



Notes from Smart Calf Rearing Conference September 25-27, 2025 | Madison, WI

Calf Health Section

Antioxidant impact on newborn calf immunity and health – Dr. Angel Abuelo, Michigan State University

- Oxidative stress (OS) in calves
 - Origin?
 - In utero from transition calves
 - Birth: reactive oxygen species (ROS) in calves +30% vs. dams
 - ↑ metabolism for establishing growth rates
 - ↓ antioxidant potential in milk replacer (MR) vs. whole milk (WM)
 - Relationship to immune function
 - ROS activates antigen presenting cells → TH1 biased → pro-inflammatory response
 - Study comparing low vs. high OS in calves and their differences (observational and in vitro → flow cytometry; [Cuervo et al. 2021](#))
 - OS compromised critical lymphocyte function in newborn calves
- Antioxidant supplementation
 - Best/main way to control OS
 - Some antioxidants (vitamins/trace minerals; VTM) are also key co-factors for immune function
 - Antioxidants act synergistically (i.e., Vit C and E) → **several** antioxidants needed for best response
 - Exceeding requirements results in **harmful effects** → toxicity (not evidenced in calves yet, but in cows – Rizzo et al. 2013, Bouwstra et al. 2010)
- So, does antioxidant supplementation really work?
 - Supplemental studies on (1) immunity, (2) health, and (3) growth
 - Studies cited for this data (different ages, sometimes beef model): [Nayak and Abuelo 2021](#), [Carlson et al. 2024](#), [Hoyos-Jaramillo et al. 2025](#), [Bittar et al. 2020](#), [Roberts et al. 2016](#), [Teixeira et al. 2014](#), Reid et al. in preparation, Wells et al., Rizzo et al.
 - **Immunity**: injectable antioxidant effects on intranasal vaccine response
 - ↑ IgA and ↓ ROS with supplementation
 - ↑ nasal IgA, no difference in BRSV titers
 - **Health**: Injectable antioxidants on health
 - No difference in disease prevalence on well-managed farm (Carlson study)
 - ↓ prevalence diarrhea and BRD + otitis (41 vs. 49%; Wells study?)
 - **Inconsistent** results even with the same product → other co-factors are likely at play
 - **Growth**: Injectable antioxidants on growth
 - No difference on growth, unless comparing to non-vaccinated counterparts
- Summary
 - Oxidative stress may negatively impact calf immune function
 - Antioxidants (i.e., VTM) can ameliorate OX
 - Very inconsistent results in the use of injectable VTM in calves
 - Many studies show some positive effects on immune outcomes
 - Field trials that support improvements in health or growth are more limited
 - Positive immune outcomes ≠ improved health



My calves are doing well or as usual: how can we improve when everything seems as usual? – Dr. Sébastien Buczinski, University of Montreal

- Determination of the impact of disease is a challenge
 - Who has better health? How to **motivate change** and **follow it over time**?
 - FARM A: 20% scours, 5% BRD, 5% navel infection, 7% pre-weaning mortality
 - FARM B: 5% scours, 15% BRD, 10% navel infection, 5% pre-weaning mortality
 - He did not answer this question in the presentation but it's a good thought exercise.
- Concept of **disability adjusted life years** (DALY)
 - Human concept – build tree maps for most impactful health problems
- Calf DALY: project at a glance ([Ramos et al. 2025](#))
 - (1) Develop a structured way to assess calf health and quality of life during farm visit assessment
 - (2) Determine the impact of disease – disability weight
 - Selected list of diseases: scours, BRD, navel infection, failed passive transfer of immunity (FPTI), fracture, arthritis, wound/abscess, dystocia, congenital defect
 - Survey of vets and producers → good correlation except **arthritis**
 - (3) Report DALY in pre-weaned dairy calves
- Next study (ongoing): Follow 40 farms for > 1 year
 - Herd characteristics – median 115 cow herd size, total n = 1,908 calves, median age = 23 d, variable recording methods (paper, computer, etc.)
 - Farm and disease characteristics: 30% scours, 7% BRD, 5% navel infection, 24% FPTI
 - YLD (years lived with disability) per 10 calves:
 - 2.03 YLDs/10 calves (range 0.55-4.27)
 - **Diarrhea** and **BRD** biggest contributors across farms
 - Except one farm with navel infections as the biggest contributor
 - YLL (years of life lost) per farm
 - Dystocia → diarrhea → BRD (not exactly sure how this conclusion was drawn)
 - YLD + YLL = DALY – average farm **DALY = 3.37 life years**
- Summary:
 - Like human health, limited information can be gleaned from herd records; we need to improve data and record keeping in dairy calf management.

