commercial dairy farm with an automatic milking system (AMS)
- Treatment pre-mixed in concentrate pellet

Olagaray et al., 2019

Whole-lactation response to polyphenol supplement

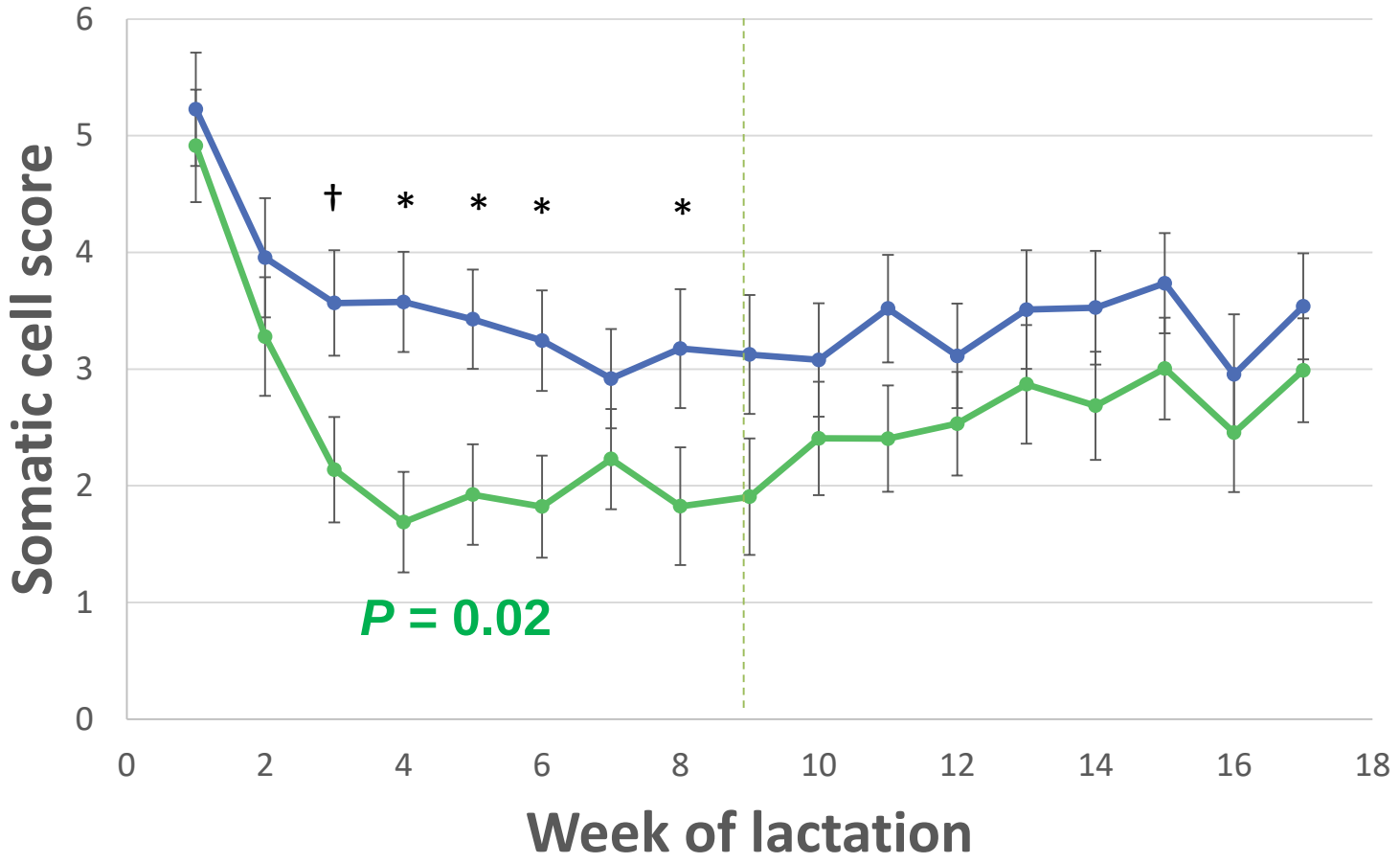


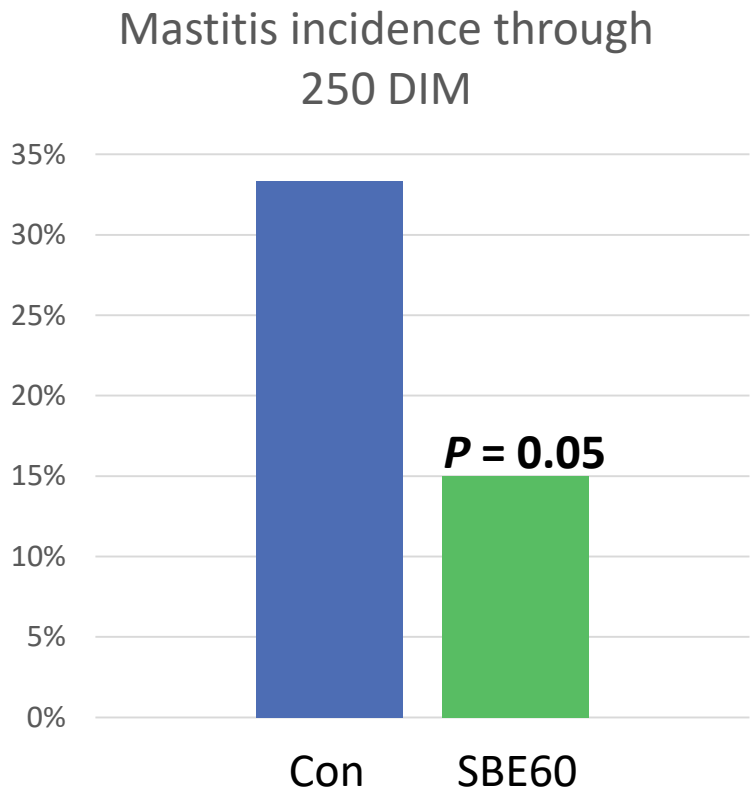
Con v. SBE60: *P* = 0.07

Con v. SBE60: *P* = 0.04

Olagaray et al., 2019

Decreased somatic cells point to reduced mammary inflammation





n = 39 – 43 / trt

Olagaray et al., 2019

An easy first step – no calving pen vaccinations

- Cornell survey of 72 farms with nearly 1,500 cows
- Assessed farm conditions and management factors associated with health, productivity, and fertility
- 8 of 72 farms vaccinated at least primiparous cows in the calving pen
- Calving pen vaccination was associated with:
  - A DOUBLING of 1st month disease incidence: **26.1%** vs. **13.5%** ± 5.0% (*P* = 0.02)
  - A 4-kg DROP in week 4 milk for multiparous cows: **43** vs. **47** ± 4.0 kg/d (*P* = 0.04)

