United States Department of Agriculture

National Institute of Food and Agriculture

Award # 2012-02115
NIFA AFRI Translational Genomics for Improved Fertility of Animals

Genomic Selection for Improved Fertility of Dairy Cows with Emphasis on Cyclicity and Pregnancy

http://agrilife.org/afridairycowfertility/

Transition management: Grouping Strategies and Reproduction

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Strategies to Improve Transition Cow Health

- Management
  - Duration of the close-up period
  - Reproductive management
  - Comfort
    - Minimize heat stress
  - House heifers and cows separately
  - Stocking density
  - Regrouping
- Nutritional
  - Intake: dry matter and water
  - Anionic salts
    - ↓ Hypocalcemia
  - Monensin and choline
    - ↓ Ketosis
  - Fatty acids (omega 6)
    - ↑ Pro-inflammatory
- Hormonal
  - rbST
    - ↑ Immunity & ↓ ketosis

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- **"Our challenge is to differentiate between little non-threatening stresses of life and those stress that adversely affect an animal's welfare"**

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Animal Well-being:

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Public Perception  Profitability

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Science Based Guidelines

Model of the Biological Response of Animals to Stress

Adapted from Moberg and Mench, 2000

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Recognition of a Threat to Homeostasis

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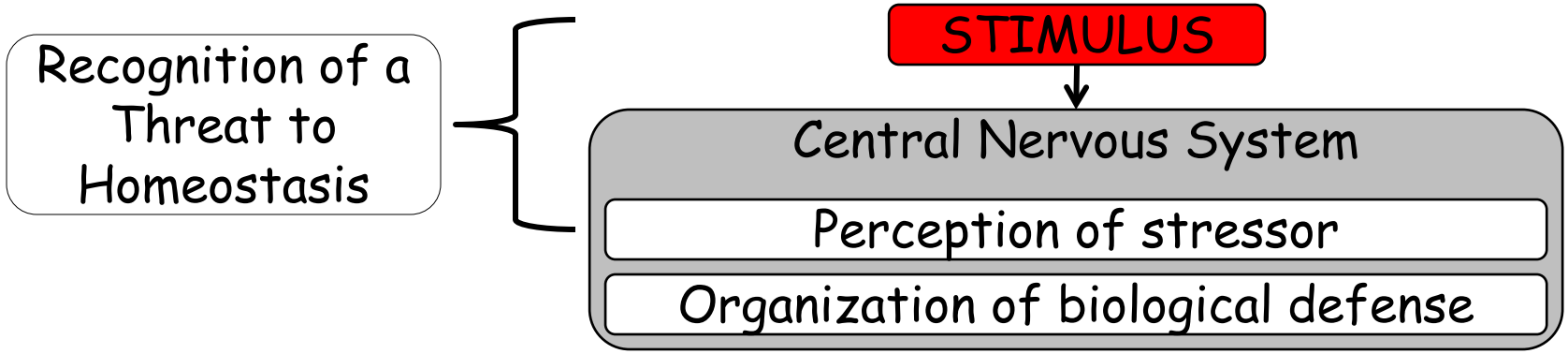

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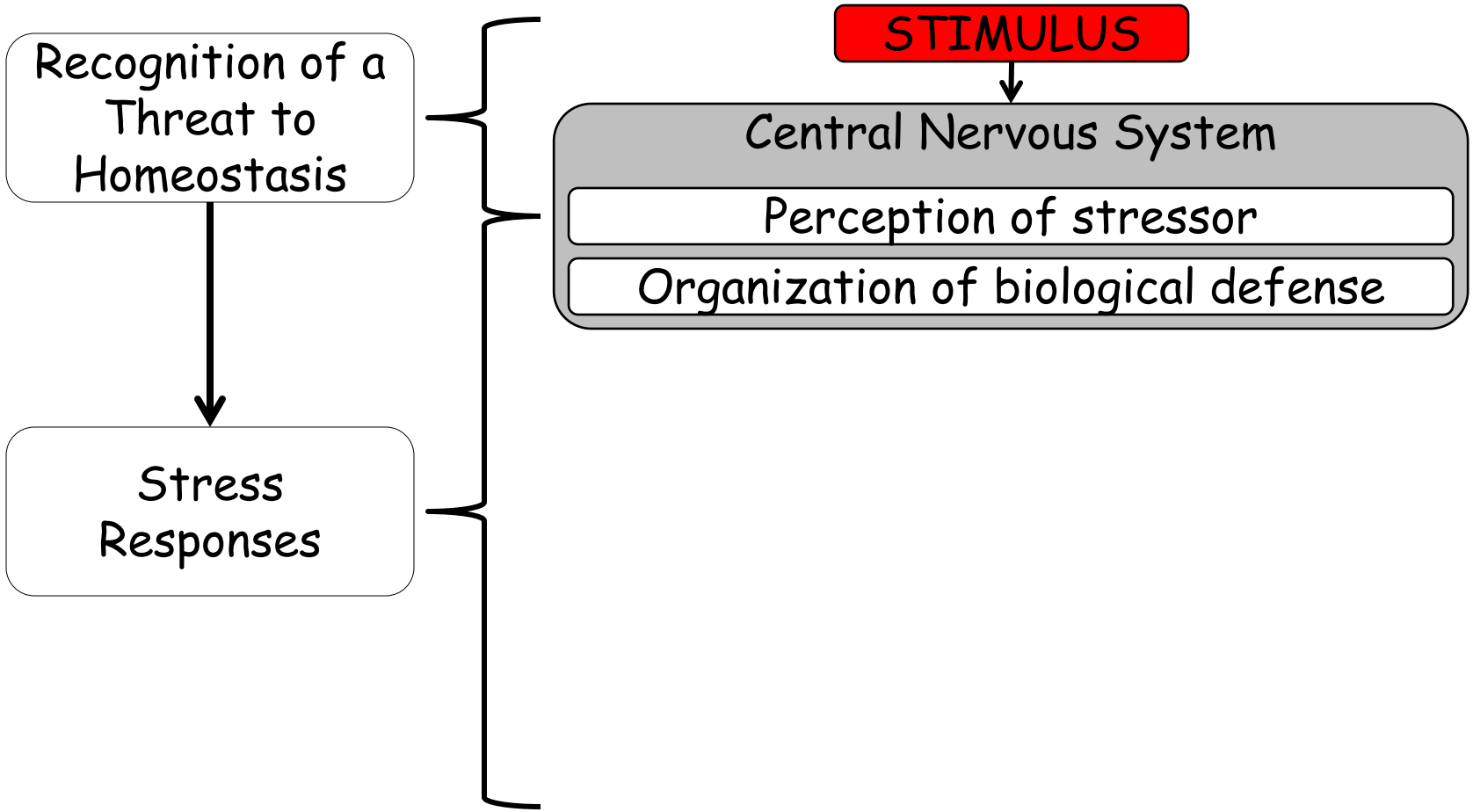

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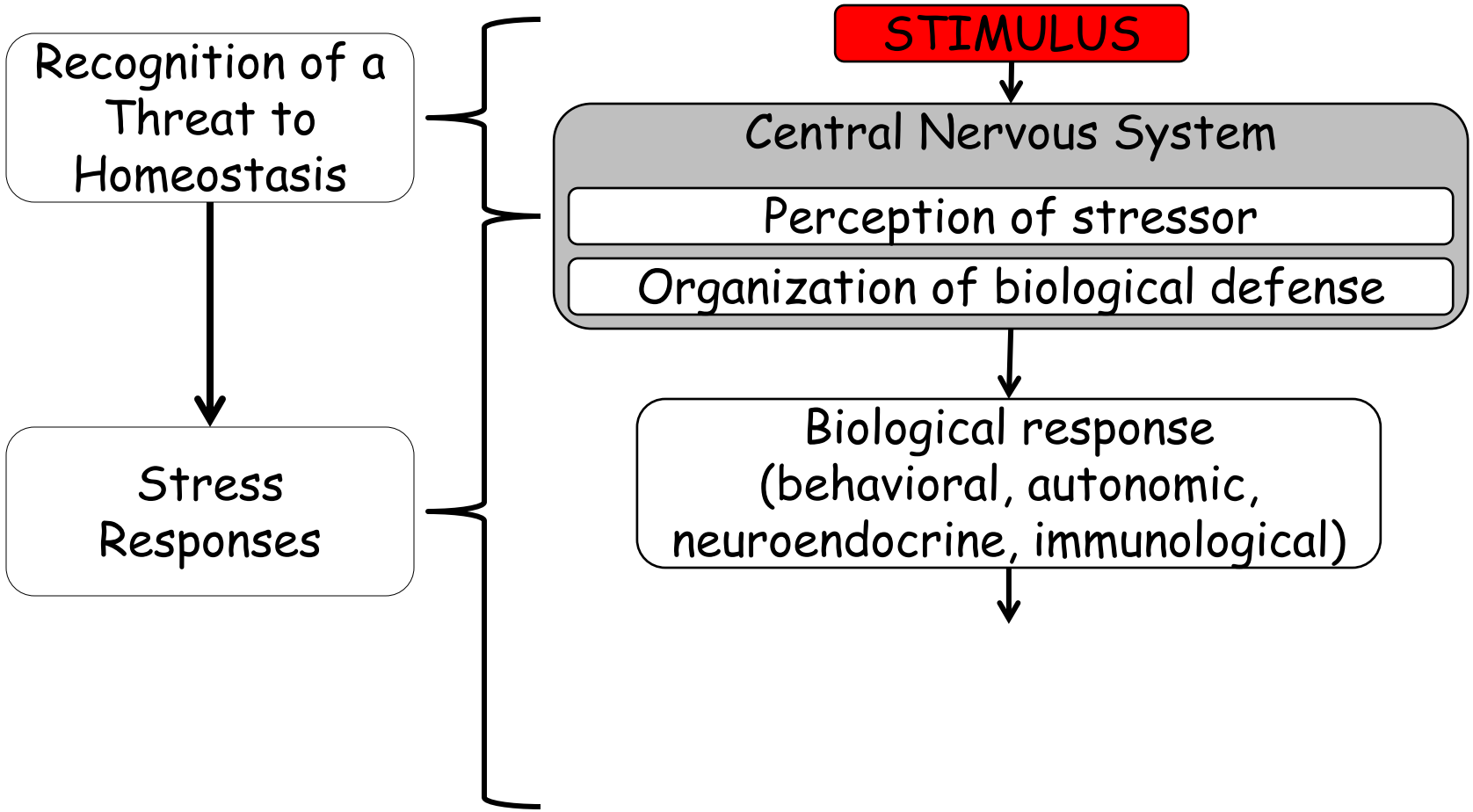

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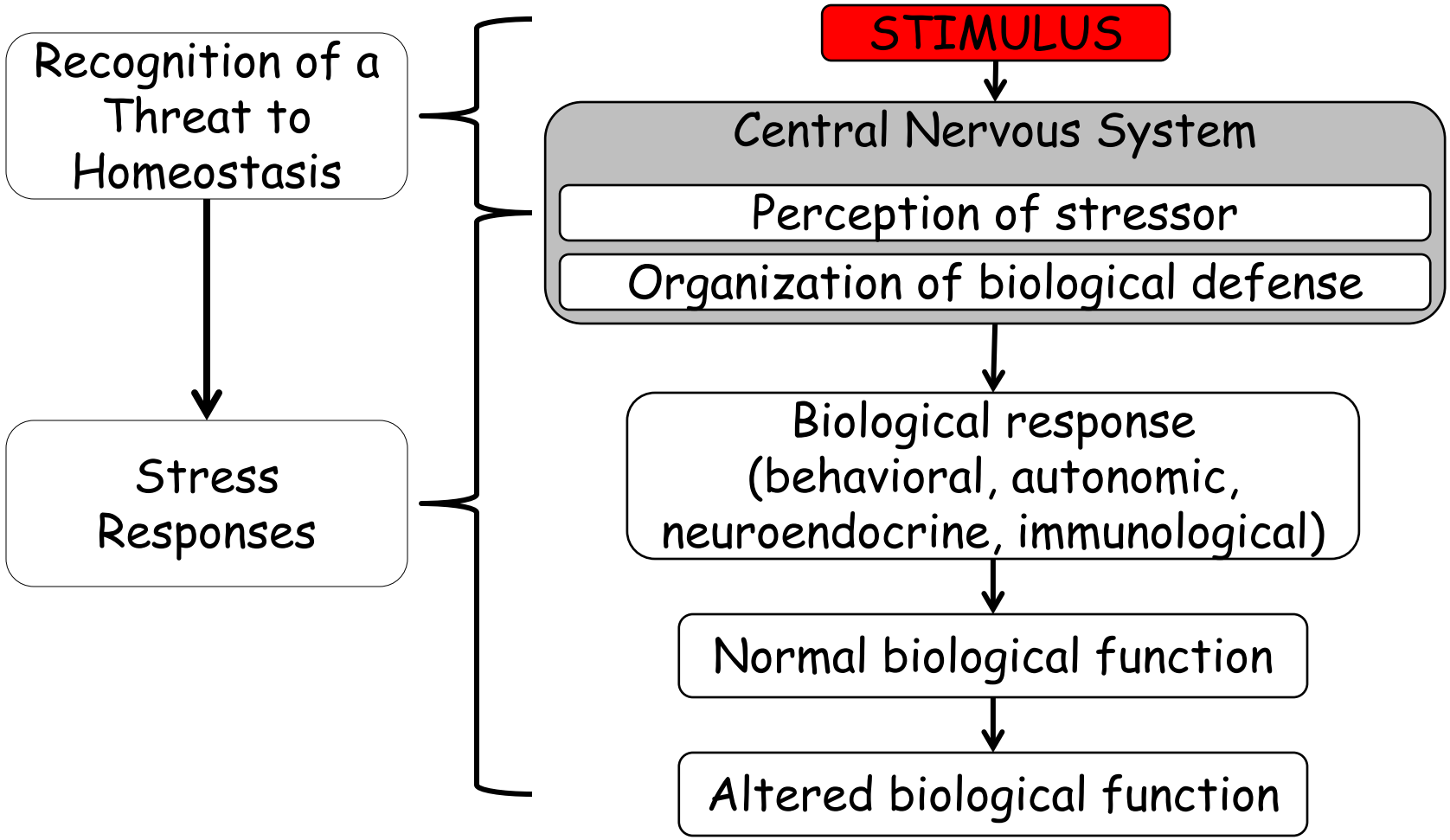

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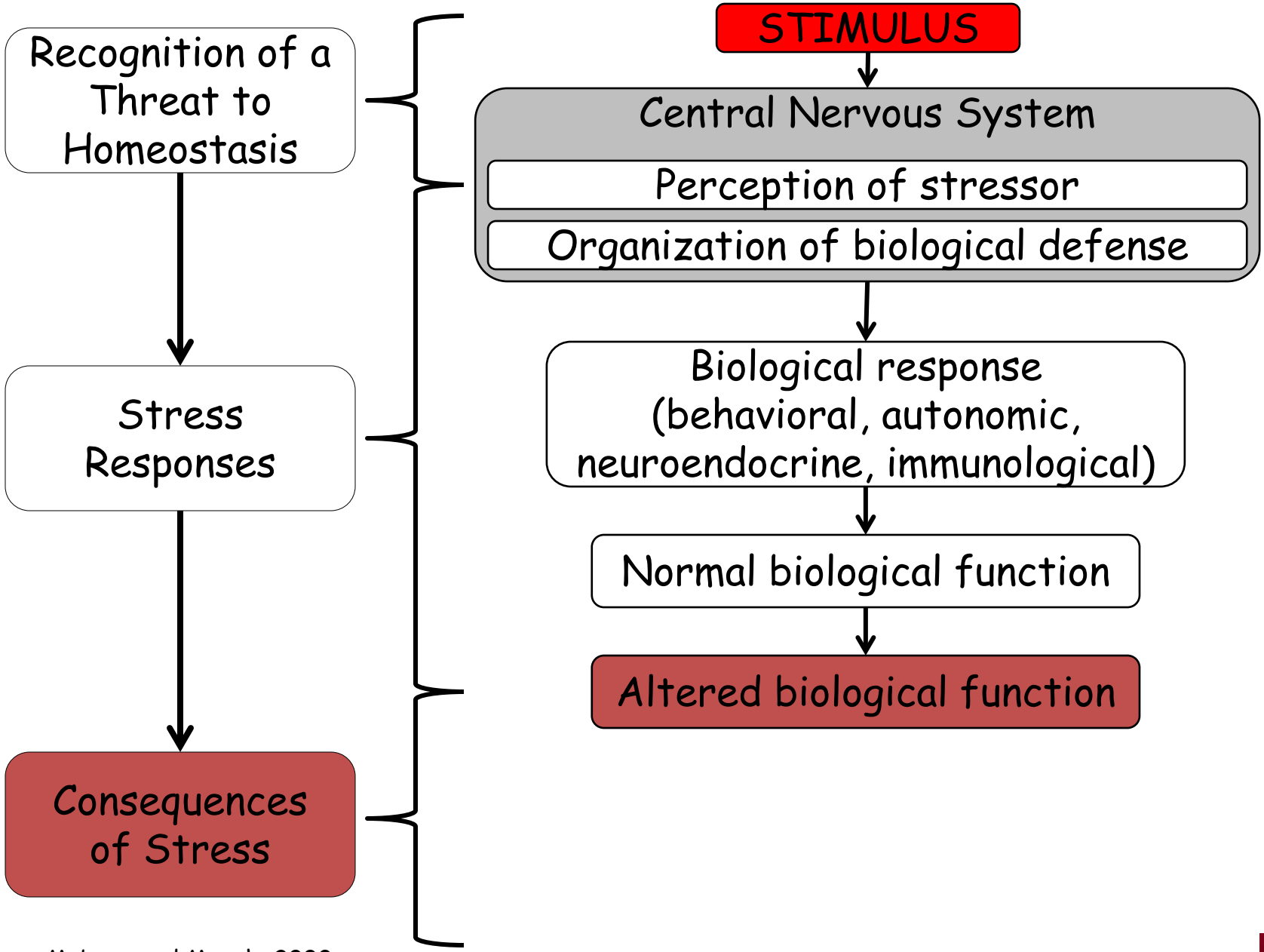

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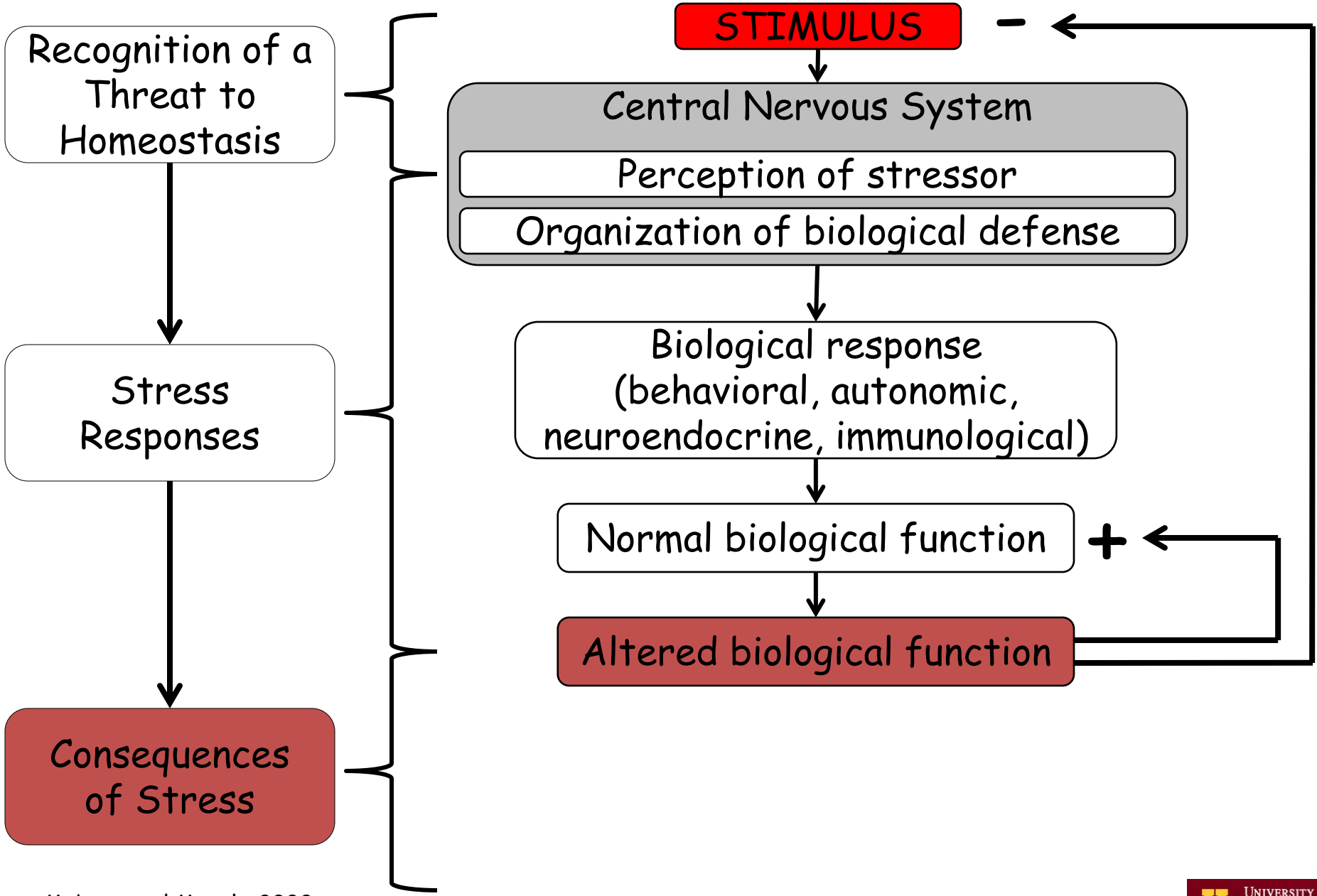

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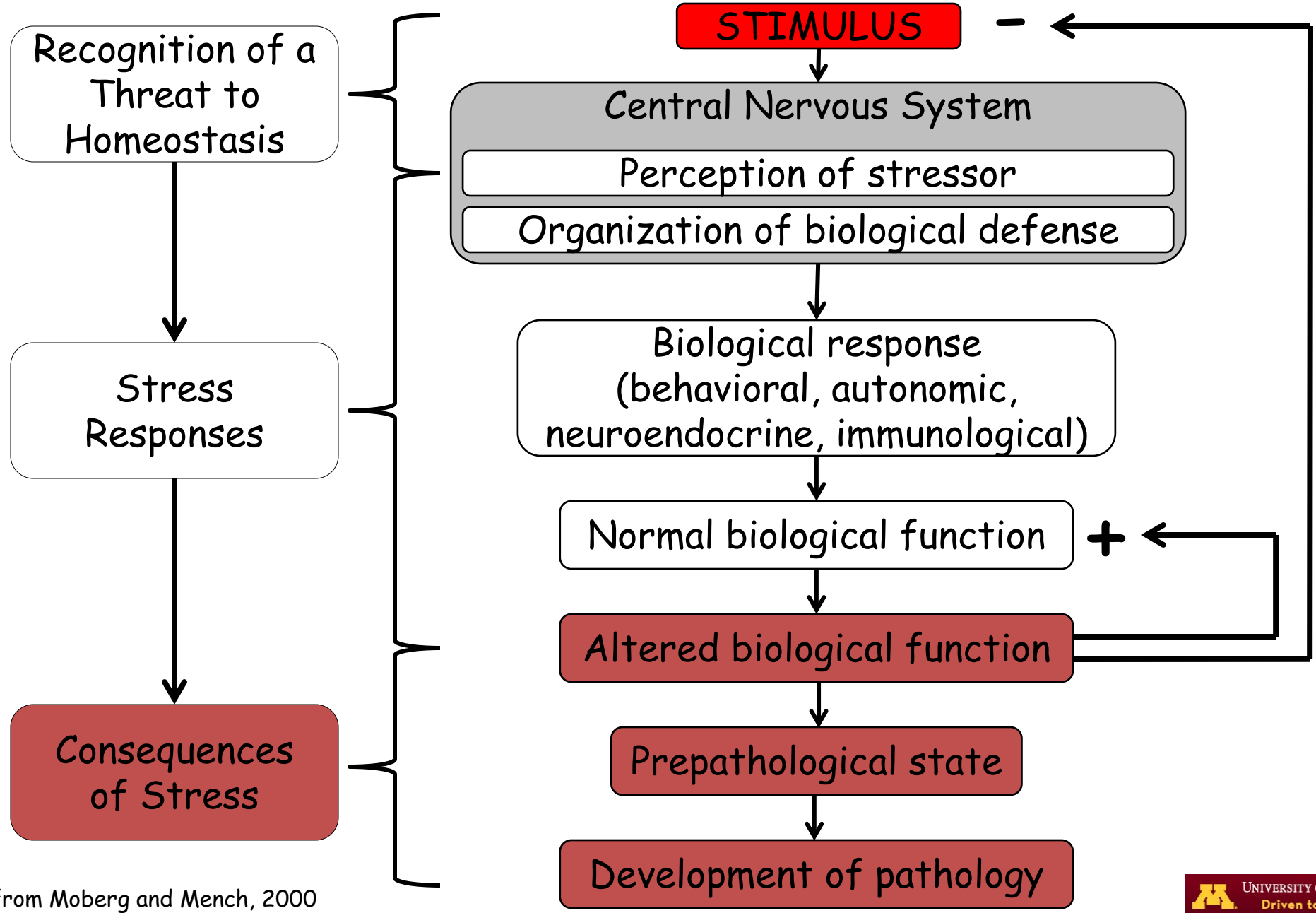

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- Behavior
  - Removal from the stressful situation (heat stress = shade and water; subordinate cow avoids feeding at the same time as a dominant cow)

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What is the Ideal Stocking Density in the Prepartum Period?