Is the microbiome our secret weapon to raise healthy calves antibiotic free? – Dr. Dirk Werling, Royal Veterinary School of London

- Early-life host-microbiome interphase: the key frontier for immune development
 - Microbiome starts at gestation – promoters, maternal microbiome, neonatal probiotics
 - Rapid growth after birth and through early life
- How and when do we think the microbial colonization starts in calves?
 - Calf is microbiome free in-utero but picks up microbes in the birthing canal (vagina → *Bifidobacteria*, *Lactobacilli* → colostrum digestion)
 - Need to be cautious with the “bad” bacteria that’s floating around in the environment – fecal bacteria, straw and bed pack, gates and walls
 - This uptake and initial colonization is well-orchestrated with the development of the immune system

- Shift from maternal contributed immunity to calf's own adaptive immunity occurs around week 5 to 6 of life
 - Window of susceptibility before this time as maternal immunity wanes
- The problem: the first microbes affect/dictate the immune response
 - Environmental microbes impact the diversity and richness of the microbiome
 - And impacts # of regulatory T cells (Treg) that control the immune response to the commensals → i.e., can the immune system respond to foreign pathogens?
 - If the environment is too sterile, actually aids in spread of pathogenic microbes (grow quicker)
- Within the first 6 weeks of life the microbiome adjusts **twice** in calves: **colostrum ingestion** and **rumen development** (i.e., weaning)
- Ongoing study:
 - Research questions - what is the first microbiome? How quickly is the GIT colonized with the microbiome, what is the interaction of microbiome with the immune system?
 - Euthanize calves (n = 8? per timepoint) at d 0, 3, 7, 14, 21, 35, and 55 (sampled dams around d 14)
 - Results:
 - Relative abundances of specific microbes
 - After birth: mouth w/ high frequency of diff microbes and cecum already colonized but less diverse
 - By age: drastic shifts in microbiome composition
 - **Weaning has a great impact** → rumen development, changes in immune cell subsets (rise in innate immune cells), ↑ Peyer's patches in ileal tissue
- The microbiome aids its own survival (human medicine study)
 - Commensals induce a Type1 IFN signal to main immunotolerance against them
 - Microbiome induces main antiviral pathway to modulate intestinal dendritic cells and Tregs → heightened anti-viral response only when rudimental microbiome established (possibly)
 - Pathogenic microbes stimulate ↑ Type1 IFN response, breaks Treg tolerance
- The "correct" microbiome is not everything in the developing gut that protects us
 - Complement system of GIT (innate immune system) tolerates commensals and fights pathogens
 - Mucus layer only fully established when there is a microbiome
- Never consider the gut microbiome as an independent unit
 - **Gut-lung axis** (calf and human models)
 - Via SCFA absorbed in intestines and distributed via blood
 - Viral infection of respiratory tract can negatively impact gut microbiome via respiratory IFNg
- Antibiotics induce reduction of microbiome, impact metabolic baseline (mouse and calf model)
 - Effect of **early antibiotic treatment** or **consumption of antibiotic-containing milk** in calves
 - Persists for a long time (epigenetics)
 - ↓ diversity of microbiome, ↓ metabolic turnover parameters (SCFA), ↑ protein fermentation
 - ↑ risk of colonization and distribution of antibiotic-resistant pathogens in tonsils (i.e., Salmonella)
 - ↑ odds of further infectious disease later in life (especially lung infections)



- Summary:
 - The microbiome is not a secret weapon – it is out there!
 - A microbiome is already present throughout the gut 2 hours after birth
 - A healthy microbiome aids in calf immune system development
 - Once established, there are no “niches” → we can impact a healthy microbiome in the first hours of life
 - Meta/pro-phylactic use of antibiotics has long-lasting effects of calf performance
 - A healthy microbiome aids vaccine efficacy (not demonstrated in slides).

