

INTERPRETIVE SUMMARIES, JANUARY 2021

Invited review: Lying time and the welfare of dairy cows. *By Tucker et al., page 20.* Abundant evidence indicates that being able to lie down is a high priority for dairy cows and that many farm practices can limit or reduce this behavior. A cow's welfare is impaired when she is forced to stand for 3+ h at a time or when she is not provided soft, dry, clean, accessible, well-designed, or appropriately sized lying areas. Her reproductive status, days since calving, age, and disease burden also influence how much time she spends lying down, and these details are important, along with the suitability of her housing and management, when interpreting measures of daily lying time.
<https://doi.org/10.3168/jds.2019-18074>.

Peptidome comparison following gastrointestinal digesta of bovine versus caprine milk serum. *By Ma et al., page 47.* We found a greater number of peptides and relative high abundance of most peptides released in gastric and intestinal digesta of caprine milk serum compared with bovine milk serum, suggesting that caprine milk serum was digested more easily in an in vitro model of infant digestion. Our results provide evidence of the higher digestibility of caprine milk-based infant formula compared with bovine milk-based formula.
<https://doi.org/10.3168/jds.2020-18471>.

Time-dependent aggregation of casein micelle concentrates. *By Krishnankutty Nair and Corredig, page 92.* Concentrated milk protein suspensions (6×) from raw or heat-treated milk (90°C for 10 min) were observed after storage at 4°C for 9 d for possible changes in viscosity, micellar size and structure, and proteolysis. All concentrates showed an increase in viscosity with storage, but not if a protease inhibitor cocktail was added, indicating the importance of proteolysis in storage-induced gelation. Both heat-treated and raw concentrated milk samples showed possible aggregation of casein micelles during storage. In heat-treated samples, the aggregation was induced by the presence of heat-induced aggregates in the serum phase.
<https://doi.org/10.3168/jds.2020-18493>.

Prediction of indicators of cow diet composition and authentication of feeding specifications of Protected Designation of Origin cheese using mid-infrared spectroscopy on milk. *By Coppa et al., page 112.* The ability of mid-infrared spectroscopy, a rapid and low-cost technique, on bulk milk to predict cow diet composition was tested. Mid-infrared spectroscopy was able to predict the pasture, pasture plus hay, corn silage, conserved herbage, fermented forage, and total herbage proportion in the daily cow diet with a standard error of prediction of <15%. Mid-infrared

spectroscopy also correctly discriminated milk, respecting the feeding restrictions included in the labeled cheese specifications. Thus, mid-infrared spectroscopy can provide useful indicators of cow diet composition for the authentication of dairy products.
<https://doi.org/10.3168/jds.2020-18468>.

A simple and rapid immunochromatography test based on readily available filter paper modified with chitosan to screen for 13 sulfonamides in milk. *By Zeng et al., page 126.* In this study, we established an immunochromatography method to detect sulfonamides in milk by using chitosan-functionalized filter paper instead of a nitrocellulose membrane as a solid-phase carrier in a strip. The performance of the developed method was similar to that of traditional nitrocellulose membrane-based immunochromatography. Moreover, the cost of the filter paper is less and filter paper is more readily available than nitrocellulose membrane, making this test suitable for use in developing countries.
<https://doi.org/10.3168/jds.2020-18987>.

Short communication: Effect of pH on the heat stability of reconstituted reduced calcium milk protein concentrate dispersions. *By Sunkesula et al., page 134.* Heat stability of reconstituted milk protein concentrate powders is an important functionality for their selection as ingredients in the manufacture of food products subjected to high thermal treatment. This study focused on evaluating the effect of pH on the heat stability of reduced-calcium milk protein concentrate dispersions. Heat stability was assessed at 140°C in reconstituted milk protein concentrate dispersions at 5 different pH levels and from powders with 4 different calcium contents. Maximum heat stability of 30.94 min was observed in dispersion made from 40% reduced-calcium milk protein concentrate powder at pH 7.1.
<https://doi.org/10.3168/jds.2020-18937>.

The nutrient requirements of *Lactobacillus acidophilus* LA-5 and their application to fermented milk. *By Meng et al., page 138.* This research provides a reference model for regulating the growth of probiotics in fermented milk prepared by a single probiotic and in fermented milk prepared by a mixed starter culture containing the probiotic, based on the nutrient requirements of the probiotic.
<https://doi.org/10.3168/jds.2020-18953>.

Investigation of the Cyprus donkey milk bacterial diversity by 16S rDNA high-throughput sequencing on a Cyprus donkey farm. *By Papademas et al., page 167.* Interest in donkey milk is growing worldwide due to its functional and nutritional proper-

ties, especially for infants, people who are immunocompromised, and older adults. Therefore, the objective of this study was to identify and characterize the bacterial communities of donkey milk produced on a donkey farm in Cyprus by using culture-based approaches in combination with high-throughput sequencing. Results from this study confirm that the donkey milk bacterial microbiome is mostly composed of gram-negative bacteria. The findings from this study are expected to increase knowledge regarding the bacterial consortium of donkey milk and provide indications of the key bacterial microbiome that contributes to donkey milk's elevated nutritional value.

<https://doi.org/10.3168/jds.2020-19242>.

Short communication: A competitive exclusion study reveals the emergence of *Bacillus subtilis* as a predominant constitutive microorganism of a whey reverse osmosis membrane biofilm matrix. By Verma et al., page 221. This study demonstrated the predominance of *Bacillus subtilis* in the biofilm constitutive microflora of a used whey reverse osmosis membrane. Culturing techniques were used to isolate the constitutive microflora from an 18-mo-old membrane. Six microorganisms were distinguished based on colony morphology, Gram staining, and matrix-assisted laser desorption/ionization time-of-flight identification. Fifteen coculture combinations were grown and analyzed to establish the emergence of predominance. *Bacillus subtilis*, identified using rpoB sequencing, was observed to be the predominant species among the constitutive microflora. The predominance was further validated using natural selection in a multispecies growth environment.