Effect of Overstocking on Feeding Behavior

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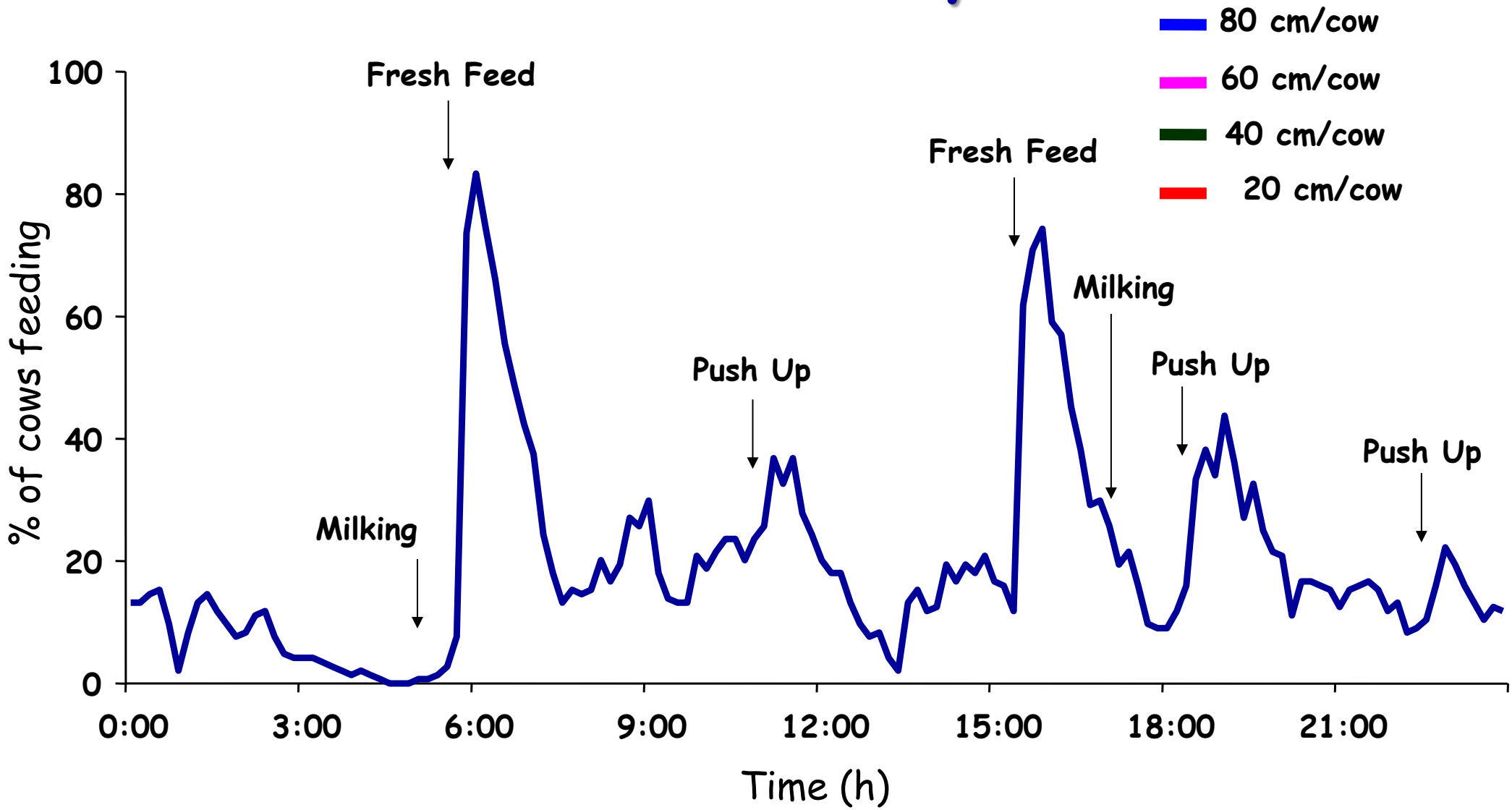
Effect of Feed Bunk Space on Feeding Behavior of Dairy Cows



courtesy : T. DeVries

Huzzey et al. (2006)

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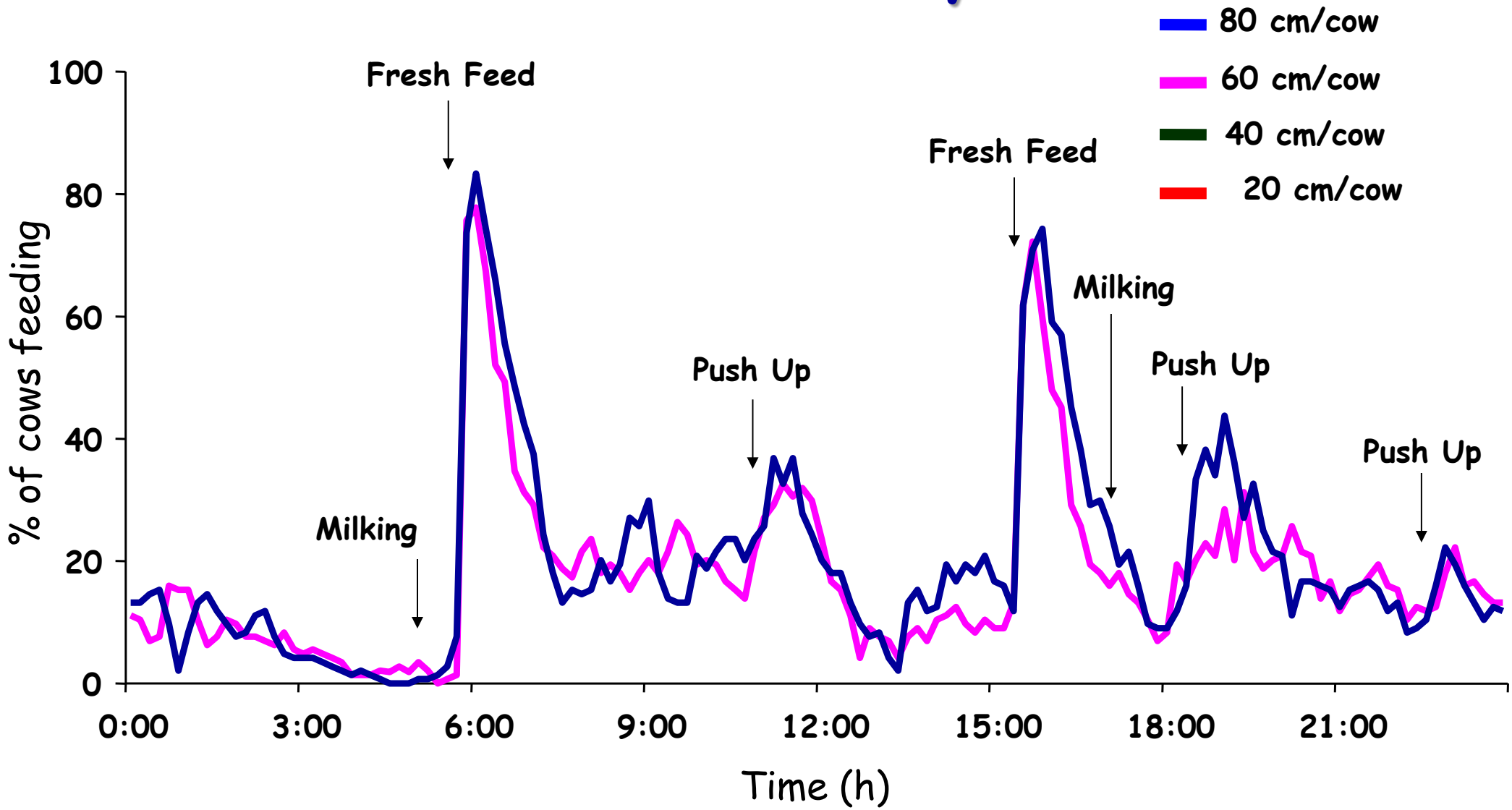

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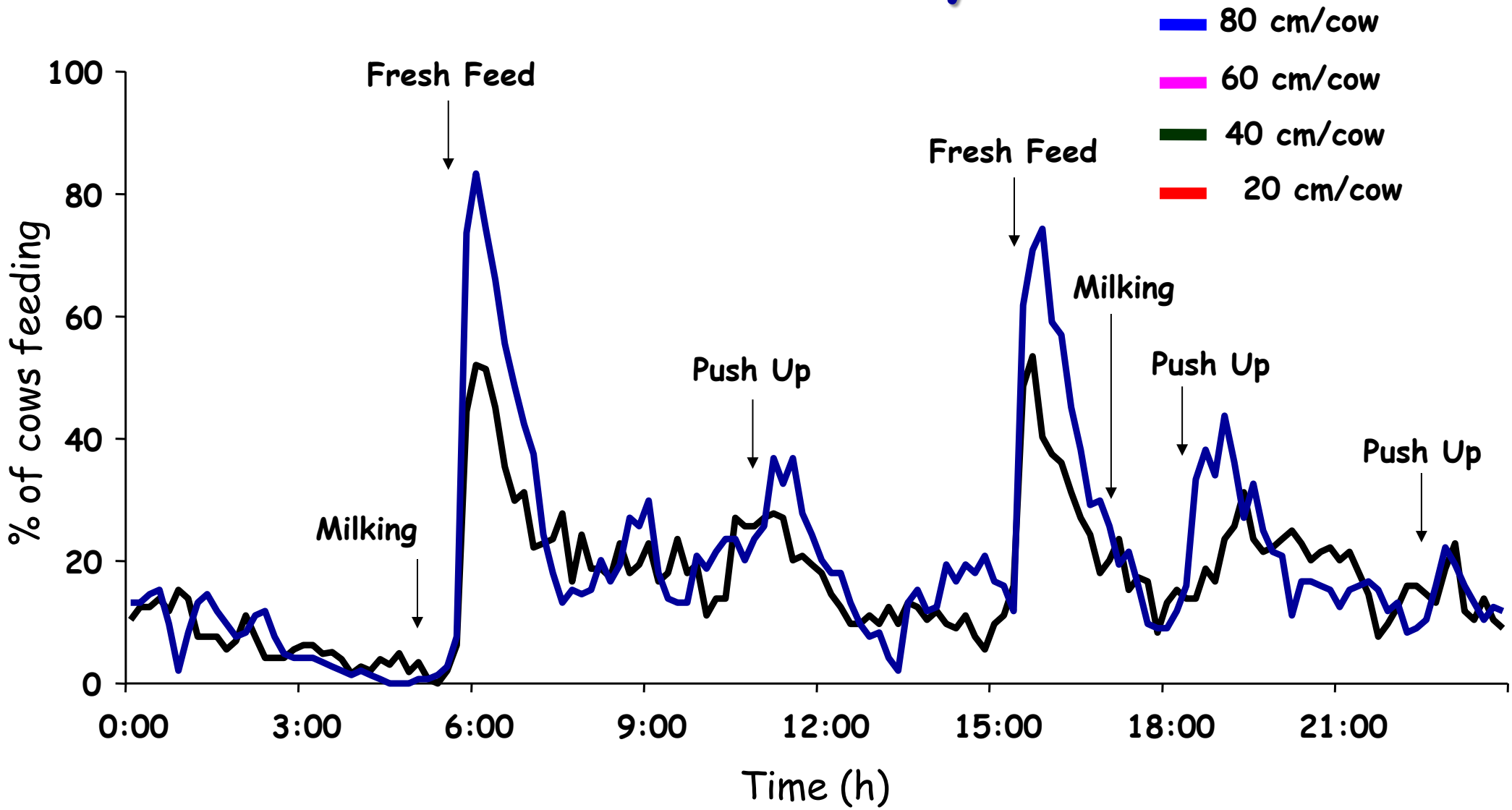

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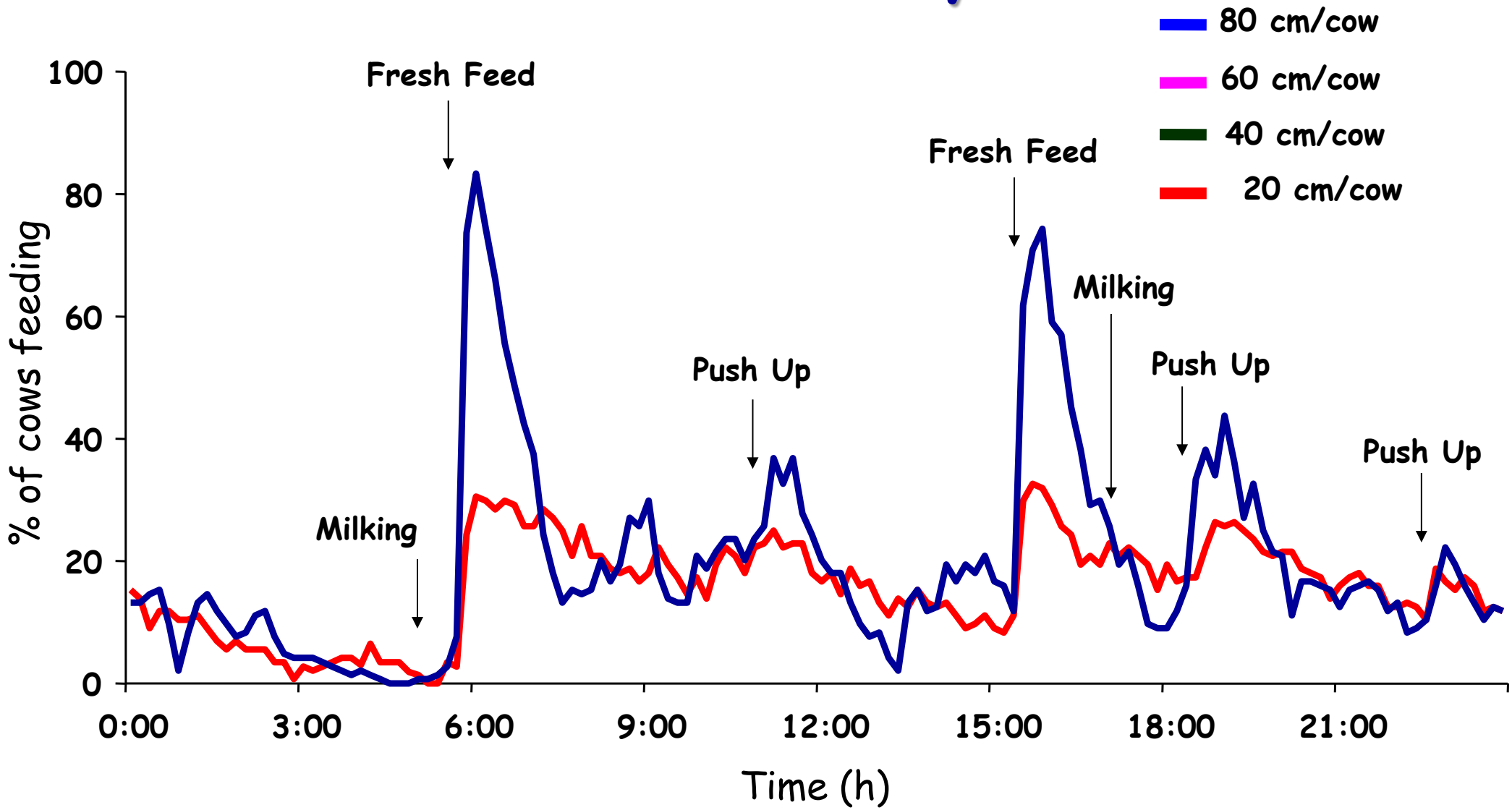

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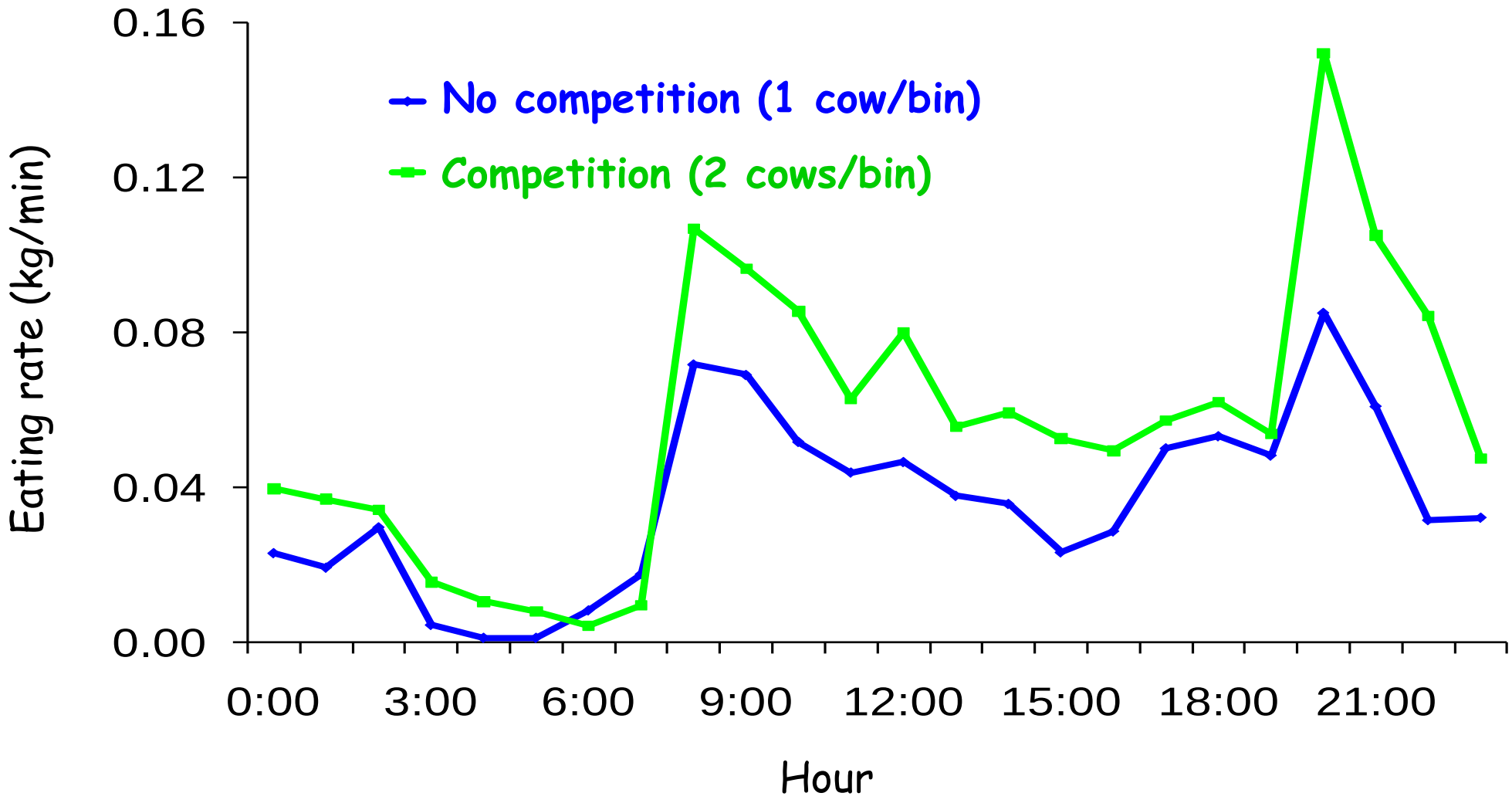
Effect of Competition on Feeding Behavior



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  - Affect metabolism of first lactation cows by increasing cortisol secretion and predisposing them to more lipolysis and insulin resistance/desensitization (Huzzey et al., 2012)

Association Between Prepartum Stocking Density and Production

Oetzel et al, 2007

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  - Nulliparous animals produced 0.73 kg/d less milk for every 10% unit increase in stocking density above 80%
- Retrospective data not controlled for changes in ration, season, management, etc.