PANEL DISCUSSION

- How do you define diarrhea and BRD on-farm?
 - Clinical/WI scoring system for Buczinski and Abuelo studies
 - Treatment records underestimate prevalence
- How do we record better data?
 - Get it written down, labor and training for proper exams, find the time...
- What is the impact of waste milk on the microbiome?
 - There's an impact but for how long? We don't know...
 - 2018 study with waste milk in California → 30-50% antibiotic resistance under E. coli challenge ([Tempini et al. 2018](#))
 - Another study of interest (not discussed at SCRC but relevant): [Flynn et al. 2025](#)
 - Lots of discussion around this point – how do we justify **not** using this commodity?
- When do we dry treat? Should we dry treat?
 - New ways forward coming to the next SCRC



Calf Nutrition Section

Quantity or quality of colostrum in ruminants? Cause of variation and consequences for the newborn – Dr. Josef Gross, University of Bern

- Necessity of colostrum supply in ruminants – agammaglobulinemic
- 5 Qs of colostrum management: Quality, Quantity, Quantity, Quickness, Quite Clean
- Rapid decline of IgG concentration in milk after parturition ([Wall et al. 2015](#))
 - Strong impact of time until first milking on colostrum quality
- Variation at farm and cow levels – what contributes?
 - Breed, genetics
 - Parity
 - Maternal IgG concentration
 - Hormonal milieu around gestation
 - Seasonal
 - Dam nutrition
 - Gestation length
 - Sex and body weight of calf
 - FcRn receptor expression
 - Heat stress, environment, and husbandry
- Is milk leaking a problem?
 - No difference in colostrum yield or overall lactation performance
- **High repeatability within cow** (i.e., across lactation numbers) for colostrum quality
- How to detect colostrum quality
 - Lab vs. farm (time constraints) so we use indirect methods (optical and digital refractometers), not always the most reliable indicators
- Summary:
 - High variability in quantity and quality of colostrum, so aim high for both in harvesting
 - Always recommend testing quality
 - There are many parameters affecting colostrum properties

Re-evaluating models to predict calf growth – Dr. Marcos Marcondes, Miner Institute

- New youngstock NASEM model = a huge leap forward
- Calf growth:
 - $ADG = 0.02 + 0.095 \text{ (kg/d)} \times \text{milk intake (kg/d)}$
 - Relationship between ADG and ME intake → ↑ ME, ↑ ADG (not always driven by fat)
 - No difference in WM versus MR at same DM
 - ↓ milk, ↑ starter intake ([Silva et al. 2019](#))
- Validation of calf NASEM models with lab data (many data points from 5 or so rigorous research labs across North America)
 - NASEM model works well, especially from 0 to 40 days
 - Some issues in predicting starter intake (maybe due to starter form?)
 - Importance of microbial protein
 - Esophageal leakage of 42-55% hits different stomachs, retained for 3-ish hours ([Pinheiro et al. 2025](#))
 - Microbial protein accounts for ~12% of protein intake → huge animal variation (need more studies)
 - Protein requirements
 - Do we need phase feeding of grain at the first step down to meet protein requirements?
 - Early life = health/cold challenge; later life = weaning

- Starter crude protein lit review

Source	Treatments compared	Main results
Stamey et al. 2012	19.6 vs. 25.5% CP starter w/ conventional vs. high MR	Under high MR, high CP starter ↑ weaning starter intake, tended ↑ ADG, ↑ 8-10 wk body weight (BW)
Lanier et al. 2021	21.5% vs. 26% CP w/ high MR	High CP ↑ lean tissue and visceral organ size, no diff BW gain
Yousefinejad et al. 2021	18 vs. 22% CP w/ varying RUP proportion	High CP ↑ ADG, weaning BW, and feed efficiency, regardless of RUP proportion
Silva et al. 2025	Fixed 18% vs. decreasing CP (higher CP, progressively reduced)	Fixed CP starter ↑ BW gain, intake. Decreasing CP ↓ fecal output and fecal N excretion, ↑ N-use efficiency

- Validation of heifer NASEM

- Heifer NASEM not great due to NDF issues
- **What are we missing?**
 - Fitting a BW vs. age curve to 18k data points → **long slump** around 150 kg/150-250 days of age (also a slump in hip height here, data not shown)
 - Why? Diet after weaning, transitioning to TMR, lots of pen changes and stress
- **Transition after weaning diet comparisons** (unpublished data):
 - (1) ad lib grain, (2) ad lib grain and hay, (3) limit grain and ad lib hay, (4) heifer TMR
 - Feed grain ad lib = 1.4 to 1.6 kg/d ADG, fast growth → feed and eat a little high quality hay
 - TMR = 1.2 to 1.3 kg/d ADG but better NDF profile
- Requirements for dairy heifers
 - Energy requirements are met
 - Protein requirements: check protein levels <20%, RDP/RUP ratio, dietary RUP @ 51% ↑ ADG
 - CP strategies for dairy heifers:

Source	Treatment	Main results
Colmenero and Broderick 2006	↑ CP from 13.5, 15.0, 16.5, 17.9 and 19.4% DM	Milk yield and protein not ↑ feeding more than 16.5% CP; linear ↑ in urinary N and sharp ↓ in N efficiency as dietary CP increases
Zhang et al. 2017	10.2 vs. 11.9 vs. 13.5% CP DM	Medium CP met requirements (2.47 Mcal/kg ME) of 9-11 mo. old Holstein heifers gaining 0.9 kg/d to breed at 13-14 months

- Dietary metabolizable protein/metabolizable energy ratio and its impact on mammary gland development (unpublished data)
 - Suggestion: **At least 43 g of MP/ME in heifer diets to promote mammary development**
 - Low ratio ↑ fat deposition in mammary parenchyma (i.e., synthetic tissue)
 - High ratio ↑ stimulates parenchymal infiltration into fat pad
- Summary:
 - Intake equations for calves' DMI seem to be doing a good job



- Microbial protein can meaningfully contribute to calves' protein supply even before weaning (~12% CP intake)
- Trend to increase starter CP in high milk feeding plans but need more studies with phase feeding (i.e., monogastrics)
- Intake equations for heifers are capturing only ~50% of the variation
- Different transition feeding plans will bring very different NDF intake results
- 50% RDP:RUP ratio seems to be recommended
- MP:ME > 43 is recommended (requires more validation)

Understanding the importance of dietary fats in liquid feeds for calves – Dr. Juliette Wilms, Trouw Nutrition

- High lactose challenges insulin-glucose metabolism ([Welboren et al. 2021](#))
 - High lactose inclusion (≥50% DM) in MR at high feeding plane for extended period (15 wk of age) lead to insulin resistance ([Hugi et al. 1997](#))
- Higher fat in liquid feeds ↓ morbidity and mortality ([Urie et al. 2018](#))
 - Odds of mortality 3x higher in calves fed ≤ 0.15 kg fat/d in liquid diet compared w/ calves fed ≥ 0.22 kg/d
- High fat liquid feed ↑ body fat deposition ([Tifosky et al. 2001](#))
 - Is higher fat deposition deleterious to pre-weaned calves? No, not like for post-weaned heifers and their mammary gland development
 - Gene expression profile in calves fed high (1.2 kg/d) vs. low plane (0.6 kg/d):
 - Adipose tissue - ↑ adipocyte differentiation, ↑ brown-like adipocytes, ↑ oxidative metabolism, ↓ inflammation
 - Van Amburgh 2011 image of fat deposition in kidneys ([Soberon and Van Amburgh 2017](#))
 - Important for fat deposition, thermoregulation, immune competence, energy homeostasis, and responding to other stressful events in the calf's life
- High fat in MR **does not** (strongly) ↓ starter feed intake ([Echeverry-Munera et al. 2021](#); [Wilms et al. 2022](#))
 - High lactose influences satiety → eat more grain (high fat meets energy needs)
 - To avoid starter drop – wean calves gradually
- Should we care about fat composition in milk replacer? Yes.
 - Dairy cream seems to be superior to alternative fat sources
 - [Wilms et al. 2024](#) compared vegetable vs. animal vs. mixed fat sources with some implications for short term metabolism.
 - C4:0 and C6:0 are often missing from MR
 - Inclusion ↓ scours, ↑ GIT development and digestive secretions, ↑ insulin sensitivity, and ↑ ADG
 - How to restore? Studies with tributyrin and tricaproicoin added to vegetable fat (unpublished)
 - ↑ MR and starter intake, ↑ BW versus control (vegetable fats only)
 - Enhanced rumen development at 5 weeks (pre-starter)
 - Less likely to receive a medical treatment (5 vs. 1 d of treatment), particularly BRD (hazard ratio 0.25)
 - Potential enhanced insulin sensitivity
- Summary
 - Macronutrient profile of a MR depends on rearing objectives (cost vs. resilience) → rethink what defines healthy or desirable calf phenotype beyond just growth
 - ↑ the fat inclusion in MR is beneficial for:
 - Short-term: ↑ body fat reserves for ↑ disease resilience and energy



- Fat in MR should be formulated based on FA profile and triglyceride structure
 - Long-term: metabolic health and energy metabolism
 - Inclusion of tributyrin offers significant benefits to calves (health, growth)

PANEL DISCUSSION

- Can we make a more superior milk replacer versus whole milk?
 - Lots of discussion here, not sure a strong consensus was found
- Should we be weaning later?
 - Looking for 15 kg cumulative NFC intake ([Quigley et al. 2019](#))
 - All panelists agreed that weaning later would help, audience provided some anecdotes about when this does and does not work well (i.e., space constraints)