<https://doi.org/10.3168/jds.2020-18478>.

Effect of anthocyanin-absorbed whey protein microgels on physicochemical and textural properties of reduced-fat Cheddar cheese. By Wen et al., page 228. Reduced-fat cheese is important for dietary calorie reduction, but the reduced-fat content affects the quality and mouthfeel of cheese, giving it an undesirable, hard, and rubbery texture. In this study, added whey protein microgels served as a fat substitute and anthocyanin carrier, which effectively reduced the hardness and improved the sensory acceptance of reduced-fat Cheddar cheese. Whey protein microgels should promote the industrial production of better-quality reduced-fat cheese, form a promising general strategy for mimicking fat globules, and create more consumer-acceptable reduced-fat foods.

<https://doi.org/10.3168/jds.2020-18450>.

A rapid method to quantify casein in fluid milk by front-face fluorescence spectroscopy combined with chemometrics. By Ma and Amamcharla, page 243. Casein in fluid milk can affect cheese produc-

tion yields and product quality. In the present study, we developed and validated a method to determine casein in fluid milk with various casein-to-crude protein ratios using front-face fluorescence spectroscopy and chemometrics. This method can be rapidly performed on-site or at-line to obtain information about raw milk quality, standardize cheese milk, and indicate cheese production yields and finished product quality.

<https://doi.org/10.3168/jds.2020-18799>.

Relationships between cheese-processing conditions and curd and cheese properties to improve the yield of Idiazabal cheese made in small artisan dairies: A multivariate approach. By Aldalur et al., page 253. The technical processing conditions used during cheesemaking have an important effect on cheese properties, yield, and whey losses. The improvement of the cheesemaking process increases cheese yield and reduces the organic content of whey, contributing to the economic and environmental sustainability of dairies, particularly in those where the role of the cheesemaker is essential. This study evaluates the multiple relationships that affect curd grains, cheese, and whey properties during the manufacturing of cheese on a small dairy scale.

<https://doi.org/10.3168/jds.2020-18926>.

Physicochemical and textural characteristics and volatile compounds of semihard goat cheese as affected by starter cultures. By Jia et al., page 270. The effect of starter cultures on the biochemical changes of goat cheese during maturation should be understood and considered in cheese production and processing. In this study, we explored the physicochemical and textural properties and volatile compounds of goat cheese made with 5 starter cultures during 60 d of maturation. The results showed that the type of starter culture had a limited effect on the physicochemical properties of goat cheese but a more pronounced effect on the texture and volatile components. In addition, we identified, through comprehensive comparison, a suitable starter culture for goat cheese with dense texture and milky flavor.

<https://doi.org/10.3168/jds.2020-18884>.

Consumer perceptions of anticake agents on shredded Cheddar cheese. By Meals et al., page 281. Anticake agents are applied to commercial cheese shreds to assist with shelf life and ease of use. This study documented consumer perception of 3 anticake agents applied at various levels to Cheddar cheese shreds. Overall liking, flavor, and texture liking attributes for melted shreds and appearance liking for cold shreds were negatively affected at >3% (wt/wt) application regardless of the anticake agent used. In general, anticake agents can be applied to Cheddar

cheese shreds at up to 3% (wt/wt) with minimal effect on consumer perception.
<https://doi.org/10.3168/jds.2020-19052>.

Short communication: To what extent do environmental or technological conditions affect the sensory differentiation of raw ewe milk cheeses produced in valley or mountain farms? *By Amores et al., page 301.* This work discusses the extent to which differences in technological or environmental conditions affect the sensory properties of cheeses made with raw milk from sheep flocks managed under extensive grazing in mountain or valley farms. Cheese sensory properties were mainly dependent on the type and amount of rennet used for cheesemaking. These results contribute to the prescription of adequate cheesemaking protocols that permit regulatory boards, producers, and consumers to characterize the typical sensory properties of cheeses produced in mountains or in valleys.
<https://doi.org/10.3168/jds.2020-18358>.

Linking forage choice behavior of goats with the metabolome of contrasting silages. *By Scherer et al., page 308.* The interrelationships between silage preference of ruminants and compounds that may affect forage choice are not fully understood. In this study, we applied a nontargeted metabolomics approach to comprehensively profile the characteristic metabolites of alfalfa (*Medicago sativa* L.) and red clover (*Trifolium pratense* L.) silage and link metabolite profiles to forage choice by goats. This study offers an important new approach to better understand feed preference of ruminants.
<https://doi.org/10.3168/jds.2020-18628>.

Diet supplementation with thyme oil and its main component thymol failed to favorably alter rumen fermentation, improve nutrient utilization, or enhance milk production in dairy cows. *By Benchaar, page 324.* Based on previous in vitro studies, it has been claimed that thyme oil and its main component thymol may improve efficiency of rumen fermentation because of their antimicrobial properties in the rumen. The present study was undertaken to assess whether the use of thyme oil or thymol as rumen fermentation modifiers (50 mg/kg of diet dry matter) positively affected dairy cow metabolism, improving milk production and efficiency. The findings of this study revealed no positive effects from using thyme oil or thymol at 50 mg/kg of diet dry matter for lactating dairy cows.
<https://doi.org/10.3168/jds.2020-18401>.

Factors that affect heat production in lactating Jersey cows. *By Morris et al., page 346.* We evaluated factors that affect heat production (HP) of lactating Jersey cows from feed intake, milk component yield,

digestibility, and urinary N. Equations were derived from a database containing 293 cow-period observations of energy balance. Average HP was $28.1 \pm 3.7\%$ of gross energy intake. Variation in HP was adequately explained by metabolic body weight and dry matter intake. The inclusion of milk production and nutrient digestibility variables resulted in similar model performance. Compared with milk fat synthesis, milk protein synthesis was associated with twofold more heat.
<https://doi.org/10.3168/jds.2020-18976>.