Oetzel et al, 2007

Effect of Prepartum Stocking Density on Performance

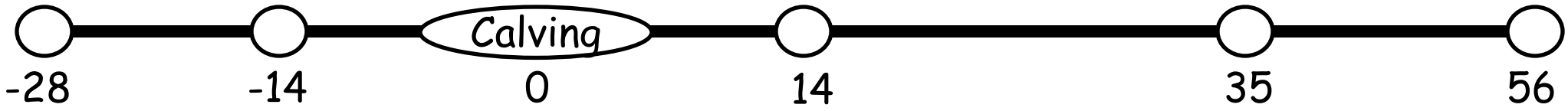
- Hypothesis was that reducing prepartum stocking density (100 vs 80% of headlocks) would improve performance of lactating cows
- Nulliparous (n = 324) and parous (n = 404) animals assigned to one of two treatments at 28 d before expected calving date
  - 80SD = 38 animals, 48 headlocks, and 44 stalls
  - 100SD = 48 animals, 48 headlocks, and 44 stalls
  - Nulliparous and parous animals separate throughout the study
- After calving, animals from different treatments were commingled in the same pens

Prepartum Pen Design

SD80: 38 cows, 80% headlocks, 86% stalls

SD100: 48 cows, 100% headlocks, 109% stalls

Effect of Stocking Density on Immune, Health, Reproductive and Productive Parameters



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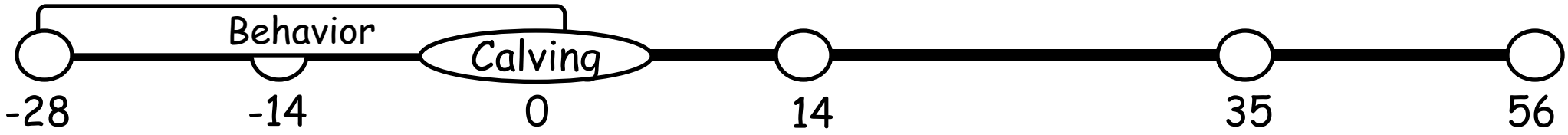

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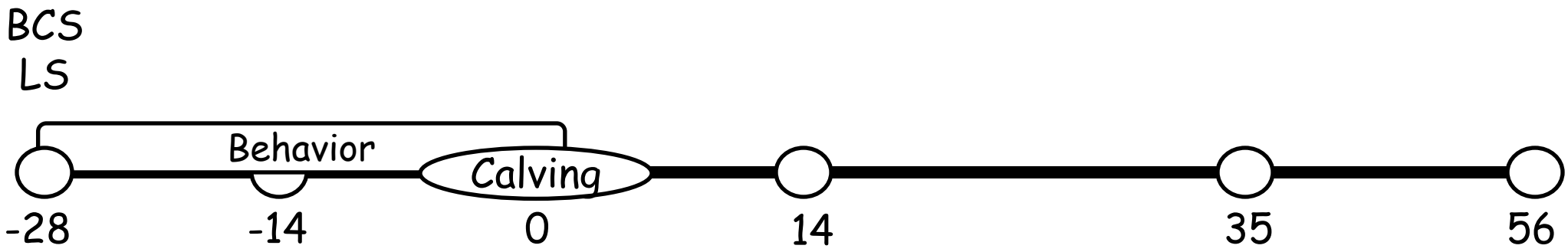

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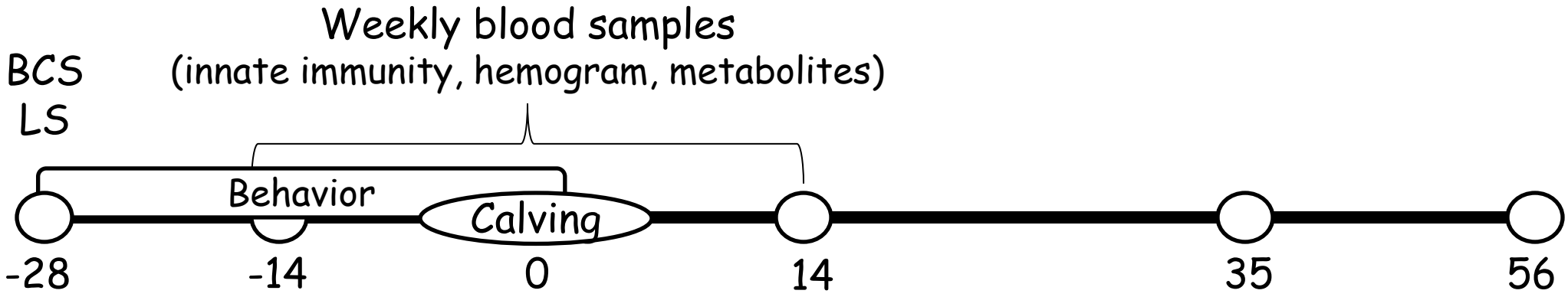

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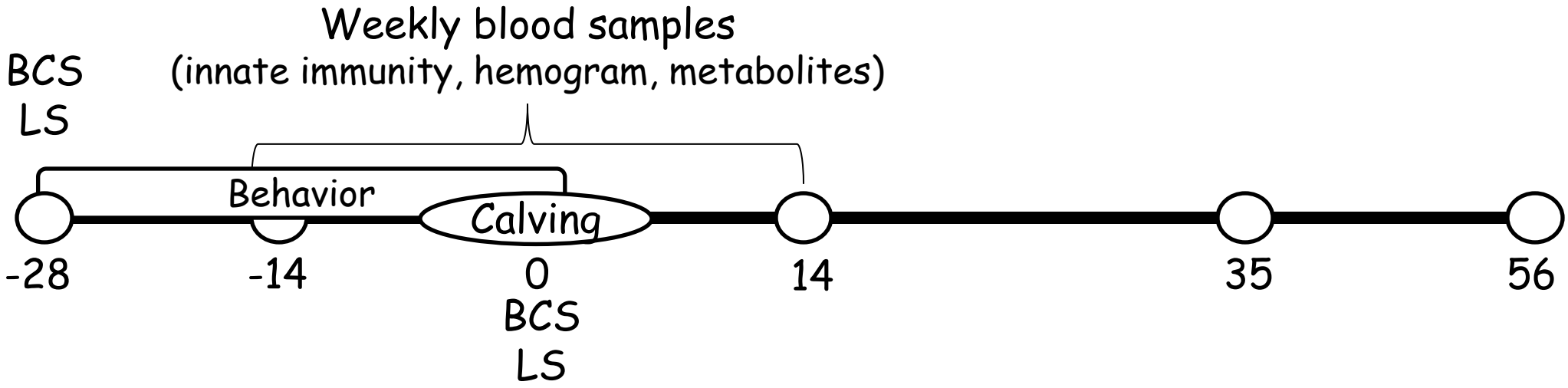

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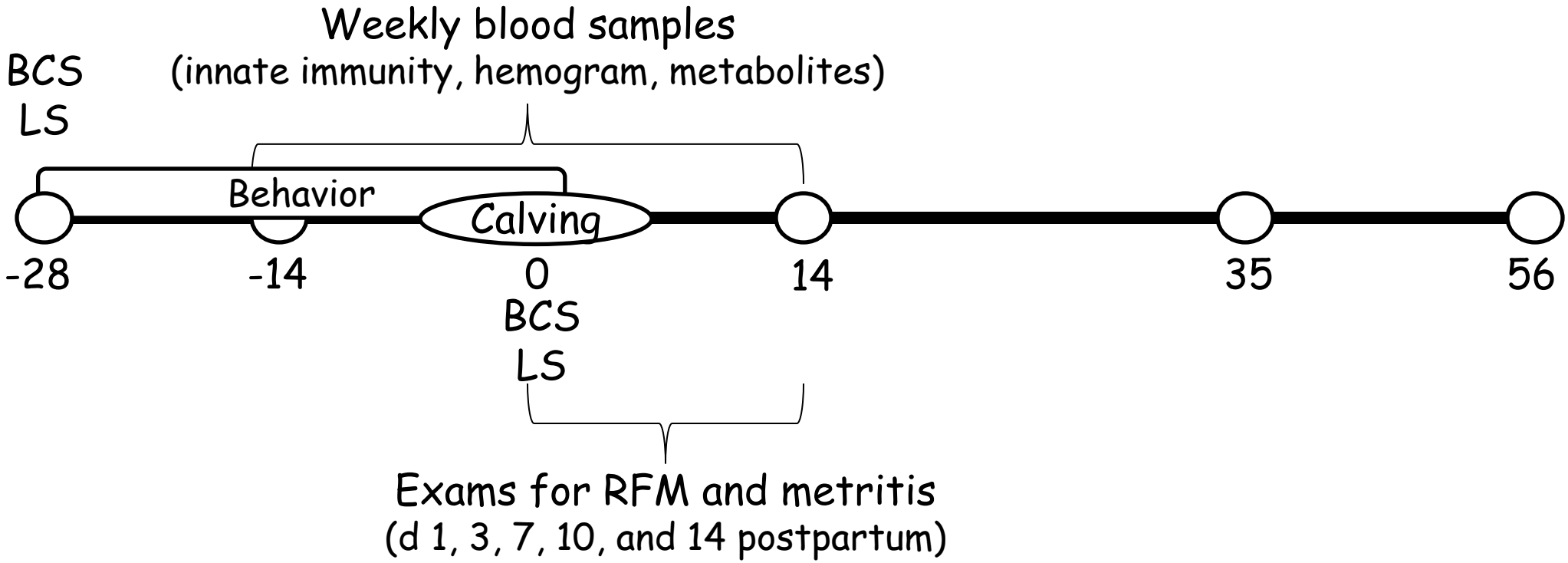

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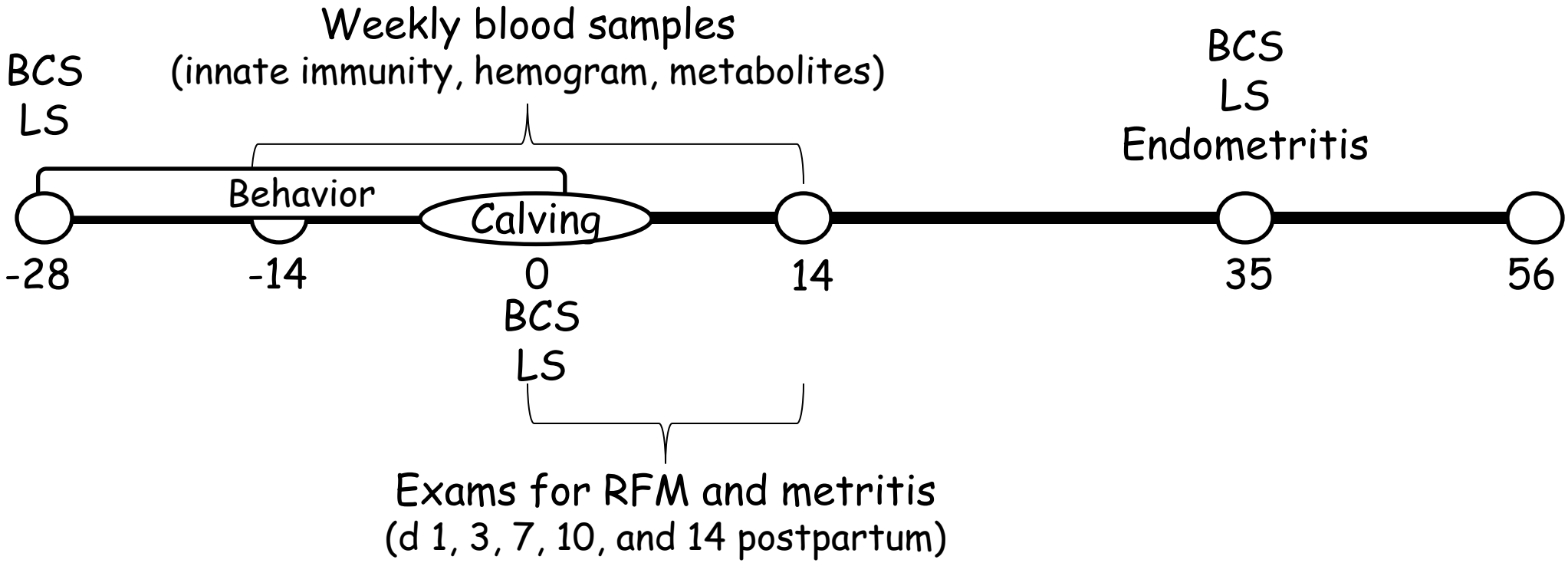

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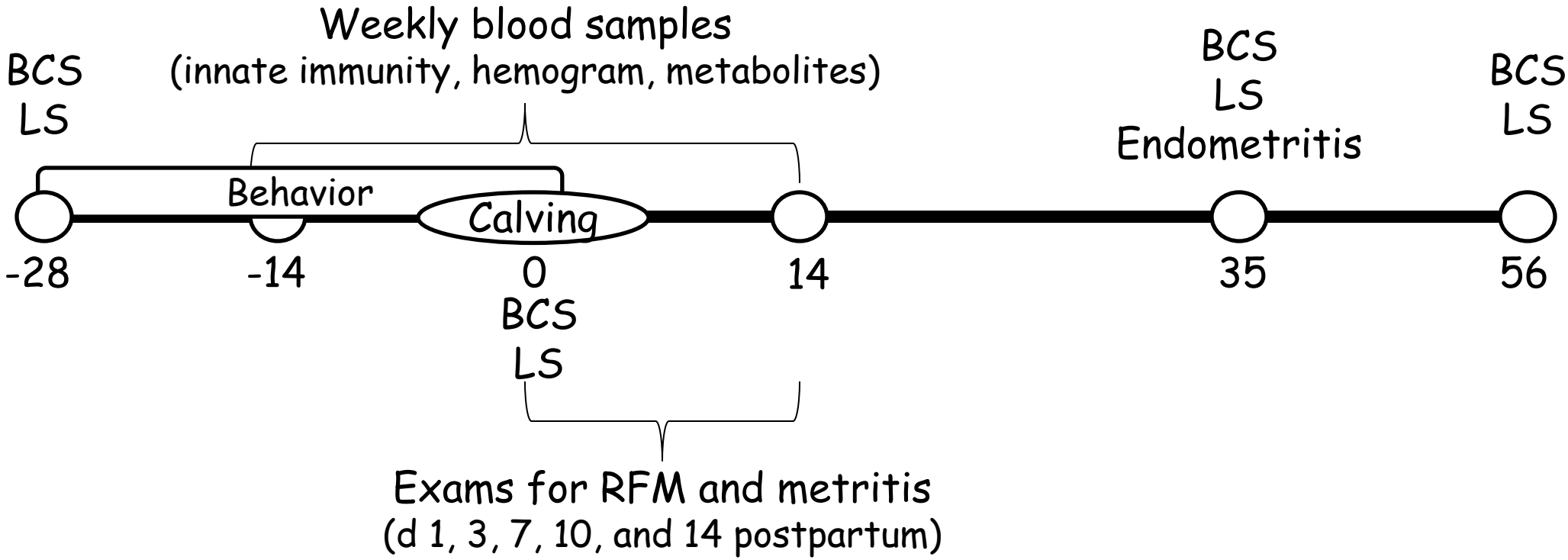

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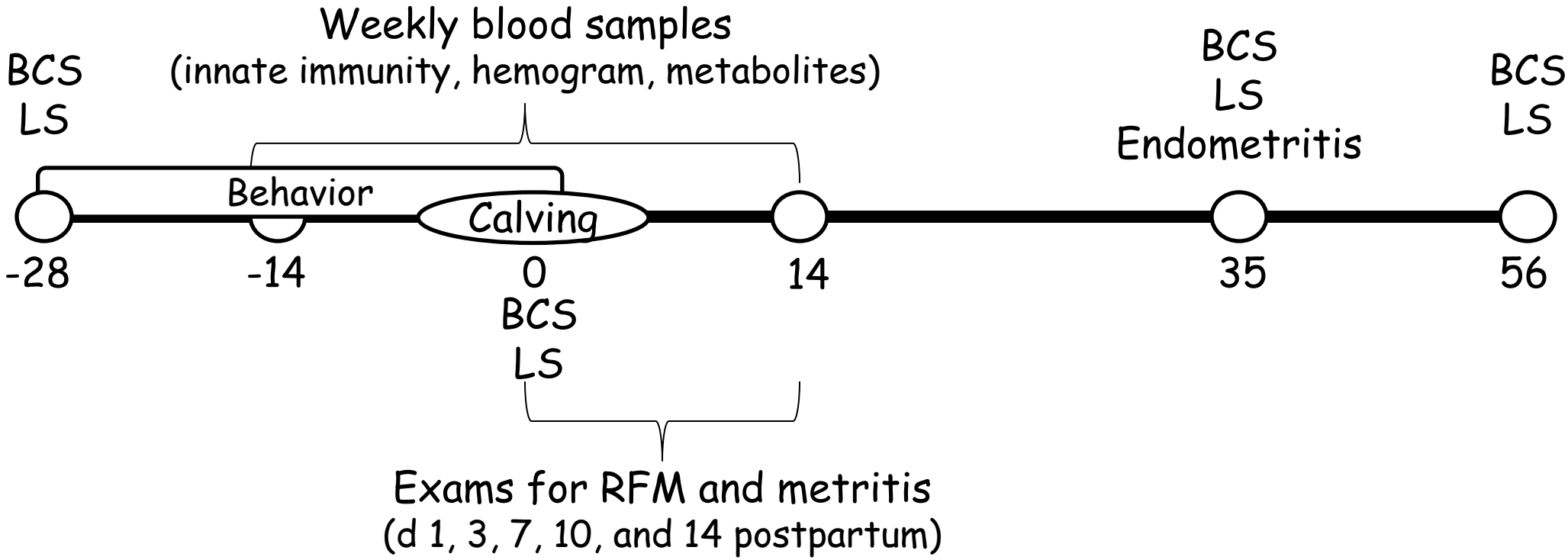

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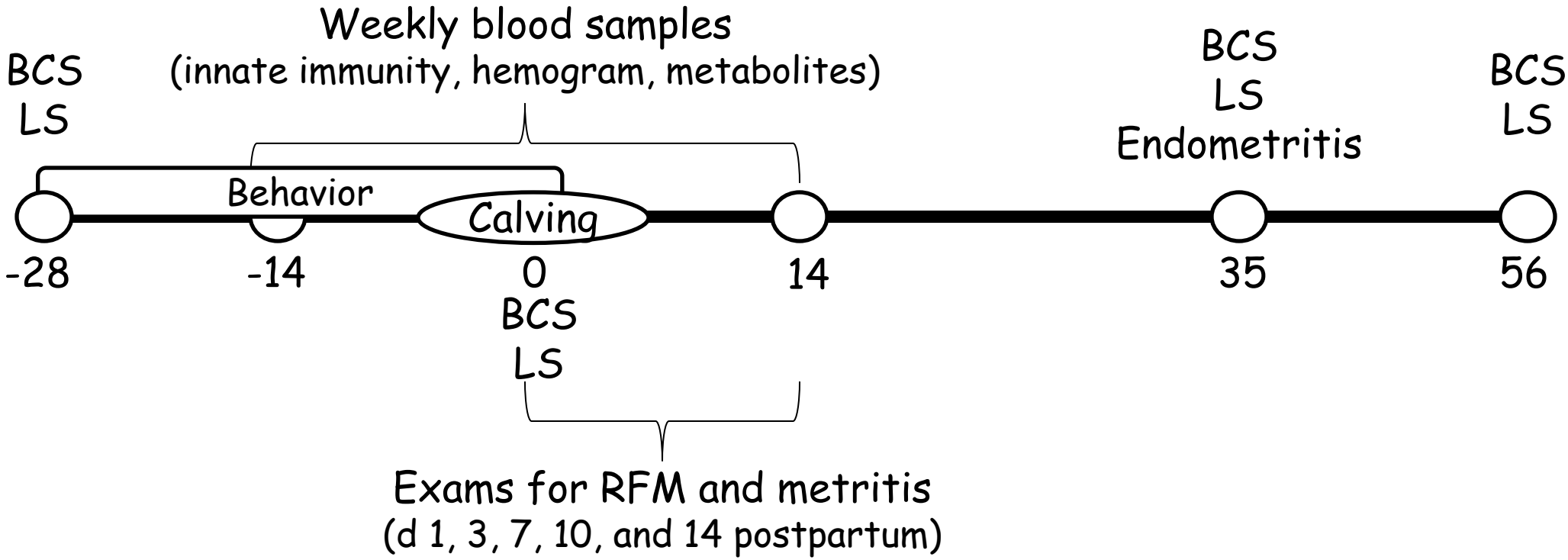

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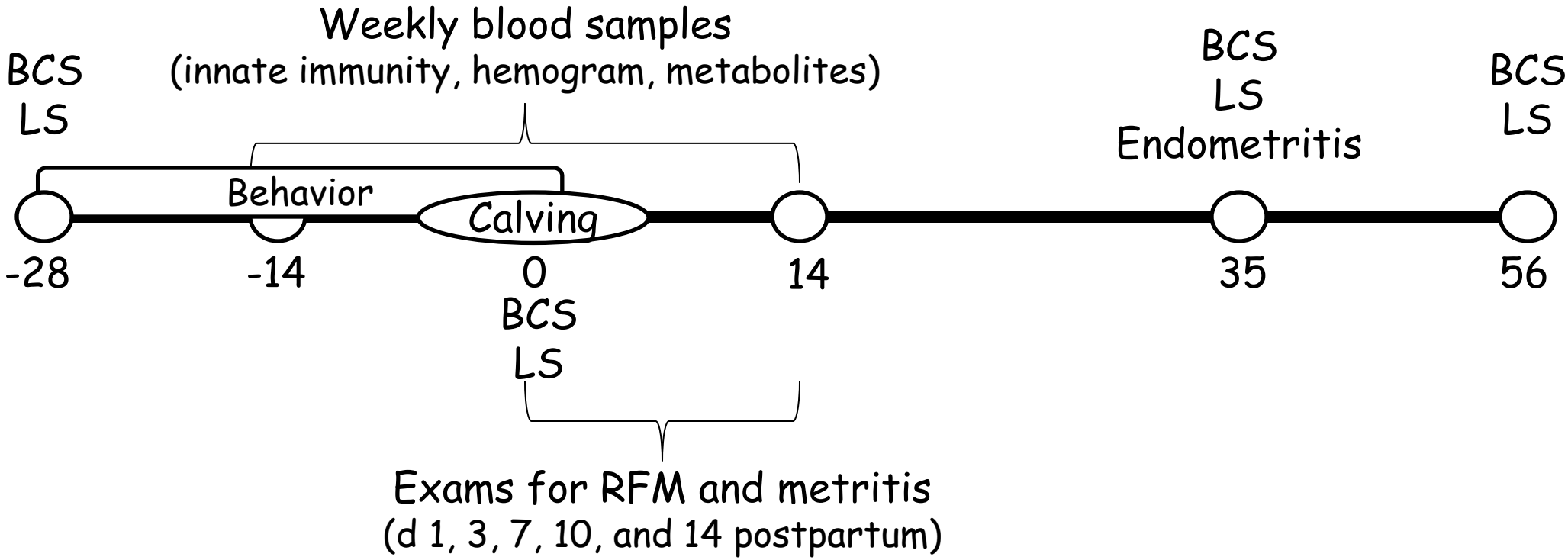