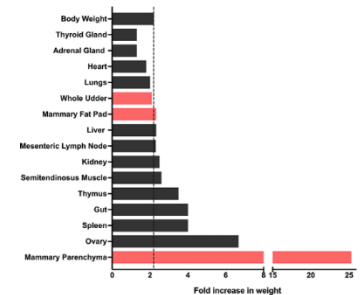
Calf Physiology Section

Beyond passive transfer: The role of colostrum in programming immune development in calves – Dr. Lautaro Rostoll Cangiano, University of Wisconsin-Madison

- Suggest reading Rostoll Cangiano’s review on the topic – [Rostoll Cangiano et al. 2025](#)
- Colostrum’s role in programming T cell immunity and immune activation (ongoing study, see Cid de la Paz poster)
 - Colostrum feeding ↓ key receptors for macrophage activation and inflammation
 - Promotes more balanced immunity, limiting excessive cell proliferation
 - ↓ immune activation in vitro
- **Mucosal immunity** (Tropini et al. 2017)
 - Intestinal immune system is largest immune compartment
 - Colonization of mucosal surfaces is critical for normal immune development
 - Several environmental and maternal factors influence immune development in the GIT
- Summary:
 - Colostrum also delivers: growth factors, antimicrobial peptides, cytokines, and maternal leukocytes
 - These actively shape neonatal immunity, promote gut development, influence microbial colonization
 - Colostrum helps calves transition from sheltered intrauterine environment to a microbe-rich external world

Early-life programming of mammary growth and milk potential in dairy cattle– Dr. Jimena Laporta, University of Wisconsin-Madison

- Strategies to improve milk potential
 - To-date focus on the lactating cow → nutrition, management, welfare, genetics
 - But the fully function gland doesn’t begin its story at calving – it starts at least 2 years before (in utero)
- “Perinatal programming” conditions during critical windows of development have lasting effects on offspring physiology, health, and lifetime productivity
 - Developmental plasticity makes programming possible → is this a risk or opportunity?
- Early-life organ growth
 - Different organs have different growth rates in the calf pre-weaning period (image)
 - But the **mammary parenchyma in particular grows 25x** between birth and weaning! (check out this review by [Laporta and Guenther 2025](#))
- Stressors can influence perinatal programming
 - **Heat stress → impactful, systemic disruption, hard to avoid without cooling**
 - Prenatal heat stress:
 - ↓ pre-weaning mammary size including fat pad (birth and weaning) and parenchyma (birth), ↓ mammary development and proliferation ([Dado-Senn et al. 2022](#))
 - ↓ pubertal mammary size, development, and circulating estrogen ([Davidson et al. 2024](#))
 - ↓ first-lactation milk production and mammary development ([Skibieli et al. 2018](#))
 - Postnatal heat stress:





- ↑ pre-weaning mammary size, especially fat pad → looking into impacts on lipid deposition and signaling (Guenther et al. 2025 ADSA Abstract)
- Following these animals to lactation, stay tuned.
- Shared some examples of cooling strategies for dairy calves:
 - Barrel fans: [Dado-Senn et al. 2020](#)
 - Positive pressure tube ventilation: Guenther et al. unpublished (ongoing)
 - Effective at cooling wire-panel housed calves in Georgia summer
 - Effective at cooling indoor hutch-housed calves in Wisconsin

Early life management choices in dairy calves – Dr. Sabine Mann, Cornell University

- Cow and calf are a “**transition pair**”
 - Calves face many extrauterine adaptations: thermal stress, immune maturation, pathogen challenges, respiratory adaptations → short and long-term effects
- Common early-life management: calf separated from cow at birth, fed colostrum, then individually or group-housed until weaning.
- Importance of transition milk ([Renaud and Steele 2024](#))
 - Key opportunity to help calves face challenge
 - **Could cow-calf contact fill that role?**
 - Sparse data on how different contact systems impact physiology, metabolism, repro, production, injury, farm management, workflow, and economies.
- Cow-calf contact considerations
 - Behavior and affective state, calf development, cow production, microbiome
- Ongoing cow-calf study (some ADSA 2025 abstracts)
 - Compared cow-calf pair, not paired with transition milk, and not paired with milk replacer for 5 days
 - Experimental notes:
 - Dam colostrum given by bottle w/in 4 hrs at 8% birth BW (fed by tube feeder if refused)
 - Cows milked 2x w/bucket milker, calf removed during milking (if paired)
 - Milk-fed calves offered milk at 20% BW/d (up to ~10 L/d)
 - Calves were individually housed if not paired
 - All cows stayed for observation
 - Preliminary results:
 - Dam milk difference for 3-5 DIM (wk 1) but then no difference between trt
 - No difference between trt for calf fecal consistency, rectal temperature, intake or growth
 - ↑ vocalization for paired calves when separated
 - Observed that some calves escaped – more work needed on pen design