Enteric methane emission, milk production, and composition of dairy cows fed 3-nitrooxypropanol. *By Melgar et al., page 357.* Inclusion of 3-nitrooxypropanol (3-NOP), administered via the total mixed ration at a concentration of 60 mg/kg of feed dry matter, decreased enteric methane emission in lactating dairy cows by 26% in a 15-wk experiment. There was no negative effect of 3-NOP on dry matter intake and milk production, but milk fat concentration and yield were increased in cows receiving 3-NOP. These results suggest that 3-NOP is a promising feed additive for reducing enteric methane emission while maintaining lactational performance and potentially increasing milk fat yield in dairy cows.
<https://doi.org/10.3168/jds.2020-18908>.

Effect of strategy for harvesting regrowth grass silage on performance in dairy cows. *By Pang et al., page 367.* Generally, temperature, day length, and annual climatic conditions affect time of harvest of forage leys and, subsequently, silage feed value. This study showed that feeding regrowth silage harvested after an early first cut and after a short regrowth interval promoted better dairy performance and feed intake and higher efficiency of feed and energy utilization. Feeding third-cut silage gave higher milk yield and feed efficiency compared with feeding second-cut silages. To optimize forage harvesting systems, whole-farm models that take into account the effects of harvesting systems on harvest yield, intake potential, and nutritive value should be developed.
<https://doi.org/10.3168/jds.2020-18888>.

Effect of active dry yeast on lactation performance, methane production, and ruminal fermentation patterns in early-lactating Holstein cows. *By Li et al., page 381.* Active dry yeast (ADY) was proven to improve lactation performance in dairy cows; however, the dose effect was rarely evaluated. In this study, although the dry matter intake was not affected by ADY supplementation (0, 10, 20, and 30 g/d per head), milk production and feed efficiency increased quadratically with increasing ADY supplementation and peaked at 20 g/d per head. Digestibility of dry matter, organic matter, neutral detergent fiber, acid detergent fiber, nonfiber carbohydrates, and crude

protein increased quadratically with increasing ADY supplementation and peaked at 10 to 20 g/d per head. These results illustrated that ADY supplementation is beneficial for milk production by increasing nutrient digestibility, and the most optimal dose could be 20 g/d per head.

<https://doi.org/10.3168/jds.2020-18594>.

Technical note: Quantification of lignans in the urine, milk, and plasma of flaxseed cake-fed dairy sheep. *By Zhuang et al., page 391.* Flaxseed is rich in lignans, which are converted into mammalian lignans (e.g., enterolactone, enterodiol) by the gut microbiota. We used flaxseed cake-fed dairy ewes as a model and established a highly sensitive quantification method of mammalian lignans in different sheep biofluids. With the combination of mass and nuclear magnetic resonance technologies, both free and conjugated (glucuronidated and sulfated) mammalian lignans were identified. The sheep plasma contained all forms of the lignans, and the free forms were more permeable to milk than the sulfated conjugates. Mammalian lignans in sheep may provide health benefits to the sheep and to consumers of sheep products.

<https://doi.org/10.3168/jds.2020-18470>.

Relationship of body weight at first calving with milk yield and herd life. *By Han et al., page 397.* Body weight at first calving is a widely used parameter of heifer rearing. We evaluated the effect of body weight at first calving on short-term and long-term milk yield and on herd life. Our results showed that body weight at first calving was not a strong indicator for first-lactation milk yield and long-term milk yield. Heavier heifers lost more weight during the first month of lactation and subsequently faced higher risk of being culled than lighter heifers.

<https://doi.org/10.3168/jds.2020-19214>.

Milk losses and dynamics during perturbations in dairy cows differ with parity and lactation stage. *By Adriaens et al., page 405.* Milk yield dynamics during perturbations reflect dairy cows' responses to challenges. Characterization of these dynamics allows for precision phenotyping and improved monitoring. The perturbation development and recovery rates, milk losses, and duration differed across parities and lactation stages, with more severe perturbations in early-lactation and higher parity cows.

<https://doi.org/10.3168/jds.2020-19195>.

Opportunities for improving the safety of dairy parlor workers. *By Edwards and Kuhn-Sherlock, page 419.* Worker comfort and safety are important features of an attractive workplace and are necessary for attracting and retaining skilled staff. Dairy workers spend considerable time in the parlor; this study sought to

identify common causes of milking injuries and establish links to parlor design or management practices. Of the 560 farms surveyed, 18% had had an injury in the previous year. Of the injuries, 47% occurred while attaching clusters and commonly affected fingers, hands, wrists, and arms. These body parts represented the greatest costs for accident insurance claims. Attaching clusters should be a focus for solutions to mitigate milking injuries.

<https://doi.org/10.3168/jds.2020-18954>.

Analysis of adoption trends of in-parlor technologies over a 10-year period for labor saving and data capture on pasture-based dairy farms. *By Yang et al., page 431.* Greater use of in-parlor technologies on farm has the potential to improve management outcomes, but to date adoption has been slow. This study investigated trends in parlor technology adoption across a 10-yr period in New Zealand and grouped technologies into labor-saving or data-capture categories. The analysis indicates the occurrence of 2 trajectories to technology investment on farms, where larger farms are able to take advantage of technology opportunities but smaller farms are constrained by factors such as lack of economies of scale, limited capital to invest, and inability to retrofit into aging parlor infrastructure. The results highlighted the importance of understanding spatial and temporal farm characteristics when considering future effect and adoption of in-parlor technologies.

<https://doi.org/10.3168/jds.2020-18726>.