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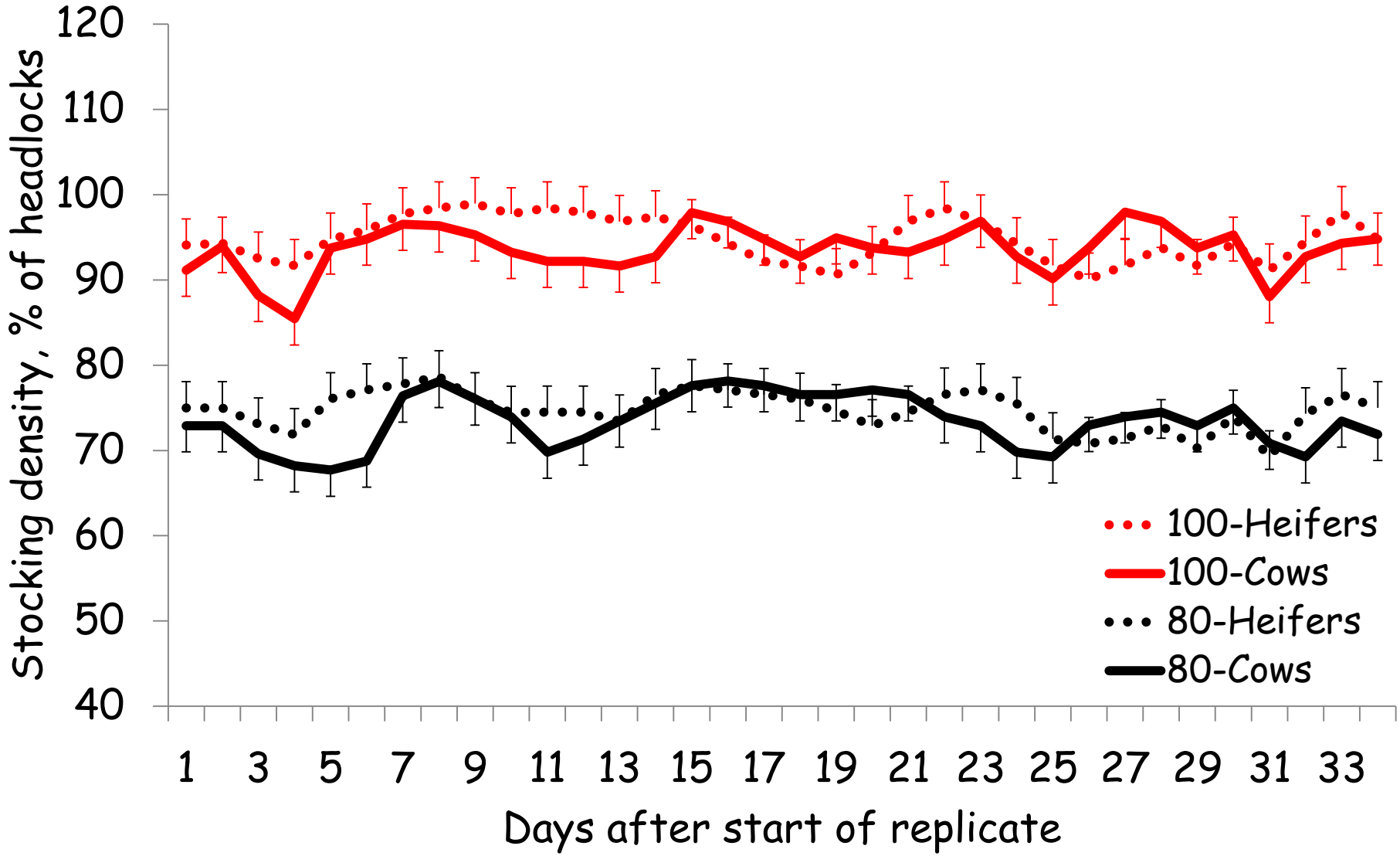
- Milk yield and milk composition in the first 150 d postpartum are reported
- Reproductive performance after first postpartum AI and pregnancy rate by 305 d postpartum are reported

Stocking Density According to Headlocks



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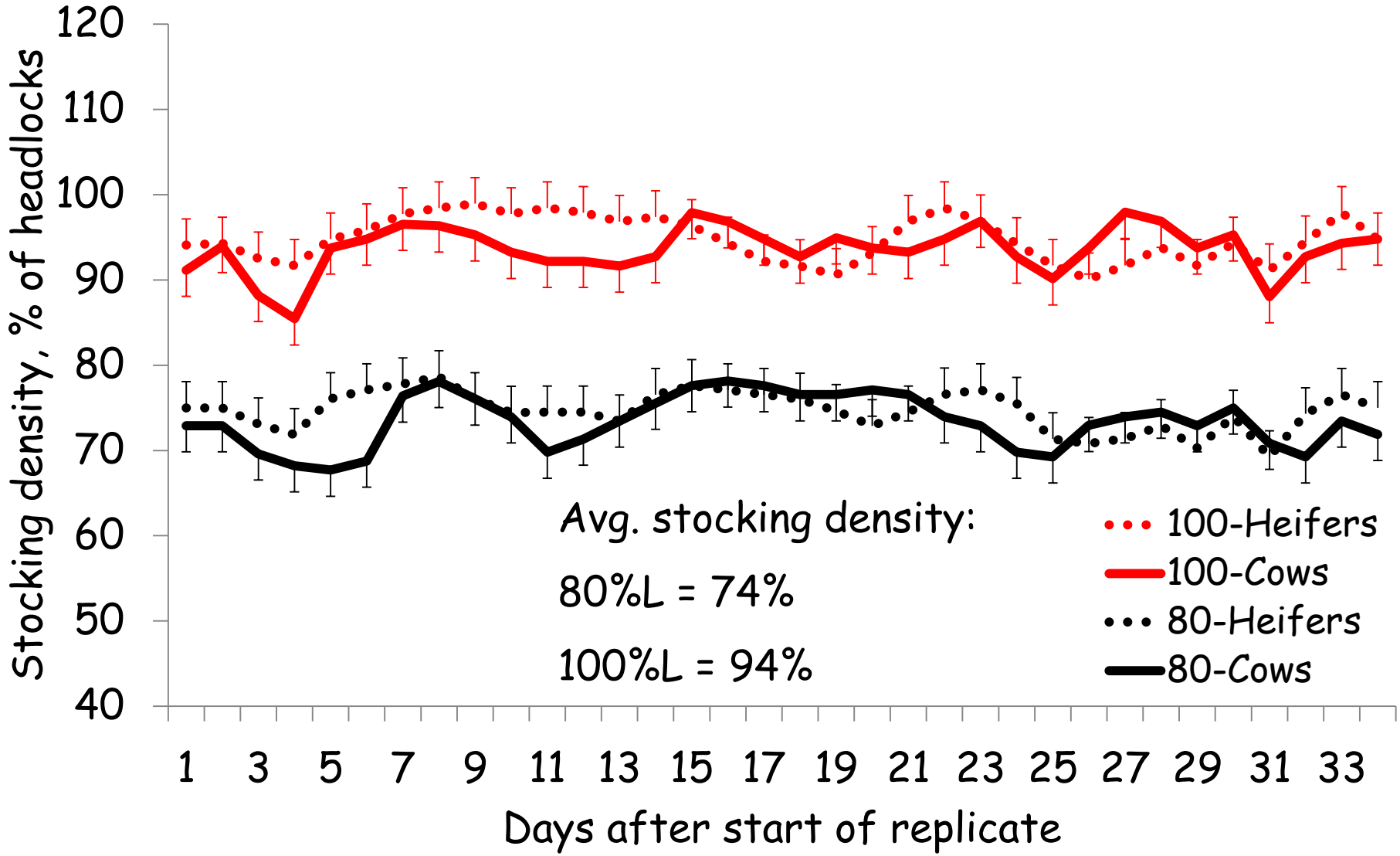
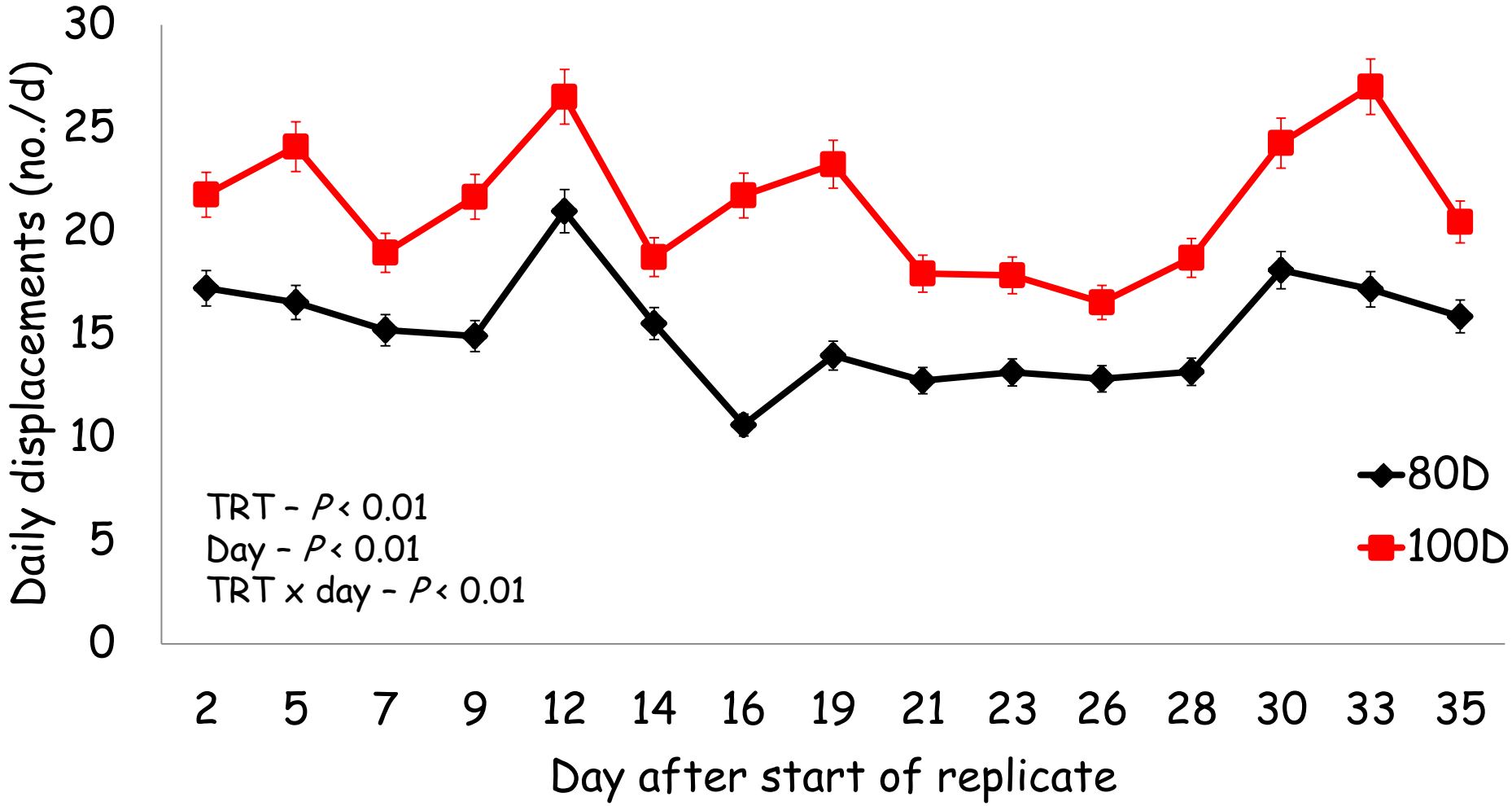


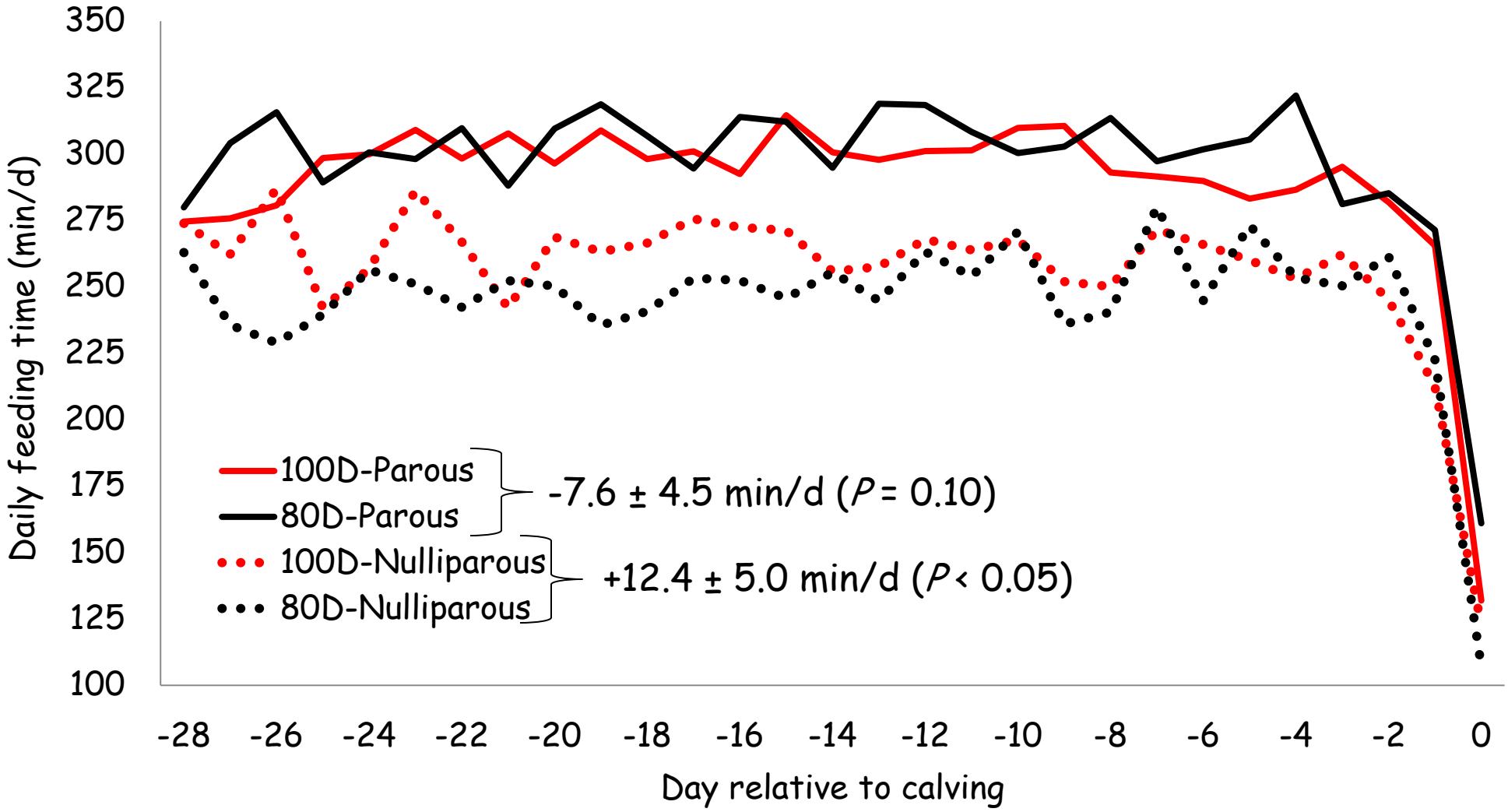
Effects of Stocking Density on Displacement from the Feed Bunk



Displacement rate ($P = 0.23$): 80SD = 0.43 ± 0.03 vs 100SD = 0.47 ± 0.03

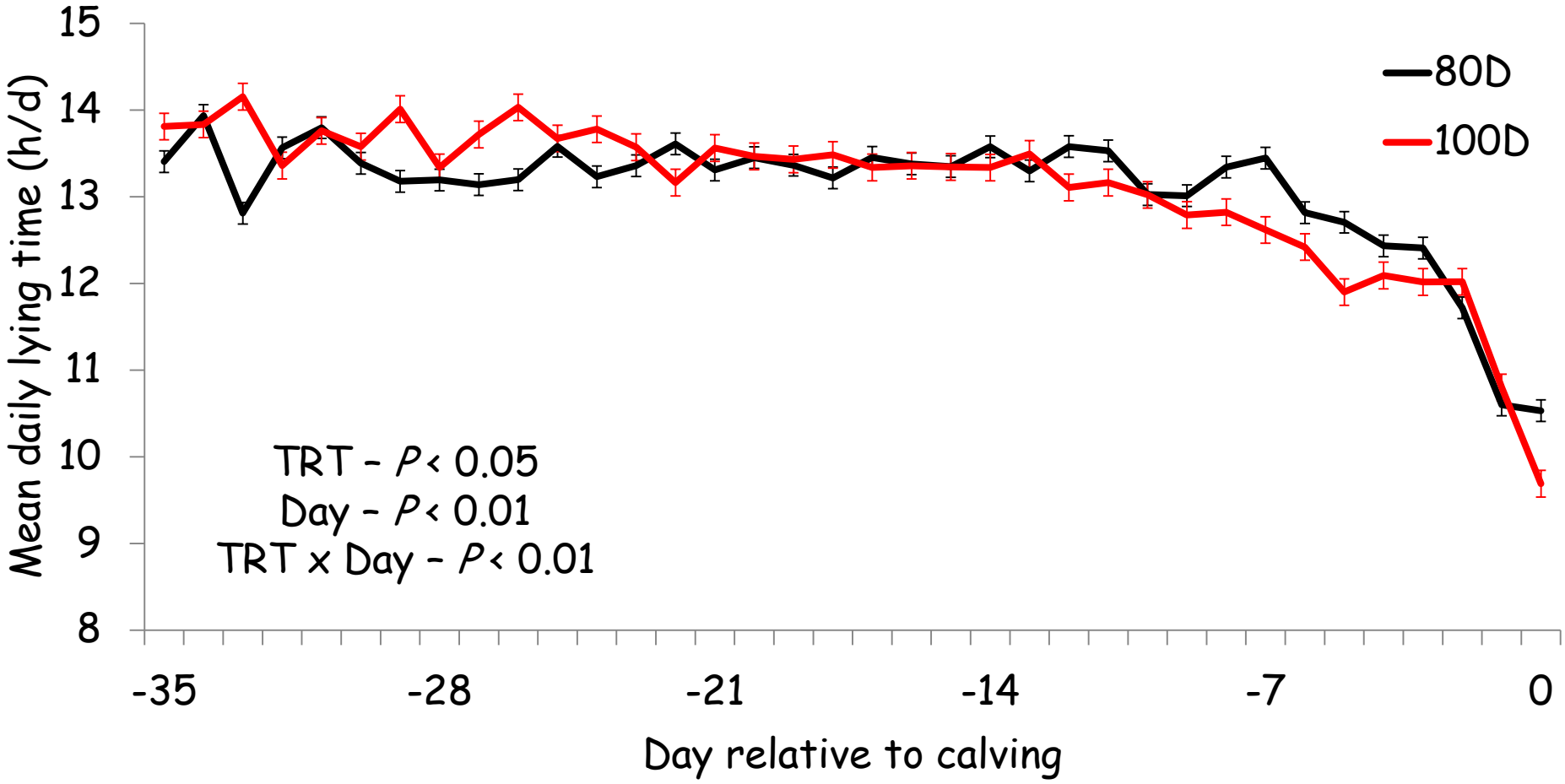
Lobeck et al. (2013)

Effects of Stocking Density on Daily Feeding Time



Lobeck et al. (2013)