PANEL DISCUSSION

- Lots of commentary on the feasibility of cow-calf pairing
 - We need research to establish benchmarks
 - How will the changing dairy landscape be able to adapt facilities to this system?
- Should we be pasteurizing colostrum? Should we feed it for longer?
 - There is not enough evidence to say that pasteurizing colostrum is not ideal (benefits outweigh the risks). Feed it for longer if possible (slight concerns for bacterial contamination here).
- Do we have any numbers on the economics of different calf cooling strategies?
 - No, but for in utero heat stress, it costs the dairy industry \$8 million/year in lost 2-year old milk production and earlier exits from the herd (Laporta et al. 2018)





Calf Welfare Section

Impact of transportation on young dairy calves: new insights and a bumpy road forward – Dr. David Renaud, University of Guelph

- Why transport matters: **over 5 million calves in US** and over 18 million calves globally transported each year
- **Keys to transport success:**
 - Dairy farm management → age at transport, fitness, prior feeding
 - Transportation conditions → time in transit, transit environment, feeding during transport
 - Post-transportation management (did not have time to discuss)
- Age at transport
 - Study: 1st vs. 2nd week of age at transport on calf health and growth (Wang et al. in preparation)
 - ↑ scours pre-transport if wk 2, ↑ scours post-transport if wk 1 (likely cause = timing of typical scours window)
 - 2nd vs. 4th week of age at transport: ↓ mortality, ↓ supportive therapy, ↑ hematocrit if transported at 4 wks ([Marcato et al. 2022](#))
 - 1 vs. 3 d of age at transport: ↓ dehydration if transported at 3 d ([Cramer et al. 2024](#))
- Fitness to transport
 - Serum total protein (STP) should be adequate and no disease present for transport
 - Calves w/ >10 g/L circulating IgG (i.e., > “Poor” status): ↓ mortality risk 59% and ↓ scours risk 67%
 - Transported calves fed 10 L vs. 2 L of colostrum/transition milk: ↑ starter and BW
- Evaluation for motivating non-replacement calf care ([Wilson et al. 2023](#), [Creutzinger et al. 2021](#))
- Time in transit
 - 1.15x in mortality risk for every + 1 hour in transit
- Transit environment
 - Can't adapt the trailer much for transit, suggest more research in this area
 - Goetz et al. unpublished study found trailers are extra cold in February and extra hot in May (compared to spring and fall weather)
- Feeding during transport
 - 16 hrs continuous travel vs. 2- 8 hr transports w/ 8 hr rest and meal: Rested calves ↑ lying at arrival and ↑ NEFA → almost better to not stop in between to avoid tired calves.
 - If you are going to stop to rest, **feed milk** ([Bajus et al. 2024](#), Cochran et al. 2004, [van Dijk et al. 2025](#))

Data driven disease, nutrition, and welfare management of calves: shaping the next generation of cows – Dr. Joao Costa, University of Vermont

- Calf nutrition program should depend on your objective of interest
 - Recommends phase feeding, tends to lean towards a higher milk diet with longer weaning.
- Intensive weaning transition
 - Calf birth → 6 weeks = high fat, high protein % liquid diet (little to none solid feed intake)
 - 7 → 9 weeks = start of solid feed intake, reduction of milk allowance
 - >10 weeks = 100% solid feed intake
- Pre-weaning phase starter
 - Use NFC intake as an indicator
 - Many factors to consider: what type of carbohydrate, starter form, milk allowance, post-weaning transition diet
- Shared some examples of meeting feeding curves using [CalfSim tool](#).



The evolving frontier of dairy calf rearing: Exploring the benefits and challenges of cow-calf contact for animals and farmers – Dr. Heather Neave, Purdue University

- Similar talk to Dr. Mann's but covered more of the producer perspectives through audience polls at Smart Calf
- Shared New Zealand producer survey on cow-calf obstacles ([Neave et al. 2022](#))
 - 3 major concerns for cow-calf contact:
 - (1) poor animal welfare: dam mastitis risk, calf inadequate colostrum intake, ↑ stress from delayed separation, lack of shelter for calves if dams are outdoors
 - (2) increased labor and staff stress
 - (3) system-level changes required: infrastructure, herd management
- Investigating some of these concerns ([Neave et al. 2024](#))
 - 3x2 factorial design: full-time contact, part-time contact or no contact and gradual or abrupt weaning
 - Neither part-time contact nor gradual weaning positively influenced weaning or separation distress (still loud vocalizations and strong behavioral responses compared to full contact) → i.e., **they're not a great strategy** to try to avoid the obstacles described above.
- Notable audience question: What should a farmer do if cow-calf contact separation is required and they don't want to input the system? #1 response was "retire."