Fertility and milk production on commercial dairy farms with customized lactation lengths. *By Burgers et al., page 443.* Some farmers in the Netherlands are extending the voluntary waiting period for first insemination to customize calving interval (CAI) for possible positive effects on fertility and health. This study aimed to investigate farms with customized CAI, with respect to calving to first service interval, accomplished CAI, fertility, and milk production. Although calving to first service interval was not related to services per conception, longer CAI was related to increased services. Although 305-d yield was often greater in longer CAI, yield per day of CAI at most farms was not always greatest in longer CAI, especially for multiparous cows.

<https://doi.org/10.3168/jds.2019-17947>.

Exploring simultaneous perturbation profiles in milk yield and body weight reveals a diversity of animal responses and new opportunities to identify resilience proxies. *By Ben Abdelkrim et al., page 459.* The adaptive responses of dairy cows to environmental stressors can be expressed as deviations from their performance trajectories for milk production and body weight. This study proposes a method to charac-

terize the phenotypic diversity that may exist in adaptive responses using time series of daily performance in dairy cows. The approach permits characterization of theoretical lactation curves of production potential and identification of the perturbations that exist in these trajectories. Detection and analysis of such perturbations can help to reveal an animal's resilience. <https://doi.org/10.3168/jds.2020-18537>.

Effect of reproductive management programs for first service on replacement dairy heifer economics. *By Masello et al., page 471.* We evaluated cash flow during the rearing period and first lactation for dairy heifers managed for first service with programs that relied primarily on insemination at detected estrus, timed AI, or a combination of both. In spite of greater reproductive cost, programs that used timed AI in combination with AI at detected estrus or solely timed AI generated numerical differences in cash flow of potential value to commercial dairy farms. Reduced rearing cost and more revenue generated during the first lactation increased cash flow for up to 15 mo under fixed or simulated variable market conditions. <https://doi.org/10.3168/jds.2020-18588>.

Piecewise modeling of the associations between dry period length and milk, fat, and protein yield changes in the subsequent lactation. *By Pattamanont et al., page 486.* To determine the optimal dry period length, it is necessary to predict changes in milk, fat, and protein yields in the subsequent lactation. Based on Dairy Herd Improvement Association milk recording data, we developed piecewise models with a continuous function of days dry to predict mature-equivalent yield changes. Milk, fat, and protein yield losses were greater with dry period lengths shorter than conventional. Long dry period lengths were not associated with losses in yields. The piecewise models may be used for decision making on the economically optimal dry period length for individual cows. <https://doi.org/10.3168/jds.2020-18363>.

Predicting dairy cattle heat stress using machine learning techniques. *By Becker et al., page 501.* Animal health professionals and dairy producers use changes in physiological responses and behavioral patterns of cows as a tool for identifying poor health and welfare in periods of heat stress. The objective of this study was to design and use a heat stress scoring system to evaluate heat stress severity on grazing dairy cows with access to different heat abatement strategies, and then to analyze and predict the accuracy of the scoring system with machine learning methods. The findings from this study provide a new tool to assess heat stress in dairy cows. In addition, machine-learning models can predict heat-stressed and non-heat-stressed

cows but had an increased accuracy and precision when using the random forest method. <https://doi.org/10.3168/jds.2020-18653>.

Short communication: Development and evaluation of equations to predict growth of Holstein dairy heifers in a tropical climate. *By Silva et al., page 525.* Evaluations of dairy heifer growth that use concurrent measures of body weight, height, and age are scarce. In this study, we demonstrated a linear relationship between body weight and age of Holstein heifers as well as an exponential relationship between body weight and height. Further, the relationship between height and age was quadratic with a plateau, demonstrating that height stabilized at 138.6 cm at 806 d of life. Overall, the models generated demonstrated high predictability of growth for dairy heifers and may be used as a tool for evaluating growth of these animals. <https://doi.org/10.3168/jds.2020-18624>.

Genetic parameters for methane emission traits in Australian dairy cows. *By Richardson et al., page 539.* Future breeding objectives will likely focus on improving sustainability without negatively affecting economically important traits. This may be achieved by selecting for a methane trait such as residual methane production (RMP). We compared 9 definitions of RMP that all had low to moderate heritability estimates and high genetic correlations with one another and other methane candidate traits. Our results suggest that direct selection for an RMP trait may reduce environmental impacts without severely affecting other valuable traits such as production, health, and fertility. <https://doi.org/10.3168/jds.2020-18565>.

Major quantitative trait loci influencing milk production and conformation traits in Guernsey dairy cattle detected on BTA19. *By Li et al., page 550.* A genome-wide association study for all traits evaluated for Guernsey cattle revealed major quantitative trait loci (QTL) influencing several production and conformation (body shape) traits on chromosome 19 in the region of 26.2 to 28.3 Mb. Multiple QTL on chromosome 19 may be associated with some of the traits (protein, dairy form, and stature). The top-associated single nucleotide polymorphisms are common variants, and the haplotype where the QTL resides has a high frequency in the US Guernsey population, indicating a potential long-term influence of this QTL on the Guernsey breed. <https://doi.org/10.3168/jds.2020-18766>.

Genetic and nongenetic factors associated with lactation length in seasonal-calving, pasture-based dairy cows. *By Williams et al., page 561.* Lactation yields are frequently standardized to fixed lactation lengths for genetic evaluations and decision

support tools. These standardized yields fail to penalize cows that do not reach the standardized lactation length. In the present study, an array of management factors, including calving month, parity, calving difficulty, and dry period length, were associated with lactation length in a pasture-based system. Although the estimated heritability of lactation length was low, longer lactations could be achieved through improved management practices and selective breeding. <https://doi.org/10.3168/jds.2020-18941>.

Mitochondrial protein gene expression and the oxidative phosphorylation pathway associated with feed efficiency and energy balance in dairy cattle. *By Dorji et al., page 575.* Feed efficiency and energy balance are complex traits, and our understanding of their underlying biology is currently limited. Mitochondria are responsible for cellular energy metabolism and may contribute to variation in these traits. We examined mitochondrial protein gene expression in blood of groups with high and low feed efficiency and energy balance. Mitochondrial protein genes were underexpressed in more feed efficient and negative energy balance cows. This study provides biological insight into possible genetic pathways underpinning trait expression. <https://doi.org/10.3168/jds.2020-18503>.