Effect of Stocking Density on Lying Time



Effect of Stocking Density on Health and Removal from the Herd

- No effect on immune and metabolic parameters and concentration of haptoglobin

Effect of Stocking Density on Health and Removal from the Herd

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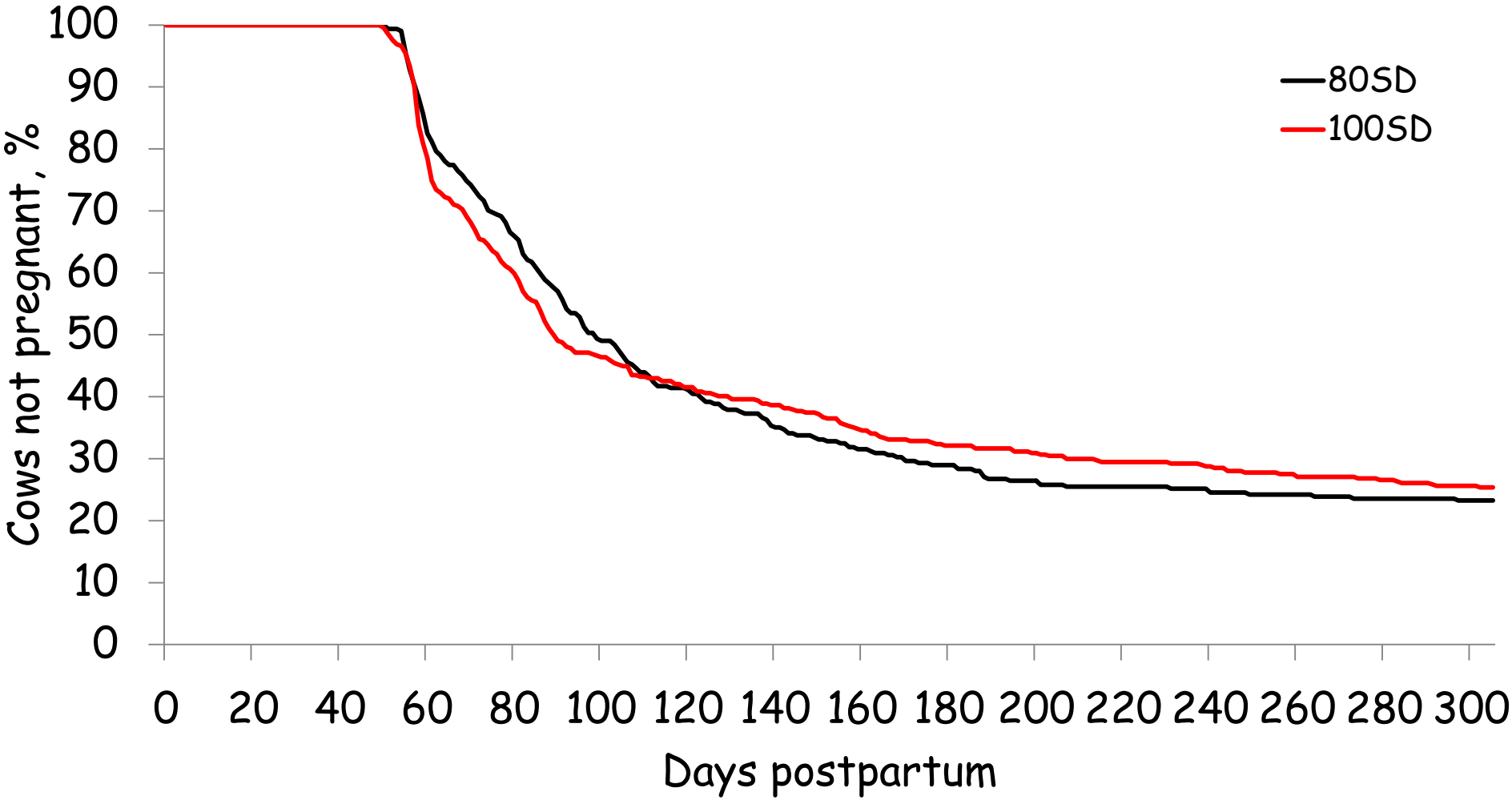
	80SD, %	100SD, %	*P* – value
RFM, %	5.1	7.8	0.19
Acute metritis, %	9.9	9.4	0.64
Metritis, %	21.2	16.7	0.11
Endometritis, %	5.8	7.9	0.35
DA up to 60 DIM, %	1.0	0.7	0.78
Removed within 60 DIM, %	6.1	5.1	0.63
1st AI P/AI, %	36.8	44.0	0.29
FCM yield, kg/d (±SEM)	34.2 ± 0.5	33.8 ± 0.5	0.56

Effect of Prepartum Stocking Density on Pregnancy Rate



Stocking Density in the Prepartum Period and Performance

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- Reduced close-up pen use in approximately 20%

Regrouping of Dairy Cows

Effects of Regrouping of Lactating Cows on Behavior and Milk Yield

von Keyserlingk et al. (2008)

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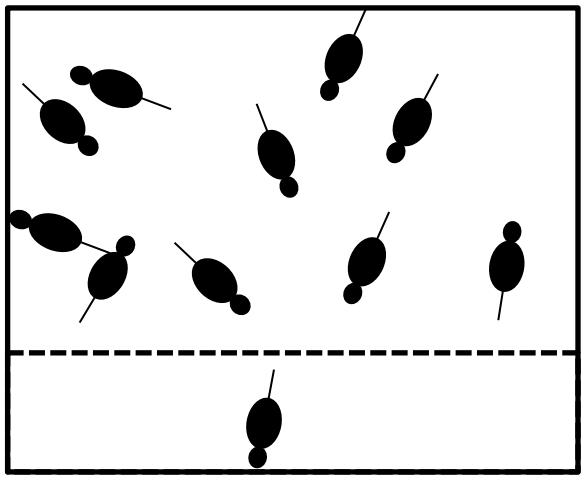

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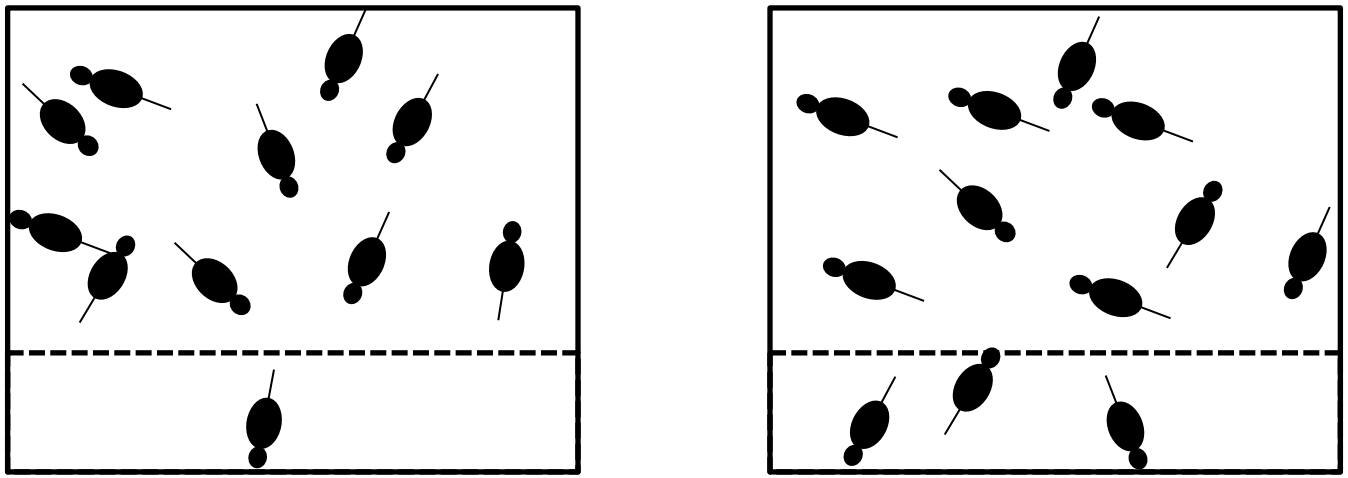

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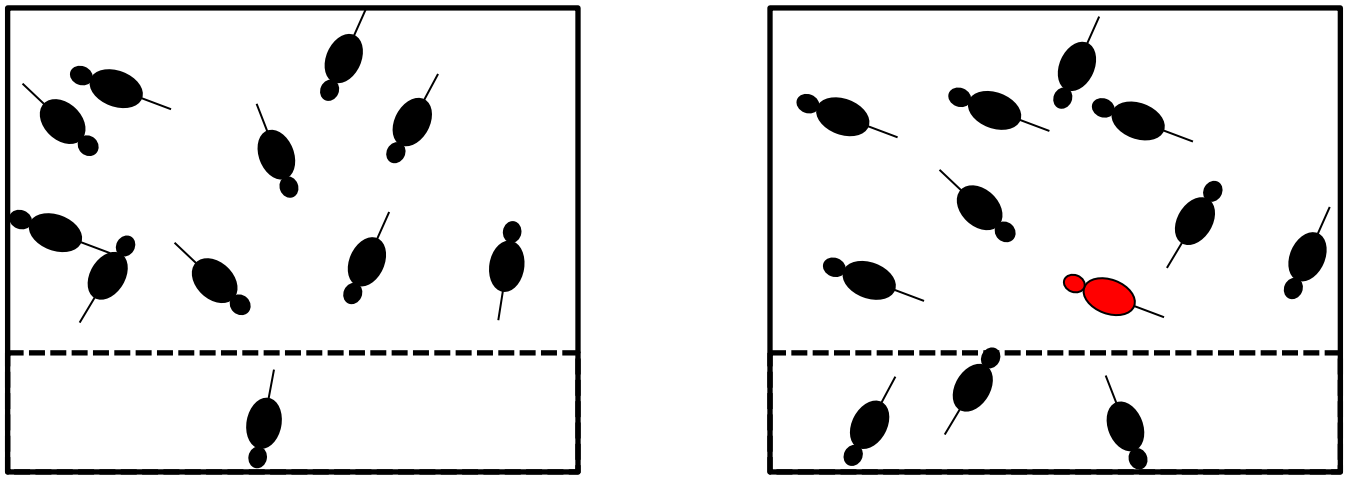

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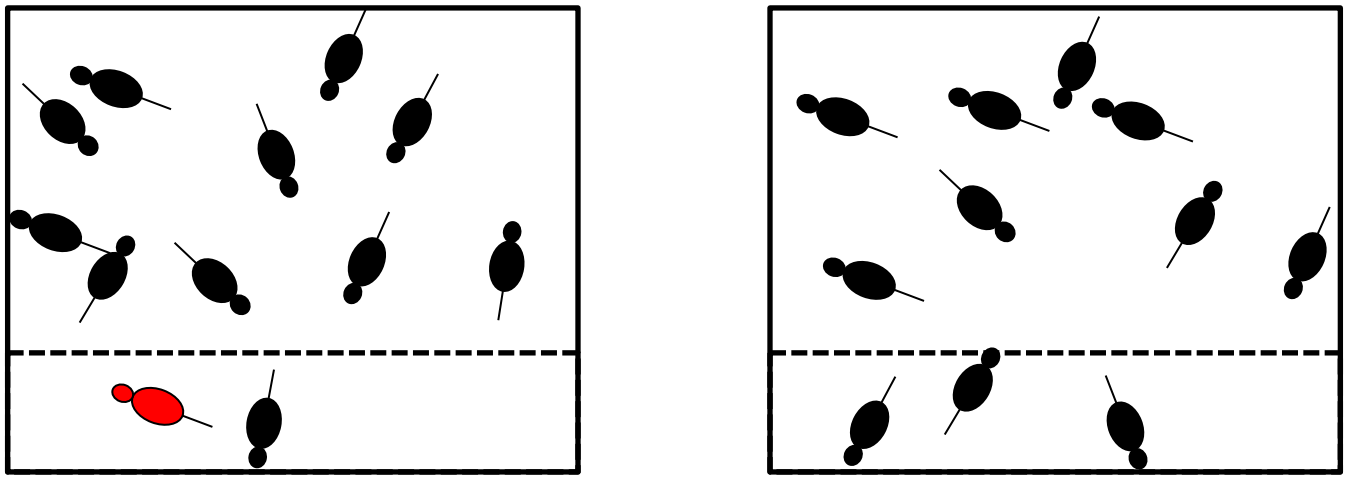

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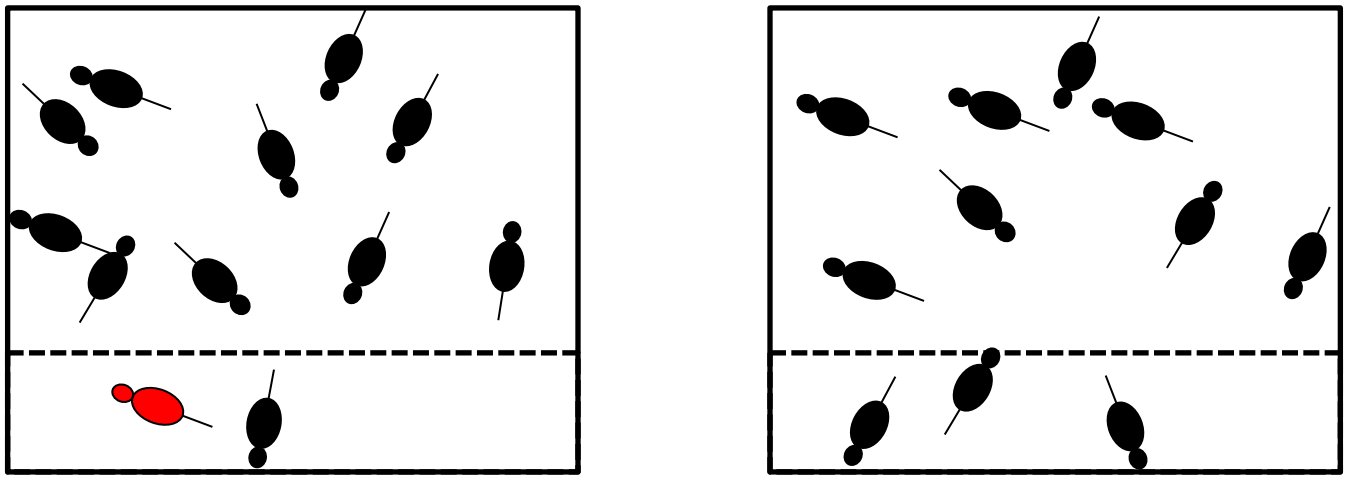

  - Cows evaluated from 3 d before to 4 d after pen change

von Keyserlingk et al. (2008)

Effects of Regrouping of High Producing Dairy Cows on Behavior and Milk Yield

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Effects of Regrouping of High Producing Dairy Cows on Behavior and Milk Yield

- Reduced feed time (↓ 15 min) during the first hour after pen change

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Effects of Regrouping of High Producing Dairy Cows on Behavior and Milk Yield

- Reduced feed time (↓ 15 min) during the first hour after pen change
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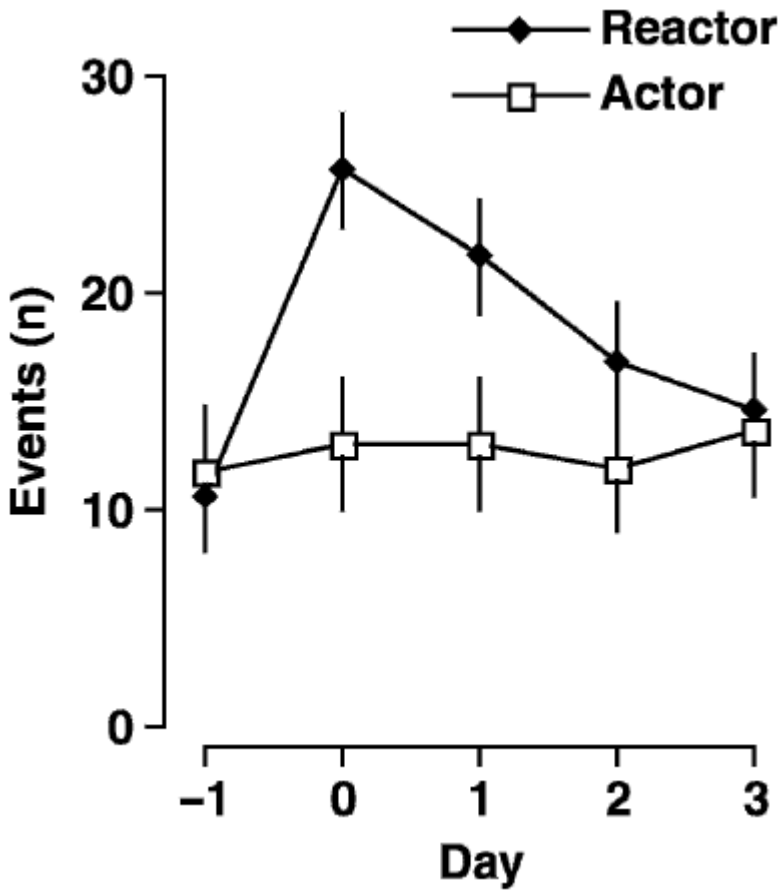

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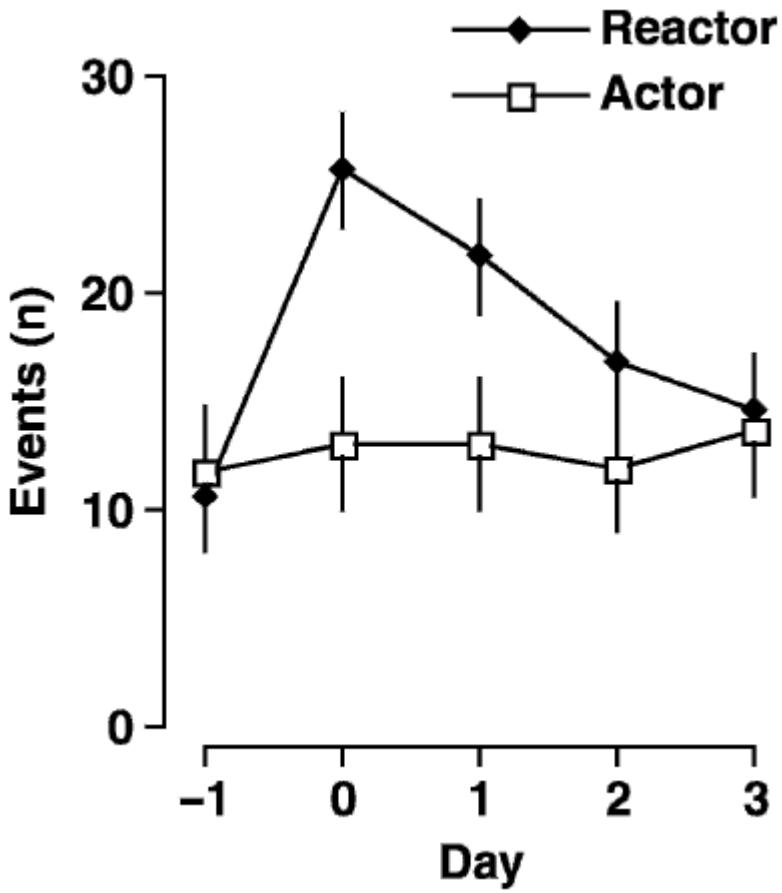

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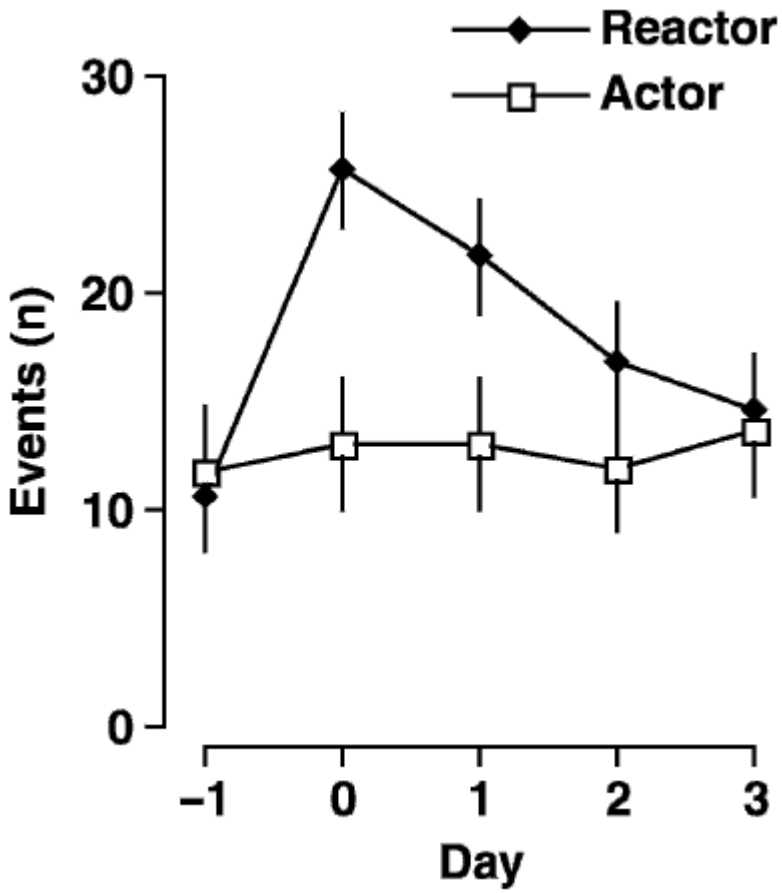

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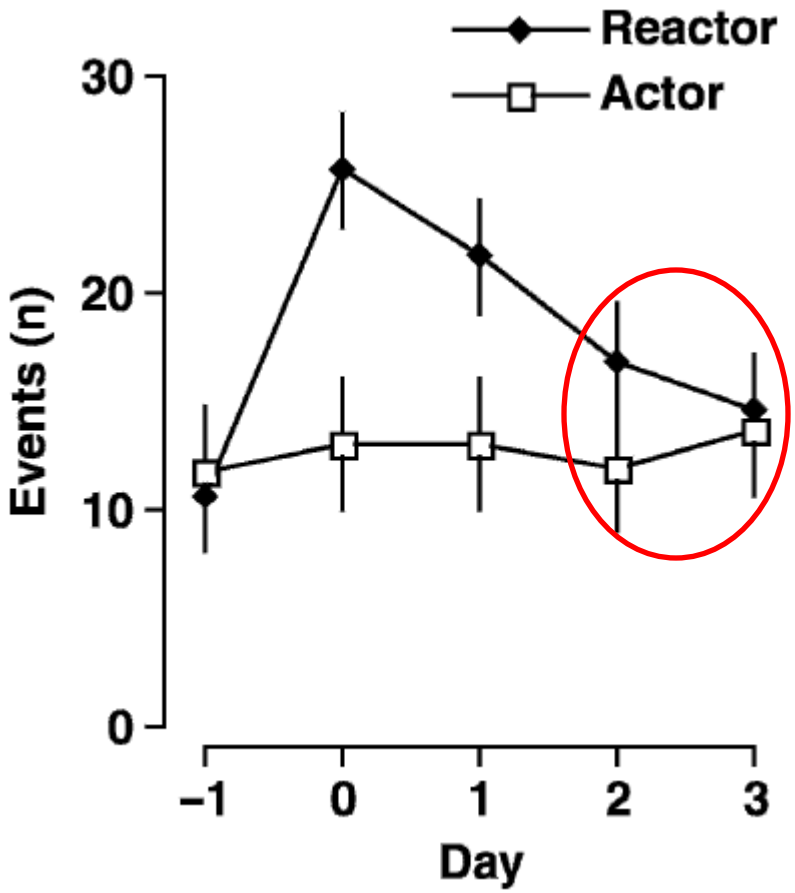


von Keyserlingk et al. (2008)

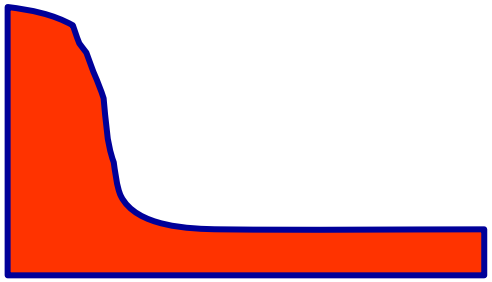
Pattern of Social Disturbance

All-In-All-Out system = Transient disturbance

Conventional system = Continued disturbance

Adapted from N. Cook

Pattern of Social Disturbance



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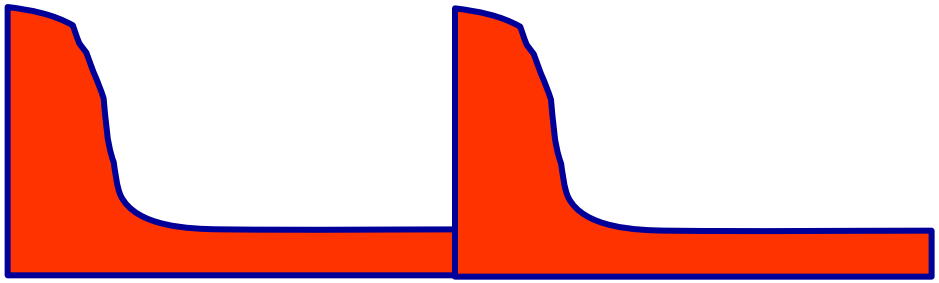