PANEL DISCUSSION

- This is the section where we have more questions than answers... how do we tackle these tough problems? How do we approach solutions either as the farmer or as the consultant with our customers?
 - Have candid conversations, small steps in the right direction, know that your targets will depend on your goals.



Producer Day Section

New concepts in colostrum and milk nutrition – Dr. Mike Steele, University of Guelph

- Colostrogenesis
 - Fischer-Tlustos et al. study in preparation: how do prepartum blood and milk IgG compare in the transition period?
 - Dam serum IgG peaks (~25 mg/mL) blood around 4 to 6 weeks before calving
 - Dam colostrum IgG peaks (~200 g/L) **7 days before calving**, linear ↑ in colostrum IgG from 6 weeks to 7 days prior, then rapid ↓ from 7 d prior to 7 d after calving.
- Colostrum feeding
 - Successful passive transfer? Sample calves for passive transfer on **days 1-3** after birth (Goetz et al. 2025)
 - Steele thinks we should strive for 0% Poor
 - Recommended volume: 10% BW for one feeding, 12% if multiple → **recommend 2 feedings**.
 - Study comparing 6, 8, 10, and 12% colostrum on body weight basis (Frederick et al. 2025)
 - ↑ serum IgG up to 10% but not going up to 12%, linear ↓ in apparent efficiency of absorption (AEA; Dr. Steele does not think AEA should be the metric that we use, however)
 - Study comparing 2 meals (8 and 4% BW) vs. 3 meals (4% each) within 12 hours ([Lopez et al. 2022](#))
 - Ideal and equivalent AEA by 24 hours (though 2 feedings had higher area under the curve)
 - Recommended quality: Enriching up to 90 g/L seems to be the sweet spot ([Lopez et al. 2023](#))
 - Colostrum IgG absorption – comparing to the “ad lib beef model” ([Hare et al. 2021](#), McCarthy et al. in review)
 - Peak at ~12 g/L serum IgG for conventionally fed Holstein and beef cross calves fed at 2.5 g IgG/kg BW
 - Note: Crossbred calves serum IgG vs. Holsteins (15 vs. 12) at this level
 - Peak at ~25 g/L serum IgG for conventionally fed Holstein and beef cross calves fed at 5 g IgG/kg BW
 - Peak at ~55 g/L serum IgG for beef calf with cow (**we have a LONG way to go**)
- Transition milk:
 - Bioactives in colostrum and transition milk ([Fischer-Tlustos et al. 2020](#))
 - Elevated protein, fat, and IgG from milking 1 to 5 (though still declines)
 - Milk replacer vs. transition vs. extended vs. transition + extended → all performed better than milk replacer alone
 - ↑ ADG and ↓ hazard of diarrhea and mortality ([McCarthy et al. 2023](#))
 - Extended colostrum feeding (Hare et al. 2020)
 - After second meal of either colostrum or 50:50 col/milk, serum IgG ↑ +10 or +5 mg/mL (no difference between colostrum or 50:50 for AEA)
 - Can also try dosing for diarrhea ([Carter et al. 2022](#)) or dosing for weaning ([Van Niekerk et al. 2021](#))

Putting our heads together: Practical strategies for successful pair or group housing – Dr. Jennifer Van Os, University of Wisconsin-Madison

- Why is individual the norm?
 - Allow for control and monitoring of individual calves (feeding and health)
 - Physical separation and disease risk → ↓ calf contact

- Management practices (i.e., disbudding)
- Global trends suggest a **shift towards group housing**
 - 40 to 62% in UK (2010 to 2021)
 - Mandate in Canada for pair/group housing by 2031
- Benefits to social housing
 - Motivated for social contact
 - Social development
 - Cognitive/behavioral flexibility
 - Play behavior
 - Stress resilience
 - Protect from cold stress
 - ↑ solid feed intake
 - ↑ ADG
 - Early evidence of long-term benefits
- [UW Extension resource](#) as a “how to” guide to pair housing.
- Challenges to social housing
 - Health outcomes: BRD and diarrhea review for group housing ([Cantor et al. 2019](#); [Plaugher and Cantor 2025](#)) → health outcomes neutral to poor
 - Large group housing is more complex: group vs. individual impact of calf health is mixed → larger group size (15+) is a **risk factor**
 - Adapted from [Ollivett 2020](#), Miller-Cushon and Jensen 2025