Using sequence variants of a QTL region improves the accuracy of genomic evaluation in French Saanen goats. *By Talouarn et al., page 588.* The recent decrease in sequencing costs has made it possible to sequence large numbers of individuals in key livestock species. Sequence data are interesting for genomic evaluations as they can include causal mutations and therefore lead to a better persistency of the accuracy of genomic predictions. Here, we describe the first exploratory study of genomic evaluations using information extracted from sequence data in French Saanen goats. Our study shows that selected sequence data significantly improve the accuracy of genomic predictions in the French Saanen breed. <https://doi.org/10.3168/jds.2020-18837>.

Differential gene expression in dairy cows under negative energy balance and ketosis: A systematic review and meta-analysis. *By Soares et al., page 602.* Ketosis is a severe metabolic disease that causes economic losses for the dairy industry, causing animal welfare concerns and decreased milk production. To date, studies on differential gene expression have not revealed the full picture of the genetic basis of negative energy balance and ketosis. Therefore, a systematic review and meta-analysis of transcriptome and proteome during negative energy balance and sub-clinical and clinical ketosis were carried out to better

understand the genetic basis of these metabolic conditions. The results suggest that meta-analysis of gene expression studies using quantitative polymerase chain reaction, microarray, RNA sequencing, and proteome techniques, combined with genome-wide association studies, can contribute to a better understanding of the genetic background of negative energy balance and sub-clinical and clinical ketosis in dairy cattle, which could enhance selection decisions and help with the development of biomarkers for early diagnosis and prevention of ketosis. <https://doi.org/10.3168/jds.2020-18883>.

Between-herd variation in resilience and relations to herd performance. *By Poppe et al., page 616.* Management is expected to have an effect on herd resilience through the control of environmental disturbances and the ability of cows to handle them. We showed that differences in herd resilience exist between herds and that these differences can be explained by herd parameters such as mean milk yield level, incidence of ruminal acidosis, and mean somatic cell score. <https://doi.org/10.3168/jds.2020-18525>.

Liability to diseases and their relation to dry matter intake and energy balance in German Holstein and Fleckvieh dairy cows. *By Becker et al., page 628.* In early lactation, high dry matter intake is essential for high energy supply and therefore for dairy cow health. Furthermore, dry matter intake largely determines dairy cow efficiency. If milk yield remains the same, high dry matter intake conflicts with high efficiency. Nevertheless, breeding for higher dry matter intake or less negative energy balance in early lactation could positively affect dairy cow health. Healthy cows are fundamental for high economic efficiency, low environmental effect, and social esteem of dairy farms. <https://doi.org/10.3168/jds.2020-18579>.

Investigating the cow skin and teat canal microbiomes of the bovine udder using different sampling and sequencing approaches. *By Dean et al., page 644.* There is a growing interest in the dairy community to use the microbiome as a tool to better understand diseases affecting cow health. This necessitates the development and application of standardized, reproducible, and efficient protocols that can be used and compared across studies. This study compared the effects of different sampling devices and genomic assays on the isolation of microbes from different anatomical regions of the cow udder. Results suggest that gauze can be used to efficiently obtain sufficient DNA yield from the teat apex and that host DNA can overwhelm bacterial DNA, particularly in samples from the teat canal. <https://doi.org/10.3168/jds.2020-18277>.

Bias in genomic predictions by mating practices for linear type traits in a large-scale genomic evaluation. *By Tsuruta et al., page 662.* Bias in genomic predictions can be reduced by accounting for consistency between pedigree-based and genomic relationships using a single-step genomic model. Selection and mating practices may have effects on bias in genomic predictions. Selection can reduce between-family variation, whereas assortative mating can increase within-family genetic variation. In a population under strong selection, positive assortative mating, which is strongly associated with large genetic gains, can minimize the decline in heritability and affect bias in genomic predictions.

<https://doi.org/10.3168/jds.2020-18668>.

Short communication: Heterosis and breed effects for milk production and udder health traits in crosses between Danish Holstein, Danish Red, and Danish Jersey. *By Kargo et al., page 678.* We estimated breed effects and heterosis using data from purebred Holstein, Jersey, and Danish Red cows and crossbred cows from herds applying systematic crossbreeding programs. Heterosis for milk production traits was largest for crosses involving Jersey cows. Heterosis due to crossing of dairy cow breeds improves milk production traits but has only limited effects on udder health of the cow.

<https://doi.org/10.3168/jds.2019-17866>.

Effects of injectable calcitriol on mineral metabolism and postpartum health and performance in dairy cows. *By Vieira-Neto et al., page 683.* Objectives were to determine the effects of injectable calcitriol on blood minerals, incidence of hypocalcemia, and performance in dairy cows. Calcitriol increased concentrations of ionized Ca in blood and plasma concentrations of total Ca and P, whereas it reduced total Mg compared with control cows. Calcitriol reduced incidence of retained placenta, puerperal metritis, and morbidity in overconditioned cows. Calcitriol had no effect on milk yield, but it reduced rate of pregnancy after first postpartum artificial insemination. Pharmacological interventions to improve Ca homeostasis postpartum require identification of proper cohorts of cows that benefit from such interventions.

<https://doi.org/10.3168/jds.2020-18448>.

Characterization of *Streptococcus lutetiensis* isolated from clinical mastitis of dairy cows. *By Chen et al., page 702.* *Streptococcus lutetiensis* (n = 37 isolates) was obtained from milk of cows with clinical mastitis on a large Chinese dairy farm (~5,000 lactating cows). A dominant random amplification of polymorphic DNA type representing 84% of isolates was detected. Many isolates were resistant to ceftiofur and

tetracycline. In addition, *Strep. lutetiensis* had adhering and invasive properties for bovine mammary epithelial cells cultured in vitro. In a murine mammary infection model, *Strep. lutetiensis* caused edema, hyperemia, and migration of neutrophils into gland alveoli. We concluded that *Strep. lutetiensis* had potential to spread within a dairy herd and damage mammary tissue.