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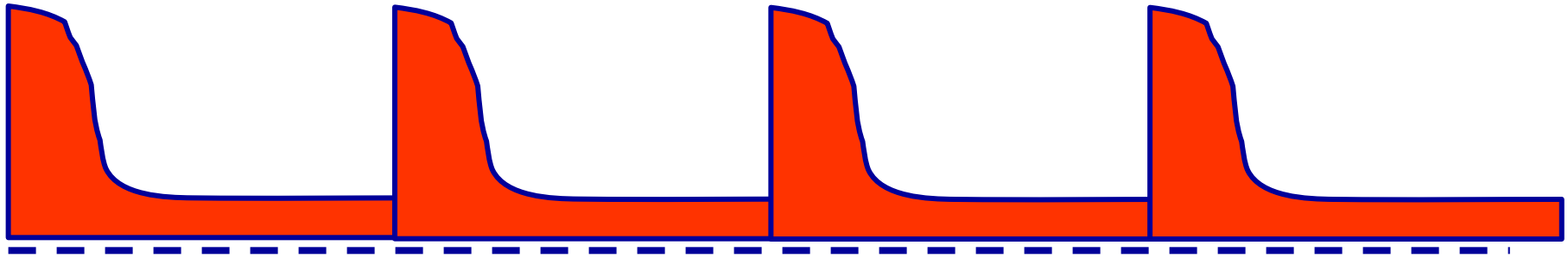

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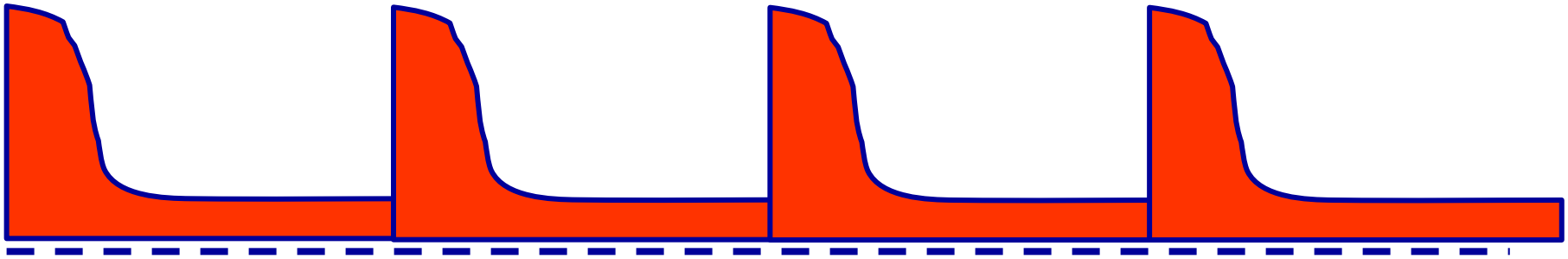

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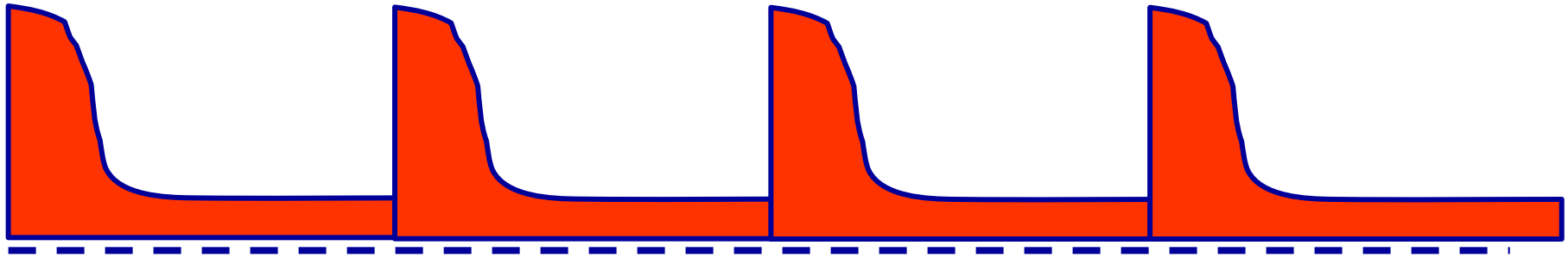

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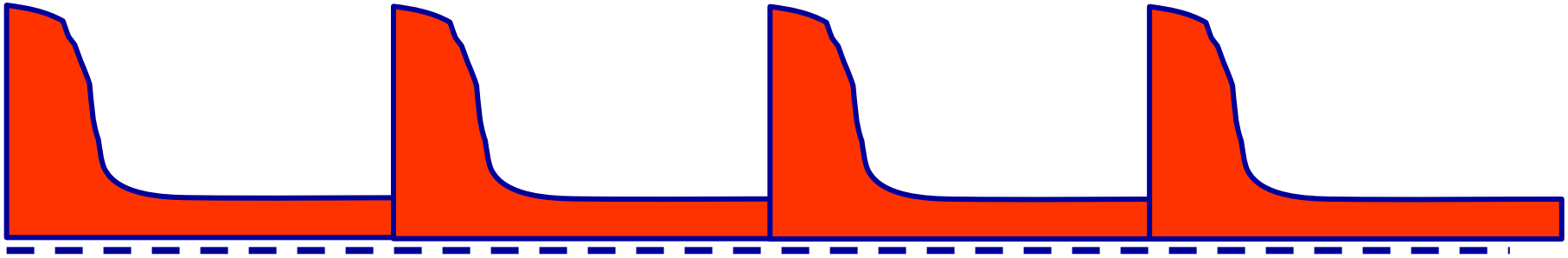

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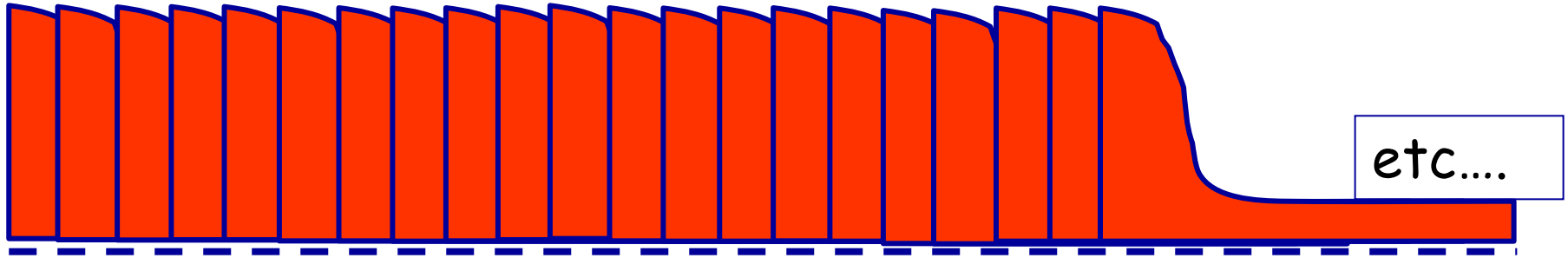

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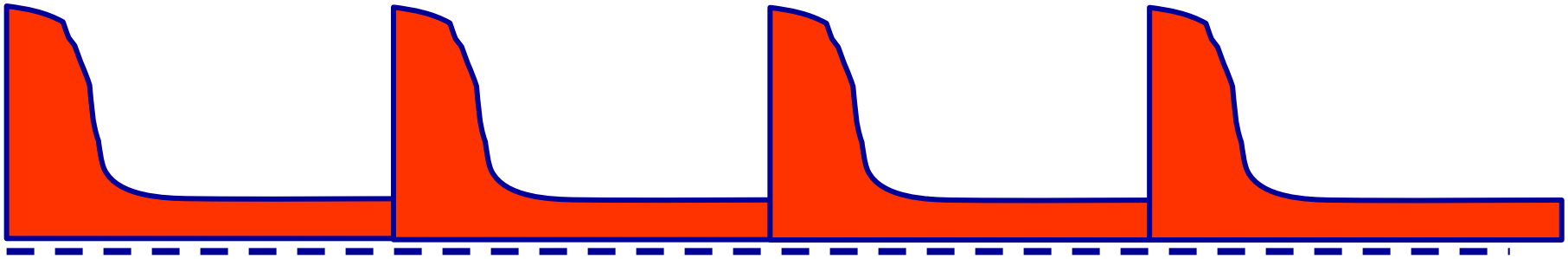

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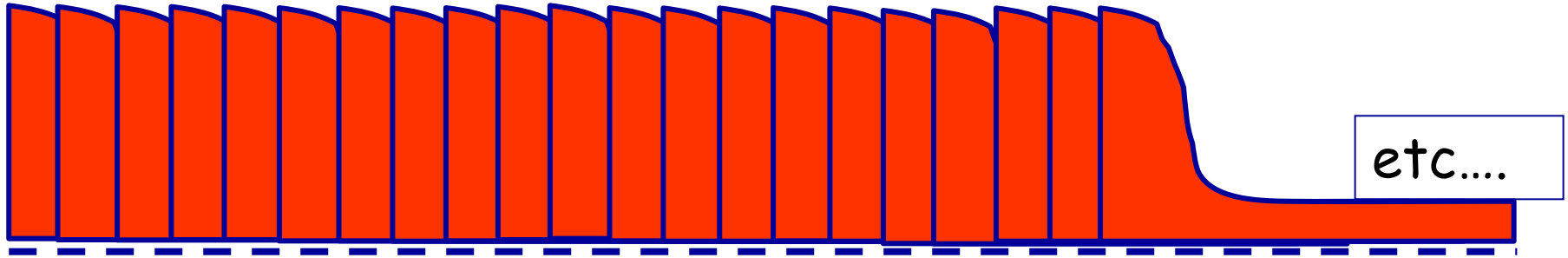

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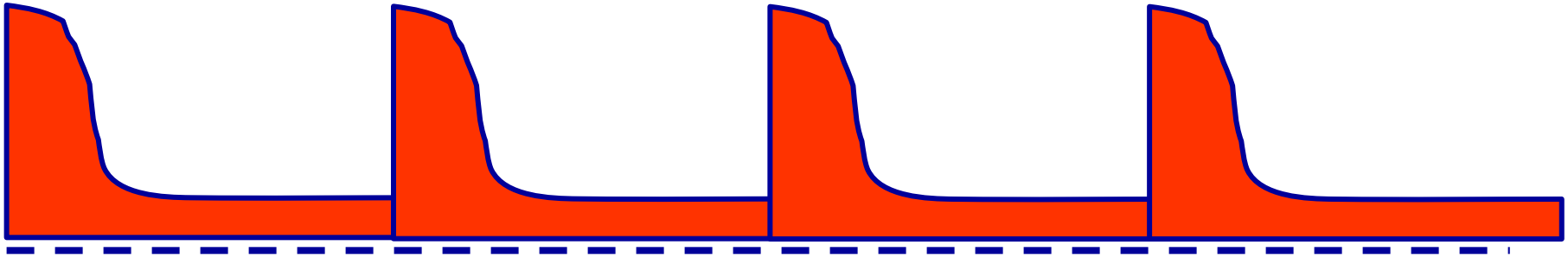

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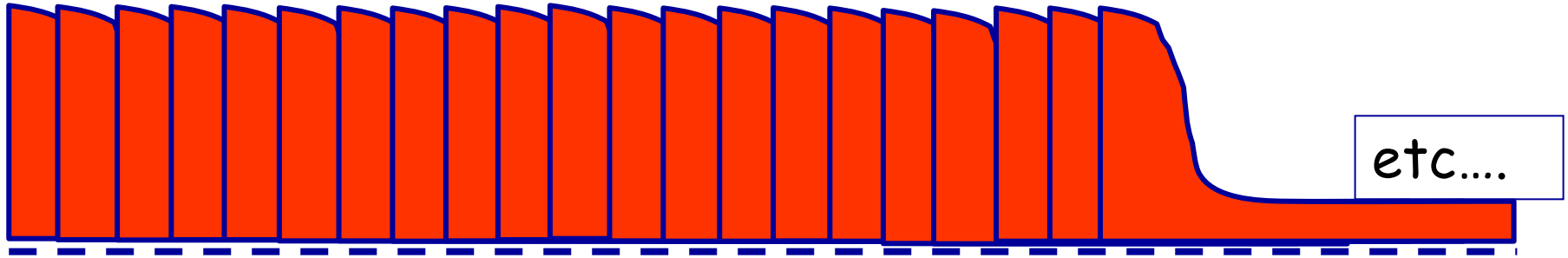

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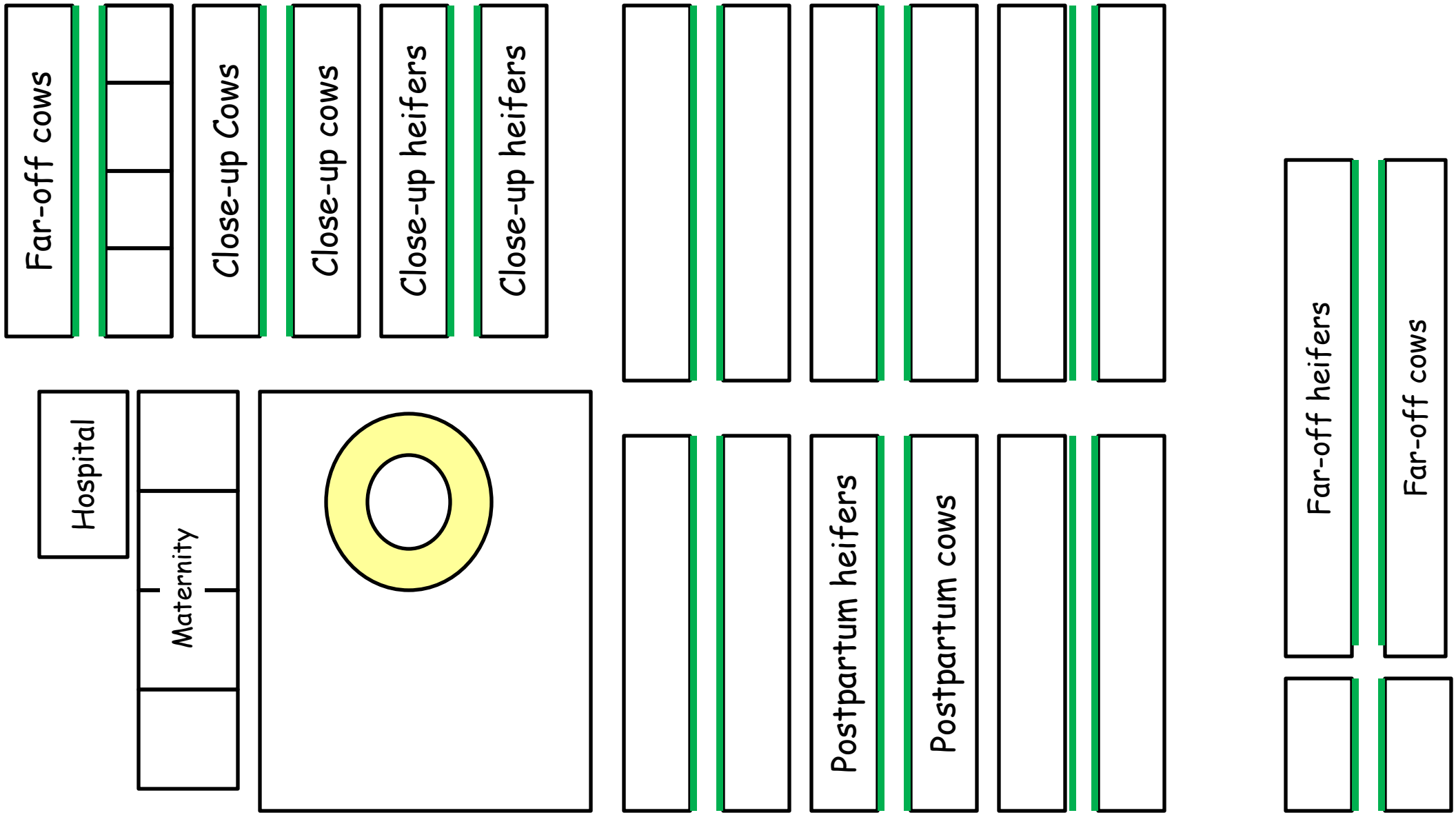
- Even though cows are social animals, the effects of regrouping large numbers of cows into large pens are questionable
  - Dairies with 1,000 to 10,000 lactating cows = close-up pens 50 to 350 cows

Weekly Movement of Prepartum Cows



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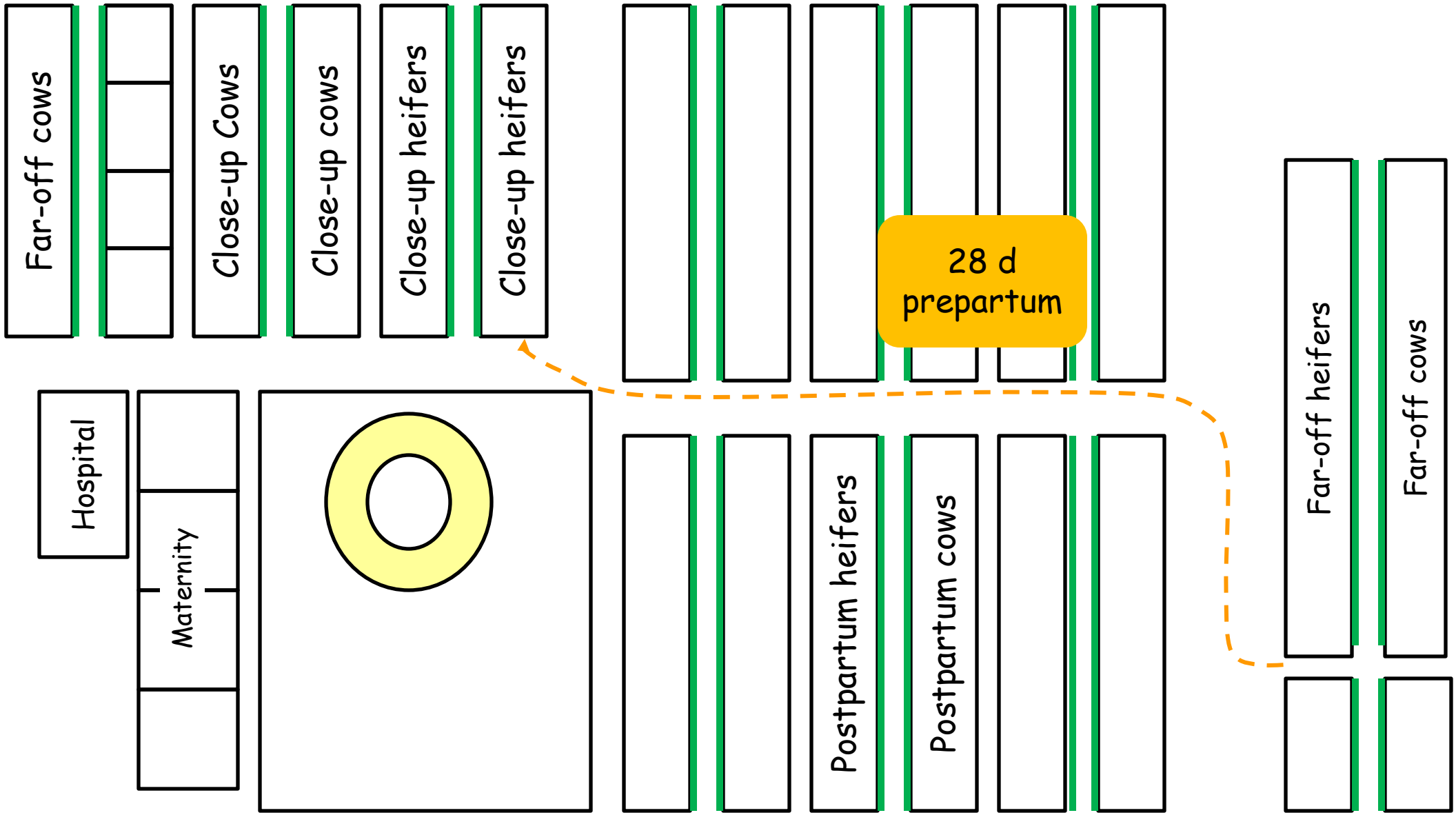