Category	Number of studies (Group relative to Individual)		
	Increased	No Difference	Decreased
Treatment incidence	2	1	0
Worse clinical scores	1	1	0
Recorded disease	2	1	0
Lung consolidation	1	0	0

- How to manage unwanted behaviors (i.e., cross-sucking/inter-sucking)
 - Survey report of at least “occasional” cross-sucking: (Van Os et al. in prep)
 - 85% of producers using pair or group housing
 - 70% of producers using individual housing with fence-line contact
 - How much of a problem is cross-sucking (according to the data)?
 - No association between pre-weaned cross-sucking and navel infection ([Gröbbacher et al. 2018](#))
 - No association between persistent post-weaned cross-sucking and 1st lactation mastitis or higher SCC ([Vaughan et al. 2015](#))
 - ↑ odds of 1st lactation udder health issues and ↑ blind quarters (7 vs 4%) after pair vs. individual housing (cross-sucking behavior not quantified; [Mahendran et al. 2024](#))
 - According to producers... **Many express concern** or hesitation and want to stop this behavior and its potential negative consequences
- Optimizing group housing
 - Goal when selecting **group size**: minimize disease and competition
 - ↑ **age gap** = ↑ **competition** ([Jensen et al. 2013, 2015](#))
 - Avoid ≥ 2 week age difference between oldest and youngest calf in pair/group
 - **Ideally < 1 week** age difference → preferred by 80% of veterinarians (Van Os et al. in prep)
 - Consider achievable age range in grouping scenarios based on calving rate when deciding how you want to group
 - Best age to pair/group?



- ~2/3 of veterinarians in survey prefer pairing calves at ≤ 2 weeks of age (~18% ≤ 3 days, ~35% at 4 to 7 days, and 25% at 8 to 14 days; Van Os et al. in prep)
- Earlier pairing = more homogenous weaning BW ([Moroz et al. 2025](#))

Managing calf health – Dr. Terri Ollivett, University of Wisconsin-Madison

- How to **“create”** pneumonia
 - Give them diarrhea → dirty environment, FPTI, dirty/inconsistent milk
 - Cold stress
 - Stale air → indoor housing, lack of fresh air, overcrowding
 - Stress them out → not enough calories, transport, grouping/re-grouping
 - Genetics??
- How to **prevent and control** pneumonia
 - Disease detection (especially important)
 - Clean maternity, transport, feed equipment, calf facility
 - Meet passive transfer goals:
 - Brix $\geq 22\%$
 - 3-4 L w/in 1-2 hrs by tube
 - 2 L **by nipple bottle** 12 hours later
 - Low bacteria counts
 - Early life nutrition:
 - 8-10 L/day
 - 13% total solids
 - Grain and water by d 3
 - Wean @ > 42 days over 2 weeks
 - Air quality: no ammonia smell; if you're comfortable in the winter, the barn is too tight
 - No cold stress: deep straw, good nutrition, jackets
 - Good passive transfer of immunity: test all calves all the time
- Walked through some of the basics of lung ultrasounding for BRD detection
 - Quick (trained vet takes 5 minutes), effective, non-invasive

Keys to success with the autfeeder system: facilities, personnel, health protocols and feeding plans – Dr. Melissa Cantor, Penn State University and Dr. Joao Costa, University of Vermont

- Missed this talk; this [podcast episode](#) would likely be a good review

Calf rearing in the Midwest: Innovation, obstacles, and opportunities – Dr. Bethany Dado-Senn, Vita Plus; Sam Peetz, Rosy Lane Holsteins; Laura Raatz, Wagner Farms; and Dean Helt, Helt Dairy

- 15 minute presentation by BDS followed by 30 minute panel
- Obstacles
 - Expenses
 - Beef cross calves (\$1,100-\$1,300 in central WI right now)
 - Replacement heifers (\$2,600 to raise, going for \$2,000-\$3,000 as springers)
 - Custom raising (\$3.00-\$4.50/hd/d depending on age and location)
 - Feed and labor
 - Facilities
 - Midwest US = 40% outdoor hutches, 33% indoor hutches, and 25% indoor group housing (2014 NAHMS survey)
 - “Renaissance” in calf facilities – why?



- Questions from audience:
 - How do you establish and maintain protocol compliance?
 - Is cross sucking a problem in your facility and how do you manage it?
 - How many employees do you have working per calf? How long does it take to feed?
 - What are your goals for the next 5 to 10 years for your dairy?