<https://doi.org/10.3168/jds.2020-18347>.

The relationship of excessive energy deficit with milk somatic cell score and clinical mastitis. *By Bach et al., page 715.* Periparturient cows go through a period of immune suppression often marked by immune cell dysfunction. Further exacerbation of this dysfunction through excessive energy deficit has been associated with increased susceptibility to infectious conditions such as mastitis. Our objective was to explore the association of somatic cell score and clinical mastitis with early-lactation excessive energy deficit, diagnosed via blood and milk β -hydroxybutyrate, milk predicted blood nonesterified fatty acid, and de novo fatty acid levels. Cows with excessive energy deficit had a tendency toward lower somatic cell scores compared with their normal counterparts; the relationship with clinical mastitis requires further exploration.

<https://doi.org/10.3168/jds.2020-18432>.

Bacterial flora associated with udder cleft dermatitis in Dutch dairy cows. *By van Engelen et al., page 728.* Udder cleft dermatitis is a skin lesion between the udder and abdomen of dairy cows. It is seen worldwide and has a large effect on animal welfare. We investigated what bacteria might be involved. Lesions were cultured, and *Trueperella pyogenes* and *Bacteroides pyogenes*, which are pus-forming bacteria, were frequently present in severe lesions. Additionally, lesions were evaluated using microscopic examination. Most of the clinically severe cases showed chronic active inflammation, suggesting the permanent presence of an activator, which could be anaerobic bacteria. This could be relevant when implementing measures against this condition.

<https://doi.org/10.3168/jds.2020-18414>.

Predictive equations for early-life indicators of future body weight in Holstein dairy heifers. *By Hurst et al., page 736.* The objective of this study was to evaluate the long-term effects that early-life preweaning has on predicted body weight of growing heifers up to 400 d of age. Data on early-life variables were collected from 5,186 heifers fed with automatic milk feeders on a commercial dairy farm from October 1, 2015, to January 1, 2019. The linear and quadratic effects of cumulative 60-d milk consumption, birth weight, feeder, year born, season born, respiratory incidence, and genetic body size composite score were

significant when predicting heifer body weight at 400 d of age.
<https://doi.org/10.3168/jds.2020-18560>.

Calving difficulty influences rumination time and inflammatory profile in Holstein dairy cows.

By Mammi et al., page 750. This study evaluated the effects of difficult calving on Holstein dairy cow behavior and health. Cows with larger calves had relatively shorter rumination times both during and after calving and presented with comparatively higher inflammation levels, suggesting a more difficult recovery. Determination of calf size before parturition and recognition of small first-calving heifers might help identify cows at higher risk of health issues at the onset of lactation.
<https://doi.org/10.3168/jds.2020-18867>.

Genetic diversity and molecular epidemiology of outbreaks of *Klebsiella pneumoniae* mastitis on two large Chinese dairy farms.

By Cheng et al., page 762. *Klebsiella pneumoniae* (n = 365 isolates) was obtained from milk of cows with clinical and subclinical mastitis as well as from bedding, feces, teat skin, feed, and milking equipment samples on 2 large Chinese dairy farms (~8,000 and 2,000 lactating cows). High genetic diversity was detected in *K. pneumoniae* isolated from clinical mastitis and from cow-based and environmental samples, whereas low genetic diversity was detected in subclinical mastitis isolates from 1 farm. Genotypes of *K. pneumoniae* isolated from (sub)clinical mastitis were also commonly detected in environmental samples; therefore, *K. pneumoniae* was mainly an environmental udder pathogen on these 2 dairy farms.
<https://doi.org/10.3168/jds.2020-19325>.

Heat stress and cow factors affect bacteria shedding pattern from naturally infected mammary gland quarters in dairy cattle.

By Hamel et al., page 786. Mastitis-causing pathogens are shed from infected mammary gland quarters and lead to further infections in a herd. Pathogen-specific properties of shedding as well as several factors influence the shedding characteristics. A better understanding of the characteristics of pathogen shedding in milk and the influencing factors will help in controlling mastitis. The current study has shown that pathogen shedding with milk is greater with a higher milk somatic cell count, lower parity, and higher temperature-humidity index. Consequently, the prevention and mitigation of heat stress in the German temperate climate can have a positive influence on udder health.
<https://doi.org/10.3168/jds.2020-19091>.

Effects of postpartum oral calcium supplementation on milk yield, milk composition, and reproduction in multiparous Jersey and Jersey × Holstein crossbred cows.

By Valldecabres and

Silva-del-Río, page 795. Our study evaluated the effects of postpartum oral calcium supplementation on productive and reproductive outcomes. Multiparous Jersey and Jersey × Holstein crossbred cows from 2 commercial dairies were assigned to control (n = 581) or given oral calcium as boluses at 0 and 1 d in milk (n = 594). Overall, oral calcium supplementation did not affect productive and reproductive outcomes. However, oral calcium had positive effects on production for cows with longer previous lactation length but a tendency for detrimental effects on cows with shorter lactation lengths. Improvement in production was also observed for lame cows at calving supplemented with oral calcium.
<https://doi.org/10.3168/jds.2020-19079>.

Acute-phase protein α -1-acid glycoprotein is negatively associated with feed intake in postpartum dairy cows.