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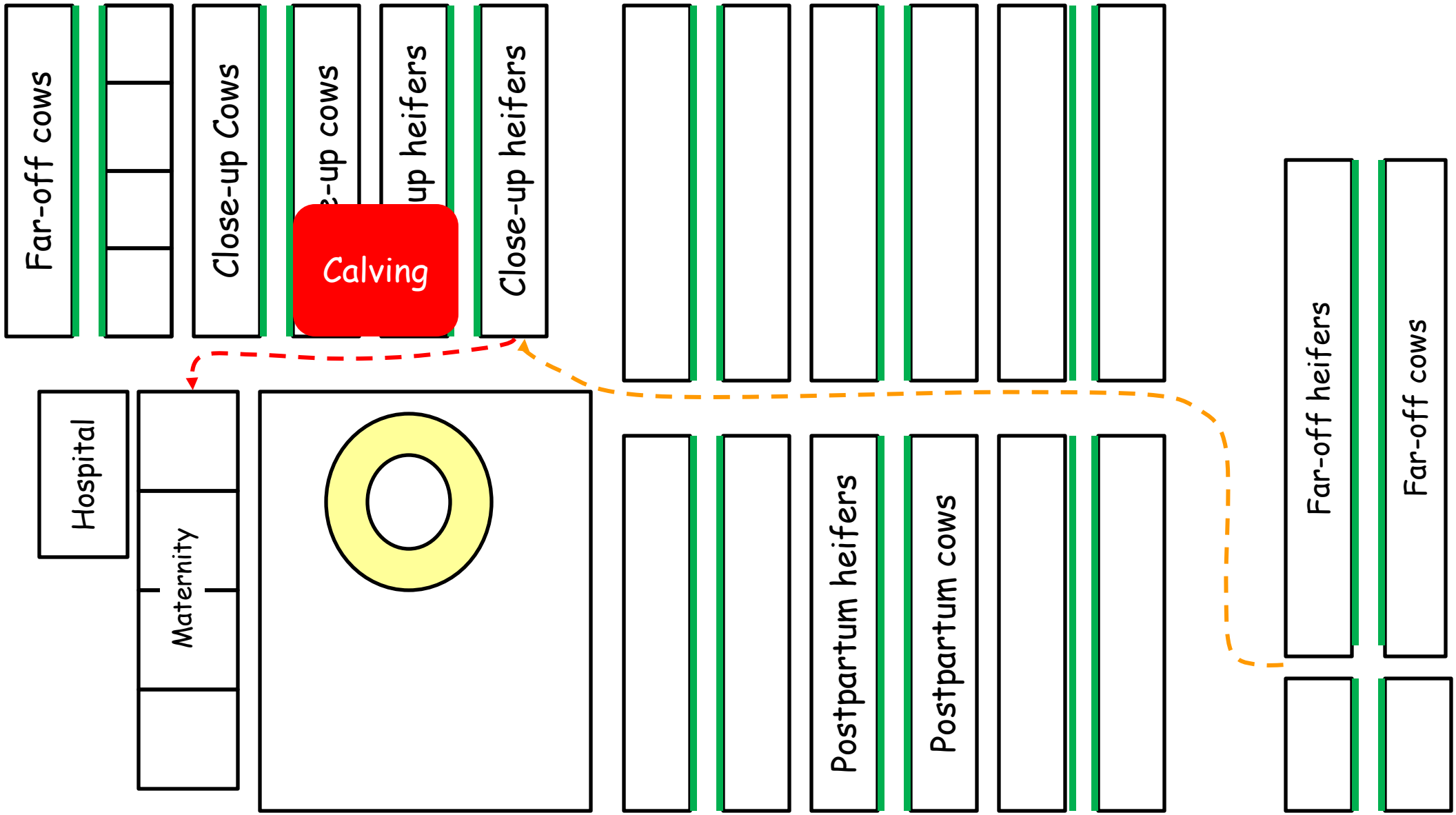

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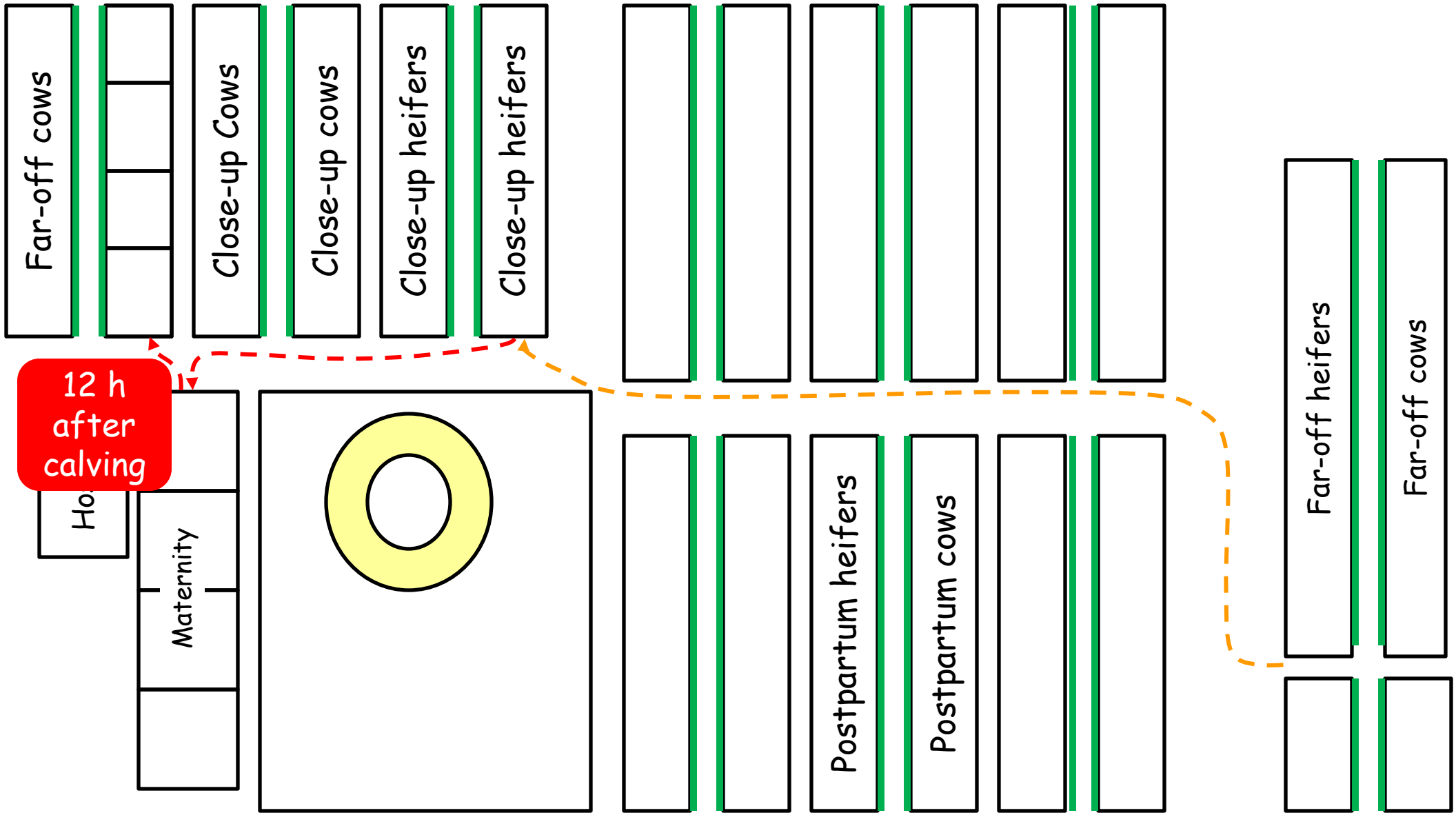

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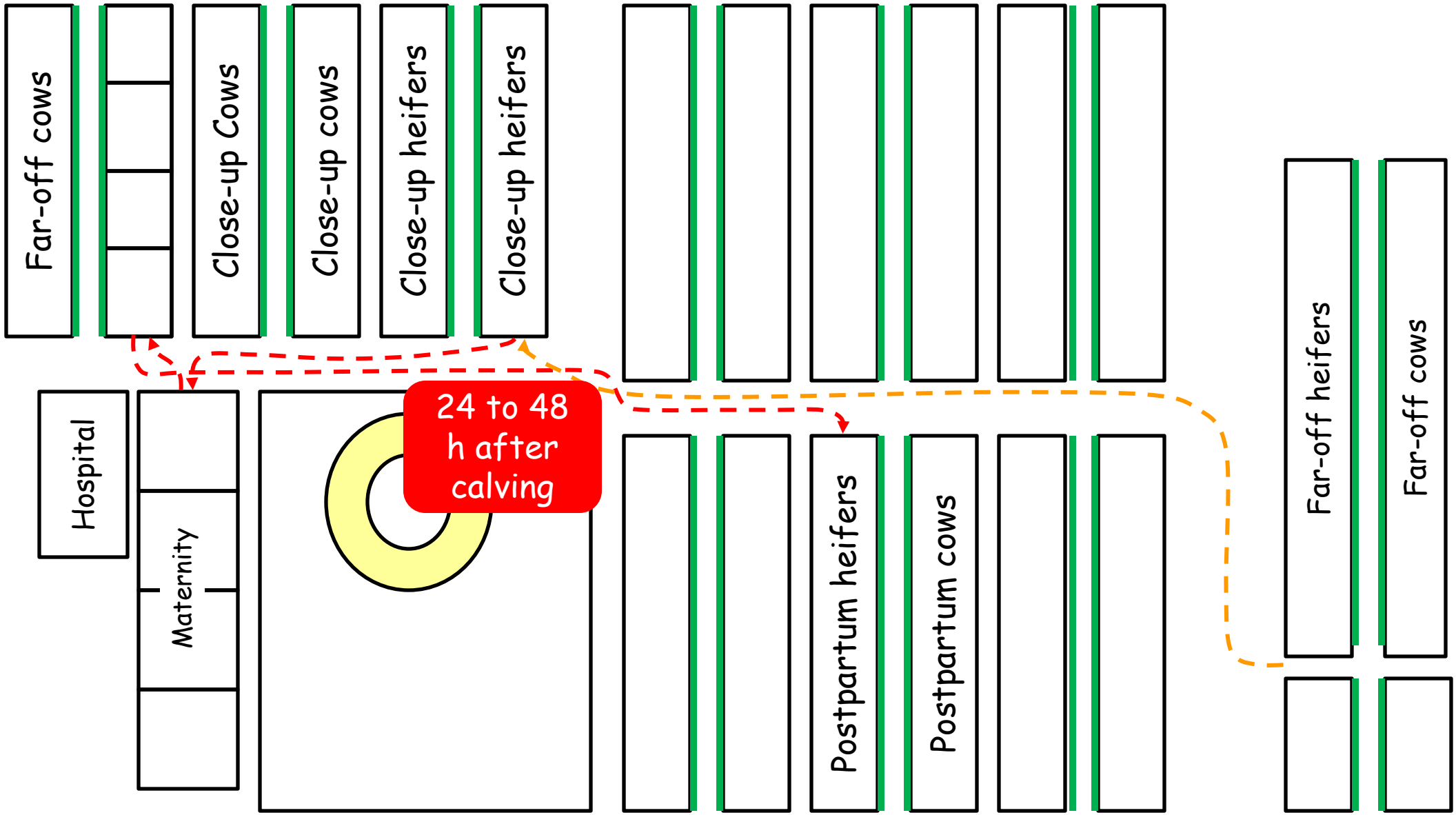

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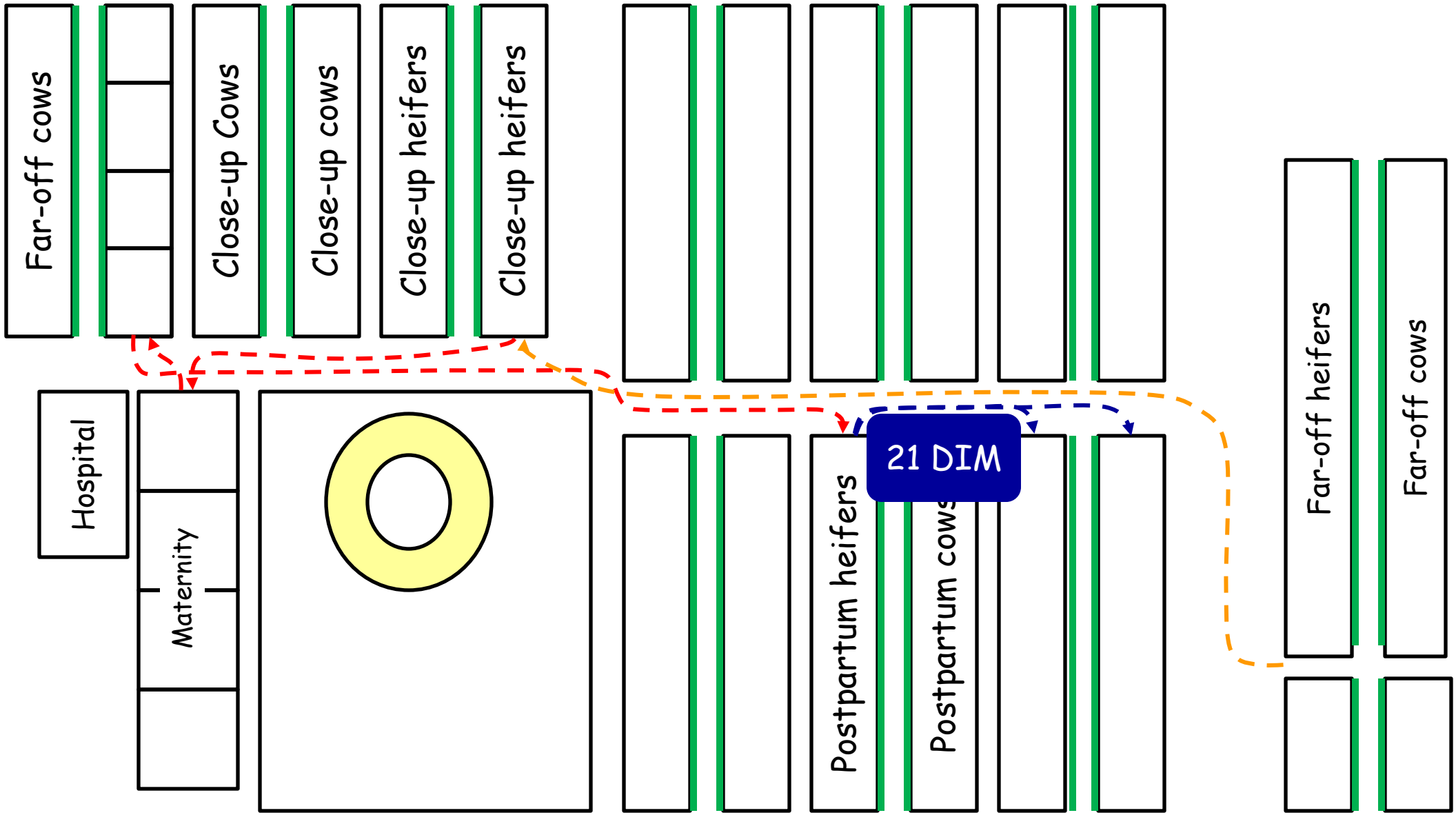

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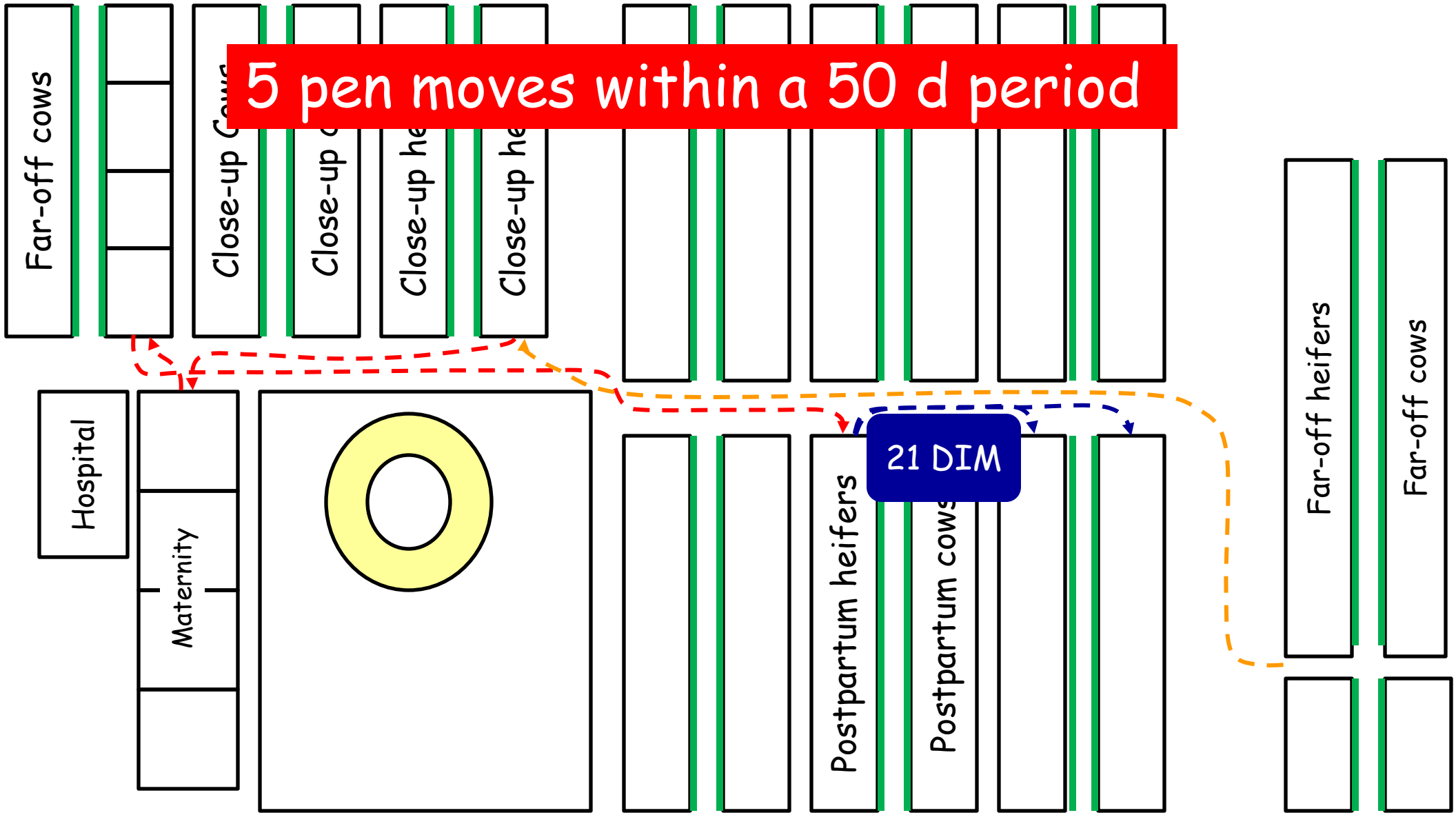

Effect of Frequency of Regrouping in the Close-up Pen on Immune and Metabolic Parameters, Health, Production, and Reproduction

Silva et al. (2013a; 2013b); Lobeck et al. (2012)

Effect of Frequency of Regrouping in the Close-up Pen on Immune and Metabolic Parameters, Health, Production, and Reproduction

- 567 cows (≥ 2ª lactation) assigned to 1 of 2 treatments:

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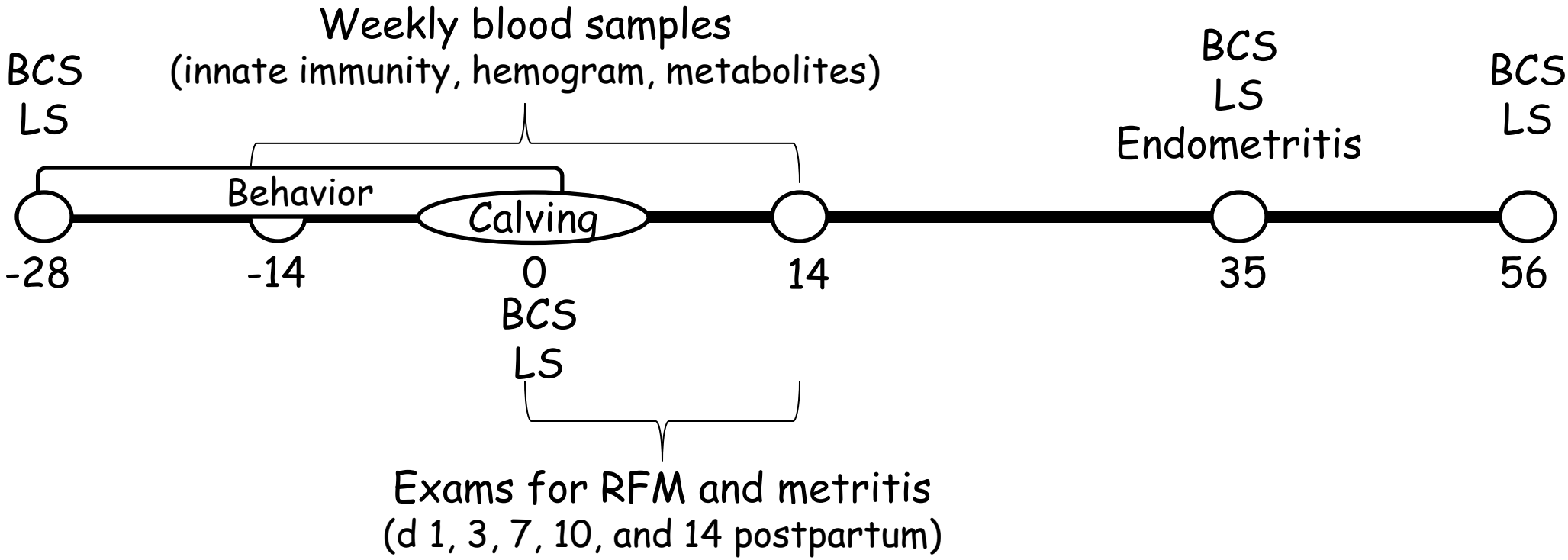
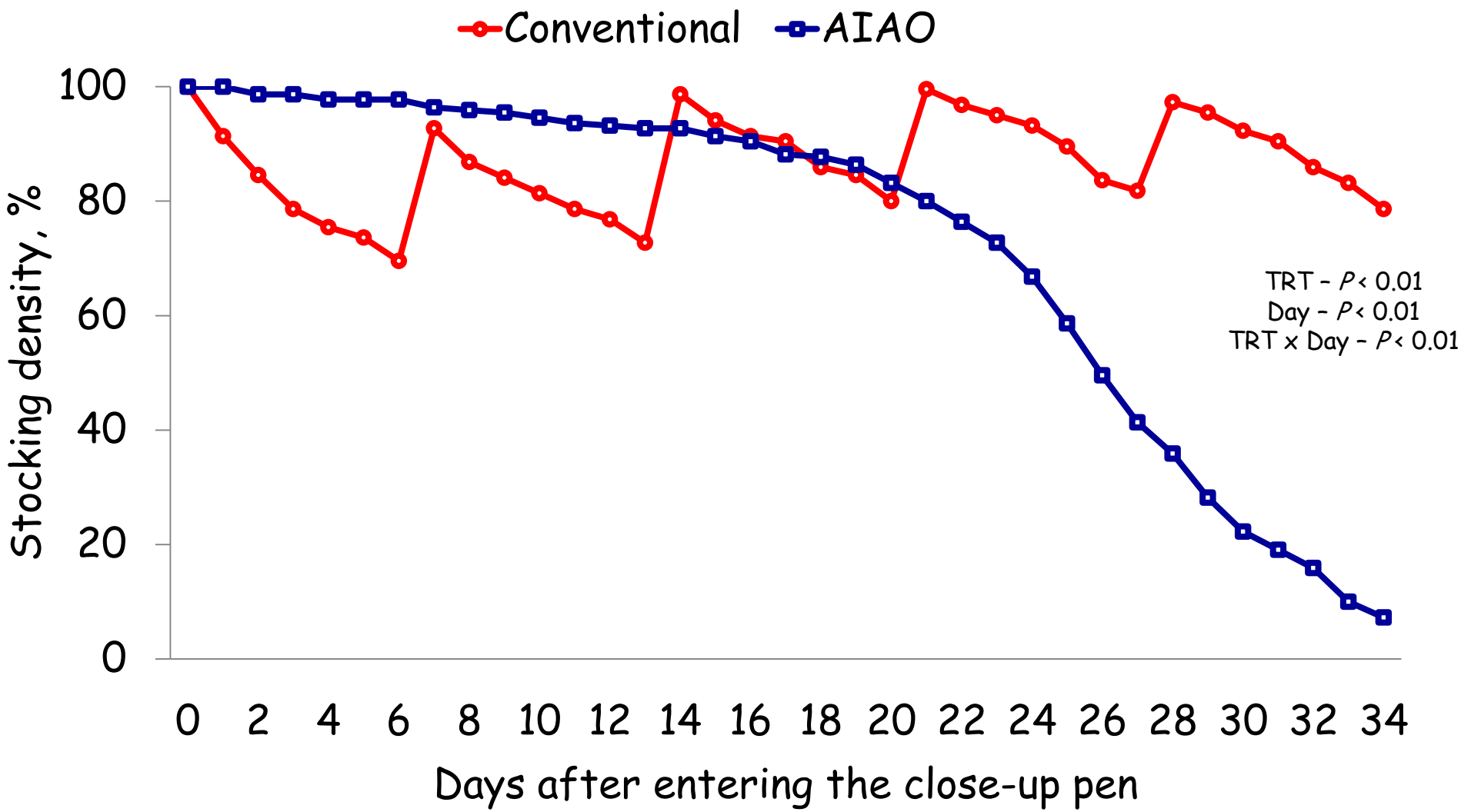
Effect of Stocking Density on Immune, Health, Reproductive and Productive Parameters