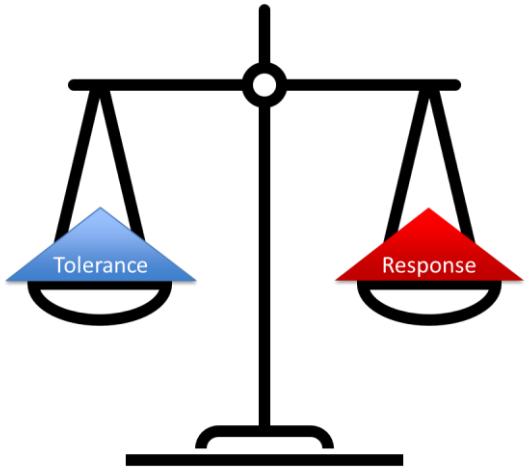
Kerwin et al., 2023

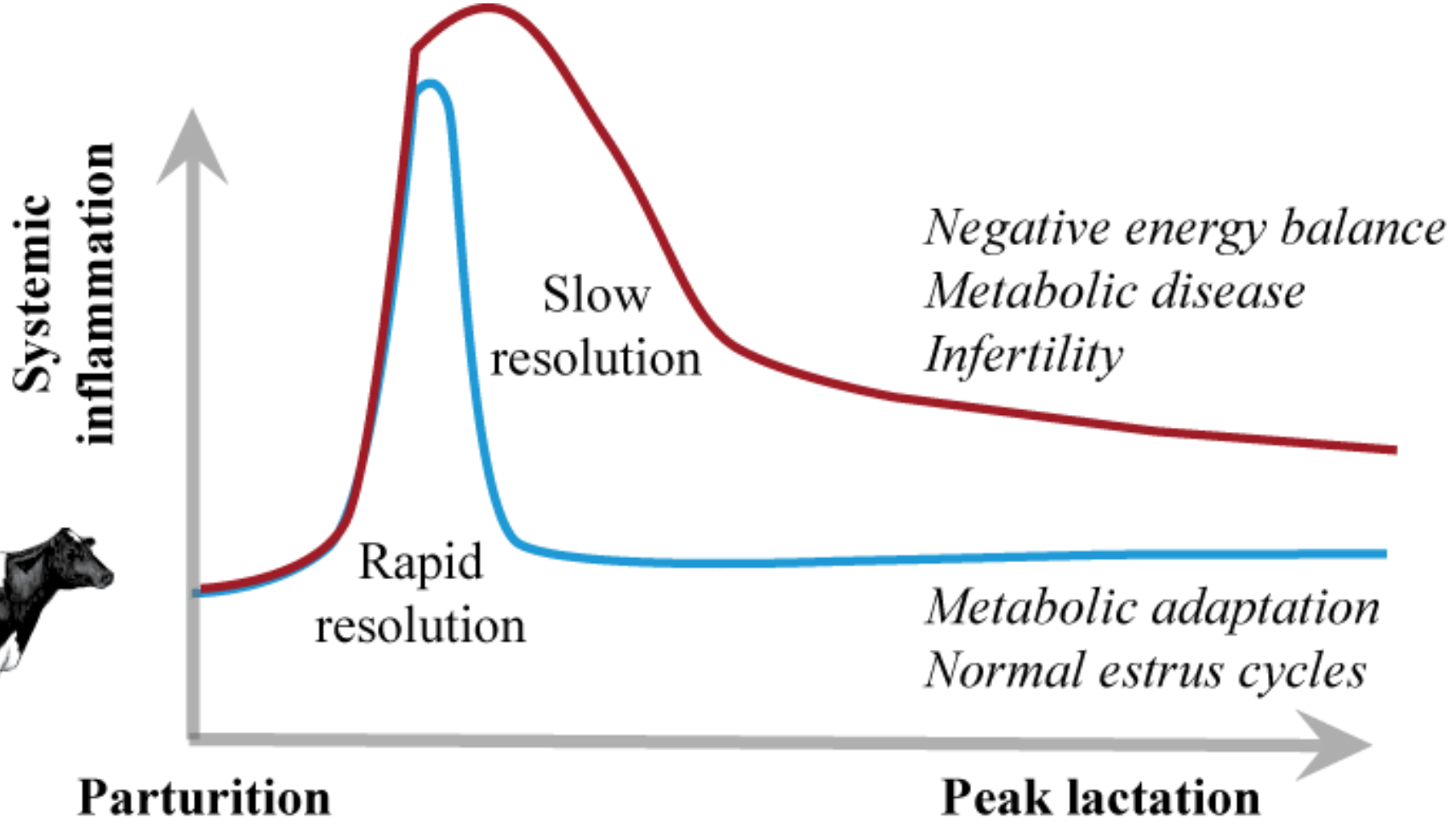
Inflammation: a double-edged sword

- Directly suppresses milk production
- Promotes joint problems and lameness
- Can lead to early pregnancy loss

- A critical component of an immune response
- Necessary for normal calving
- Part of everyday biology

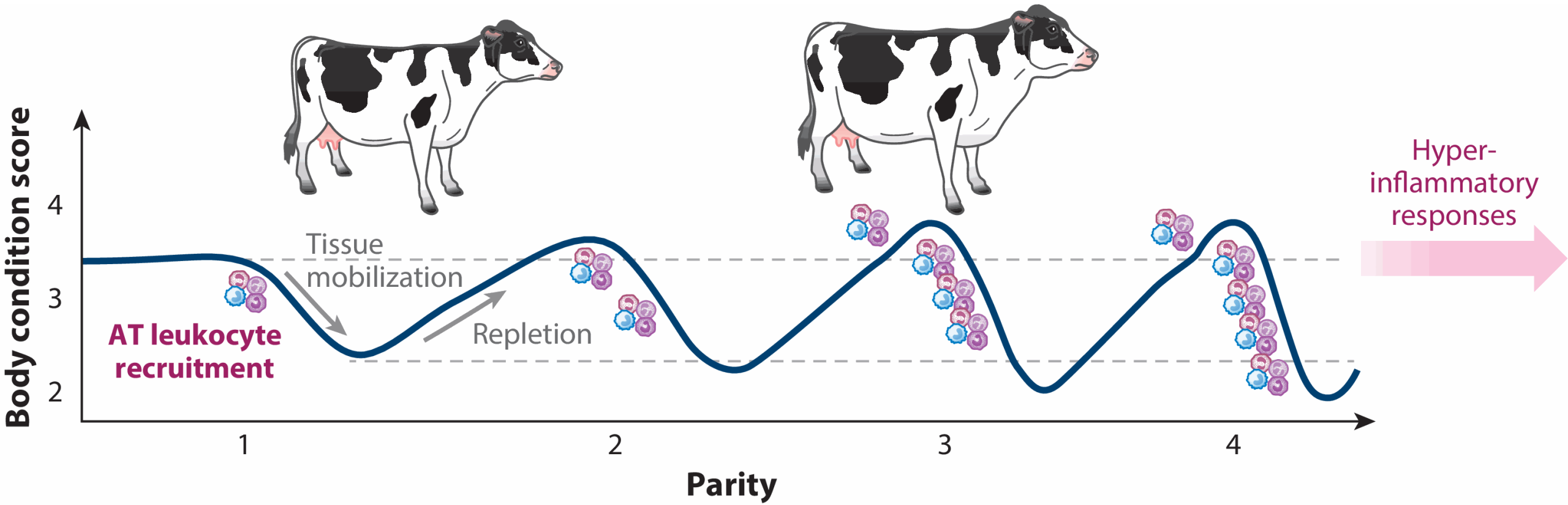
Resolution of inflammation is key to keeping in balance





Bradford et al., 2015

Evolving hypothesis: contribution of weight cycling?



Bradford BJ, Contreras GA. 2024
Annu. Rev. Anim. Biosci. 12:261–81

Anti-inflammatory feeding strategies

- Farm-level assessment can be carried out by measuring acute phase proteins with veterinary diagnostic labs
- Although the cost per cow/day for anti-inflammatory additives is expensive, the ~$10-$25 cost per lactation is similar to common transition treatments (if they are target-fed)
- Monitor for changes over months

Thank you! Questions?

Barry Bradford

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