By Brown et al., page 806. Transition dairy cows have depressed feed intake, and the acute-phase protein α -1-acid glycoprotein (AGP) may reduce feed intake. In this study, we characterized transition cow AGP plasma concentration and evaluated the prognostic capability of AGP to predict dry matter intake and disease in transition dairy cows. Although AGP and feed intake were strongly associated postpartum, the utility of AGP as a predictor of feed intake was poor. However, AGP was associated with certain postpartum diseases, and it was not strongly associated with other biomarkers except haptoglobin. Our findings suggest that AGP could serve as an independent biomarker to monitor transition cow health and performance.
<https://doi.org/10.3168/jds.2020-19025>.

Effect of hyperketonemia on the diurnal patterns of energy-related blood metabolites in early-lactation dairy cows.

By Seely et al., page 818. Dairy cows often enter a state of energy deficit in early lactation, leading to an increase in plasma concentrations of nonesterified fatty acids and β -hydroxybutyrate. Our objective was to investigate the diurnal variation in plasma nonesterified fatty acids and β -hydroxybutyrate and the correlation between the 2 metabolites. We observed consistent diurnal patterns in both metabolites and a strong positive correlation between them. Our findings suggest that the time relative to feeding is an important factor to consider when analyzing plasma metabolites, and that a single blood sample may not be representative of energy status of the early-lactation cow.
<https://doi.org/10.3168/jds.2020-18930>.

Vocal production in postpartum dairy cows: Temporal organization and association with maternal and stress behaviors.

By Green et al., page 826. This study involved assessing temporal variations

in cow vocalizations associated with calf interactions and separation. The maternal and stress behaviors surrounding postpartum vocal production are also described. During calf interactions, cows repeatedly licked their calf and produced closed-mouth vocalizations, but upon separation, cows became alert to their calf, produced calls with their mouth open, and stood close to the fence line. Separated cows emitted more vocalizations as part of a sequence, with more vocalizations per sequence and less time between separate sequences than during calf interactions. These vocal features can reveal emotional information to noninvasively assess cow welfare on farms.

<https://doi.org/10.3168/jds.2020-18891>.

A cross-sectional study of associations between herd-level calf mortality rates, compliance with legislation on calf welfare, and milk feeding management in Norwegian dairy herds. *By Johnsen et al., page 839.* We found large between-herd variation in calf mortality rates: 25.9% of farms presented no calf deaths, and the median herd mortality rate was 0.064 calves per 6 calf-months at risk. Lack of access to free water during the first weeks of life and records of calf disease events were associated with increased mortality rates. Compliance with legislation was not associated with mortality rates. Many producers (59.6%) reported feeding less milk than currently recommended in Norway. There is room for improvement in the management of young calves, including the provision of water. <https://doi.org/10.3168/jds.2020-18865>.

Oxidative stress, NF- κ B signaling, NLRP3 inflammasome, and caspase apoptotic pathways are activated in mammary gland of ketotic Holstein cows. *By Sun et al., page 849.* Ketosis is a serious metabolic disorder characterized by systemic and hepatic oxidative stress, inflammation, and apoptosis as well as reduced milk yield. Because of the paucity of data on mammary responses during ketosis, the aim of this study was to evaluate alterations in oxidant and immune responses in mammary tissue of cows with subclinical or clinical ketosis. Compared with healthy cows, molecular analyses revealed that subclinical or clinical ketosis led to severe oxidative stress and activation of inflammation and apoptotic pathways in mammary tissue. Data suggest that ketosis can induce oxidative stress in the mammary gland, which in turn activates inflammation and apoptotic pathways, all of which may contribute to dysfunctional responses. <https://doi.org/10.3168/jds.2020-18788>.

Dairy cow trade-off preference for 2 different lying qualities: Lying surface and lying space. *By Shewbridge Carter et al., page 862.* Providing good-quality indoor lying areas for cows is important for cow comfort and welfare; however, it is unclear which

lying quality, surface or space, is more important to cows. In a 3-stage experiment, cows were given a choice of 3 lying surfaces: (1) with a freestall, (2) without a freestall, and (3) a trade-off between the most preferred surface with a freestall and the two less-preferred surfaces without. Of the 19 cows tested, 14 chose an open lying space (>60% lying time) over their preferred lying surface, suggesting that cows value space over surface type when choosing where to lie down.

<https://doi.org/10.3168/jds.2020-18781>.

Identification of biomarkers measured upon arrival associated with morbidity, mortality, and average daily gain in grain-fed veal calves. *By Goetz et al., page 874.* Identifying calves upon arrival at a veal facility that are at high risk of morbidity, mortality, and reduced weight gain may allow veal producers to implement individually tailored treatment strategies earlier in the growing period to at-risk animals. The objective of this study was to identify biomarkers associated with morbidity, mortality, and average daily gain. Higher weight on arrival, creatine kinase, cholesterol, immunoglobulin G, iron, and copper were associated with improved calf health, whereas elevated zinc, haptoglobin, and molybdenum were negatively associated with calf health.

<https://doi.org/10.3168/jds.2020-18729>.

Effects of prepartum stocking density and a blind on physiological biomarkers, health, and hygiene of transition Holstein dairy cows. *By Creutzinger et al., page 886.* Some cattle seek seclusion when giving birth; however, many indoor calving facilities do not facilitate this behavior. We aimed to determine the effects of space allowance and provision of a blind on dairy cattle health and hygiene. Before calving, signs of inflammation were reduced when cows were provided a blind and better hygiene in pens with more space per cow. However, after calving, we found slight increases in disease (metritis) in cows previously housed in less-crowded pens. Our results suggest that a blind may have minor benefits to the health of cows, but stocking density effects varied between pre- and postcalving periods.

<https://doi.org/10.3168/jds.2020-18718>.