- Cows were observed daily from 0 to 60 d postpartum for mastitis and DA
- Milk yield and milk composition in the first 305 d postpartum are reported
- Reproductive performance after first postpartum AI and pregnancy rate by 305 d postpartum are reported

Close-up Regrouping Strategy and Stocking Density



Silva et al. (2013a)

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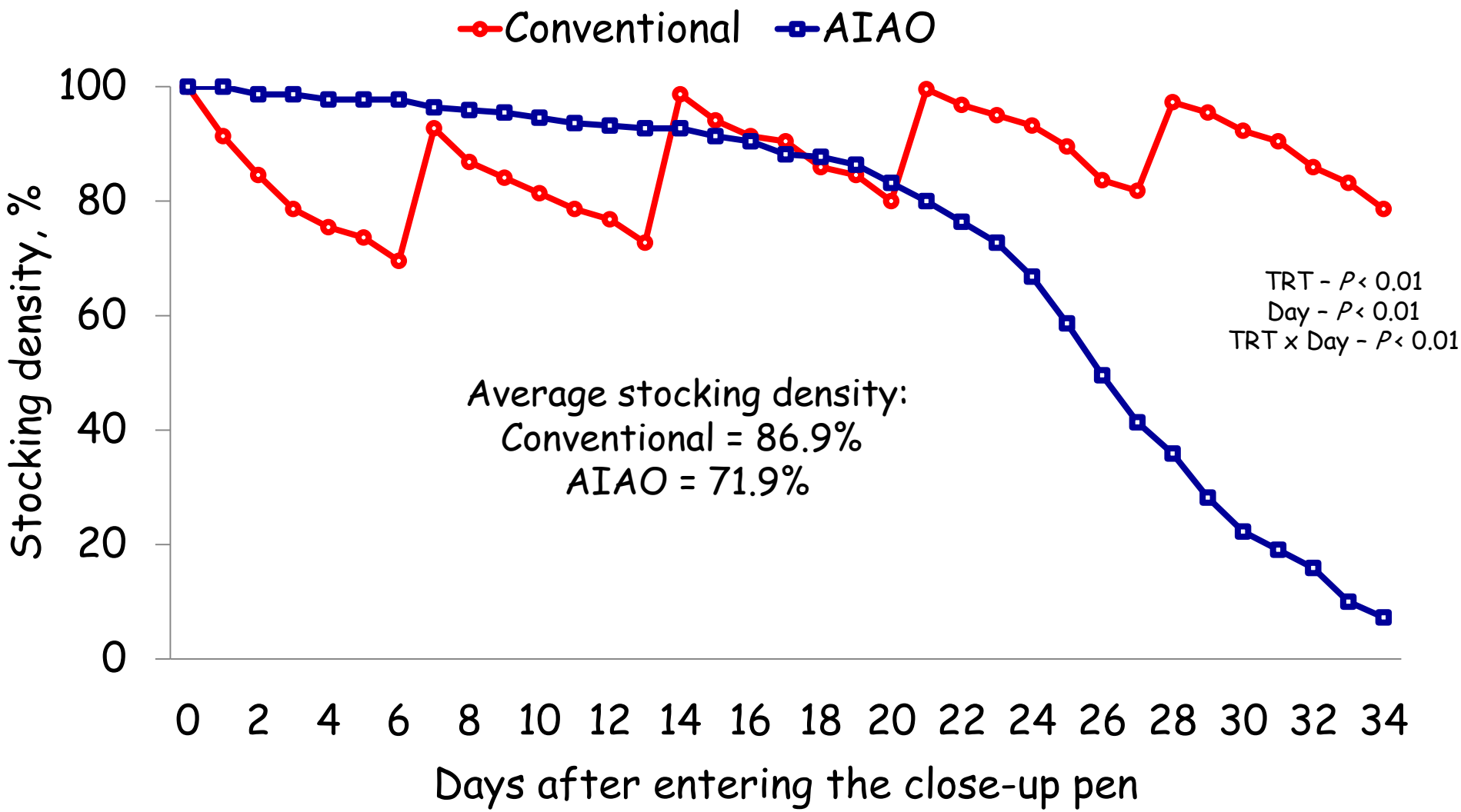
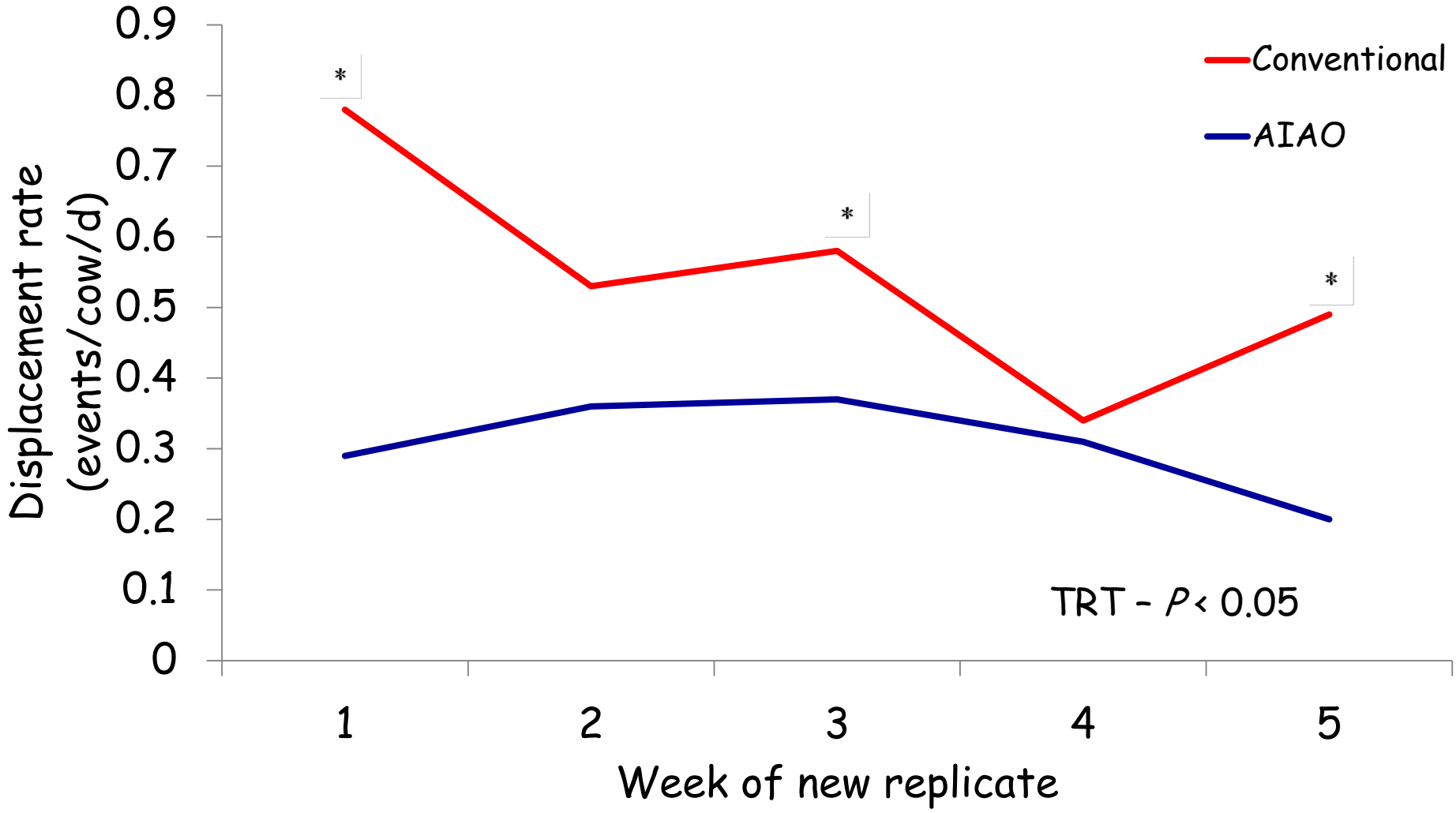


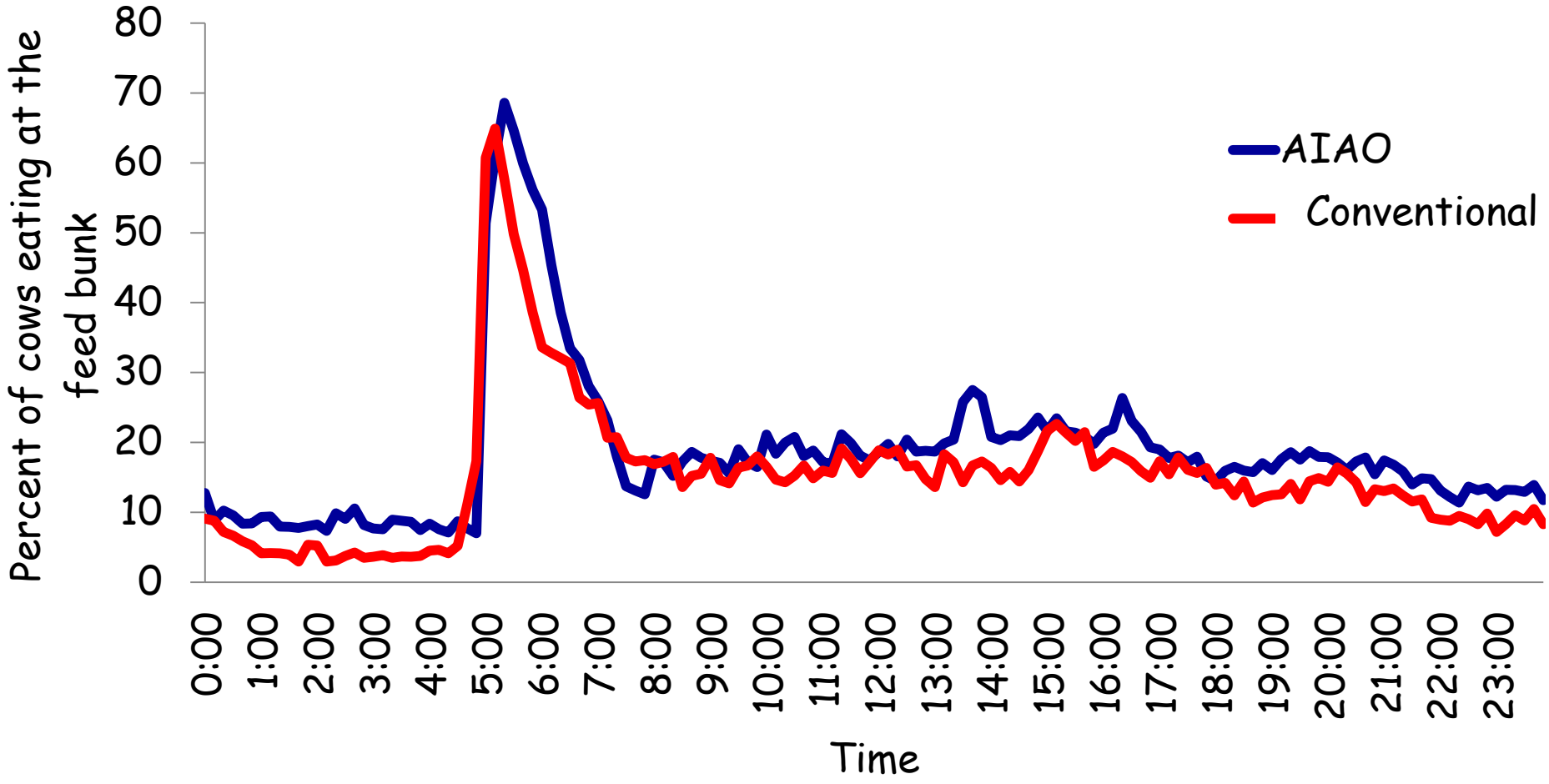
Silva et al. (2013a)

Effect of Regrouping Strategy on Displacement Rate from the Feed Bunk

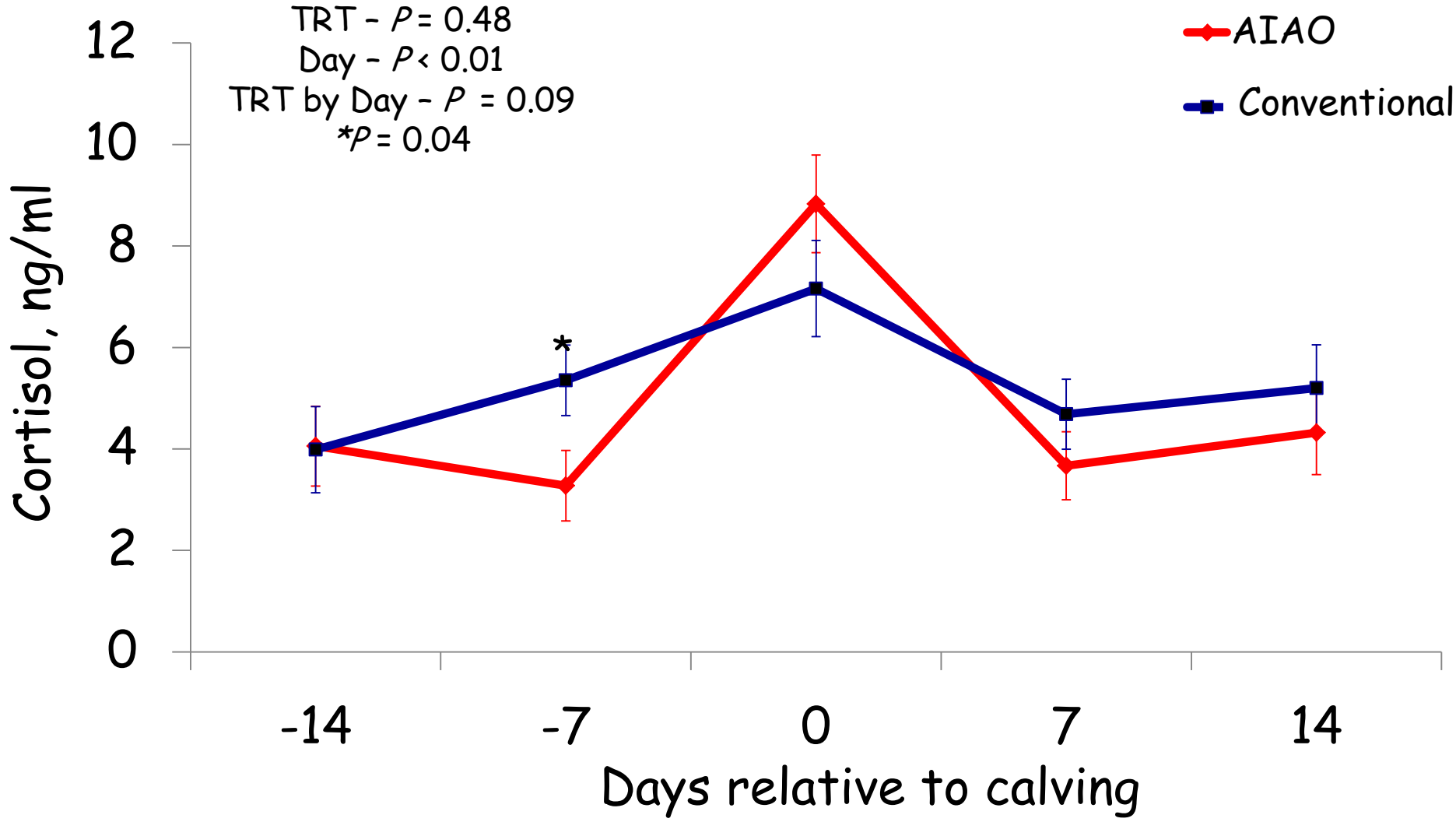


Lobeck et al. (2012)

Effect of Regrouping Strategy on Percentage of Cows at the Feed bunk



Effect of Prepartum Regrouping Strategy on Cortisol Concentrations



Weekly Regrouping in the Close-up Period

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- No effect on immune and metabolic parameters and concentration of haptoglobin

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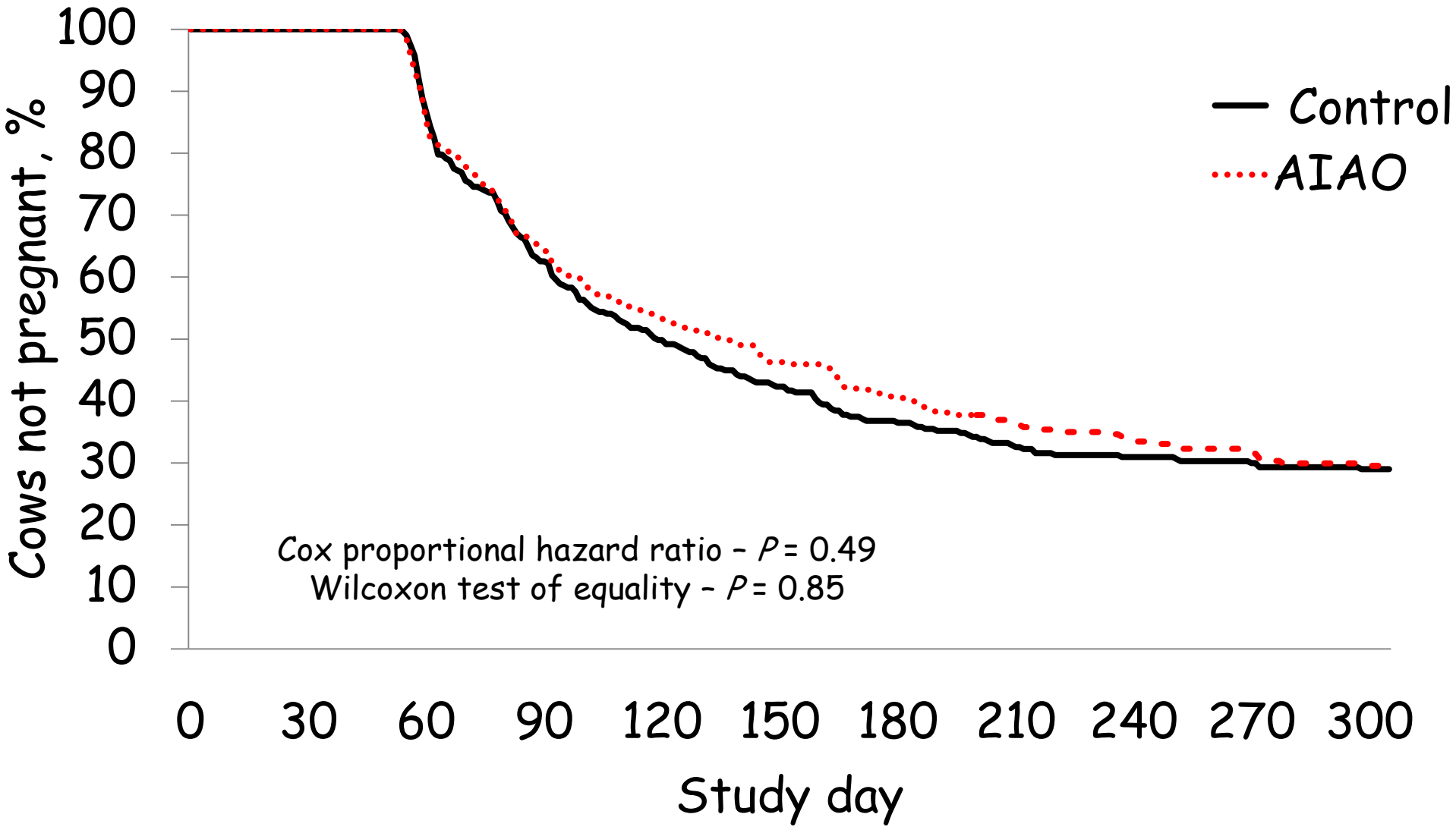
Items	Conventional	AIAO	*P*
RFM, %	10.9	11.6	0.82
Metritis, %	16.7	19.8	0.37
Acute metritis, %	1.7	3.6	0.22
DA, %	3.2	1.7	0.38
Cull/Death within 60 DIM, %	9.1	8.9	0.94
Cyclic by 53 DIM, %	90.1	90.2	0.97
P/AI 66 ± 3 d after 1st AI , %	36.3	39.9	0.41
ECM after 305 DIM, kg/d	34.4 ± 0.6	34.3 ± 0.7	0.88

Effects of Regrouping Strategy on Pregnancy Rate



Silva et al. (2012)

Weekly Regrouping in the Close-up Period

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- ↓ Stocking density in AIAO strategy (AIAO = 73% vs conventional = 87%) = ↑ Cost to build close-up cows' facilities in 16%

Health and Performance of AIAO Cows Regrouped before Calving

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- 17 cows did not calve within 35 d and were regrouped within 4 d before calving (1 to 24 d before calving)

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Item	AIAO	Regrouped AIAO	P - value
Twins, %	3.8	0	0.42
Male calf, %	47.3	47.1	0.99
Metritis, %	20	17.7	0.81
DA, %	1.8	0	0.59
Cyclic by 53 DIM, %	89.6	100	0.19
P/AI after 1st AI, %	38.3	62.5	0.06
ECM, kg/d	32.3 ± 1.4	39.1 ± 2.4	< 0.01

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  - Reduced changes in feed composition
  - 100% stocking density
    - 80% if commingling

Thank you!!!

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