Longitudinal study on the effects of intramammary infection with non-*aureus* staphylococci on udder health and milk production in dairy heifers. *By Valckenier et al., page 899.* We studied the effect of intramammary infection (IMI) with non-*aureus* staphylococci (NAS) on quarter milk yield and quarter milk somatic cell count during the first 130 d in milk. *Staphylococcus chromogenes* was the most prevalent NAS species, and 45% of IMI persisted for at least 14 d; 9.8% of IMI caused by other NAS persisted for at least 14 d. Compared with transient IMI, persistent IMI with

Staph. chromogenes or other NAS resulted in a higher quarter SCC. No significant differences in quarter milk yield were observed between quarters having a persistent or transient IMI or with *Staph. chromogenes* or other NAS and noninfected quarters.
<https://doi.org/10.3168/jds.2020-18685>.

Serum retinol, β -carotene, and α -tocopherol as biomarkers for disease risk and milk production in periparturient dairy cows. *By Strickland et al., page 915.* Vitamins in blood serum represent the functional pool available to supply tissue needs. Both the innate and adaptive immune systems depend on an adequate supply of vitamins. Thus, the serum concentrations of these vitamins might affect disease resistance. In this study, we measured serum β -carotene, vitamin A, and vitamin E concentrations in dairy cows at dry-off, at close-up, and in the fresh period on commercial dairy farms, and their associations with transition cow diseases and first-test 305-d mature-equivalent milk yield were assessed. Serum retinol concentrations were lower in cows with hyperketonuria and uterine disease. The relationship between serum vitamins and disease warrants further investigation.
<https://doi.org/10.3168/jds.2020-18693>.

The effects of a training program using a phantom to accustom heifers to the automatic milking system. *By von Kuhlberg et al., page 928.* The introduction of inexperienced heifers into the automatic milking system (AMS) can act as an additional stressor after a stressful parturition. The aim of this study was to investigate whether heifers can be accustomed to AMS by prepartum training on an AMS phantom and whether this can improve lactation performance, health, and welfare of dairy cattle. Training on the phantom increased the number of voluntary milking visits. Thus, an important contribution to the improvement of animal welfare can be achieved.
<https://doi.org/10.3168/jds.2020-18715>.

Relationships between type of hoof lesion and behavioral signs of lameness in Holstein cows housed in Canadian tiestall facilities. *By Jewell et al., page 937.* The most common method of determining lameness is by locomotion scoring; however, this can be difficult in tiestall facilities. An alternative method, known as stall lameness scoring, evaluates the cows in their stalls using behavioral indicators of limb pain to determine lameness. One of the most common causes for cattle to become lame is hoof lesions. The aim of this study was to determine whether these behavioral indicators were associated with the presence of hoof lesions. We found that these behavioral indicators were associated with some of the common hoof lesions and therefore may help producers decide which cows require treatment.
<https://doi.org/10.3168/jds.2019-17296>.

An observational study on the management of digital dermatitis through a repeated risk assessment on 19 Dutch dairy herds. *By Vanhoudt et al., page 947.* Digital dermatitis is the most important infectious cause of lameness in dairy cattle, negatively affecting their welfare and production. This study investigated the use of a risk assessment questionnaire in digital dermatitis control. We identified a small association between a higher risk score and higher prevalence of digital dermatitis, caused mainly by risk factors related to the housing of dairy cattle. The risk assessment questionnaire can be used to identify strengths and weaknesses in digital dermatitis control, but it is insufficient to decrease digital dermatitis prevalence.
<https://doi.org/10.3168/jds.2020-18730>.

Short communication: Effects of different blood buffers administered in electrolyte solution to grain-fed veal calves experiencing diarrhea. *By Wood et al., page 957.* Metabolic acidosis occurs with fluid and electrolyte loss from diarrhea. The objective of this study was to measure the effect of feeding an electrolyte powder composed of sodium bicarbonate; an electrolyte powder composed of mixed buffers including sodium bicarbonate, sodium citrate, sodium acetate, and potassium citrate; or a liquid electrolyte composed of sodium acetate in young male dairy calves experiencing diarrhea. Calves fed electrolyte powder composed of mixed buffers or a liquid composed of sodium acetate had improved acid-base status compared with those fed a powder composed of sodium bicarbonate alone.
<https://doi.org/10.3168/jds.2020-18526>.

Short communication: Informative value of an ELISA applied to bulk tank milk to assess within-herd prevalence of digital dermatitis in dairy herds. *By Aubineau et al., page 963.* Digital dermatitis (DD) is a leading cause of lameness in dairy cattle. Prevalence of DD is usually assessed through visual appraisal of the cows' feet, which is time consuming. In this study, conducted in 40 French dairy herds, we found that an enzyme-linked immunosorbent assay applied to bulk tank milk was able to discriminate herds with low ($\leq 10\%$) or high ($> 40\%$) DD prevalence. This test could be a cost-effective method to monitor DD within-herd prevalence and thus provide insight into appropriate control measures in dairy herds.
<https://doi.org/10.3168/jds.2020-18673>.

Short communication: First detection of Pantón-Valentine leukocidin-positive methicillin-resistant *Staphylococcus aureus* ST30 in raw milk taken from dairy cows with mastitis in South Korea. *By Mechesso et al., page 969.* This study presents the antimicrobial resistance profiles and molecular characteristics of *Staphylococcus aureus*, which is a serious public health burden in both hospital and community settings as well as an economic and animal

welfare problem in dairy farming. The outputs of this study will be of paramount importance in revising the current guidelines for antimicrobial use in dairy cows and reducing the emergence of antimicrobial resistance in South Korea.

<https://doi.org/10.3168/jds.2020-19004>.

Short communication: The lag response of daily milk yield to heat stress in dairy cows. *By Li et al., page 981.* Previous studies indicate a lag response of daily milk yield to heat stress with a simple correlation analysis for daily milk yield and heat stress indicators at different orders of lag. There is a risk of spurious cross-correlation when using simple correlation because the autocorrelations for daily milk yield and heat stress indicators would interfere with simple correlation. In this study, we excluded the effects of autocorrelations and built a new cross-correlation between daily milk yield and ambient temperature with transfer function modeling. The transfer function model can track and predict the fluctuation of daily milk yield.

<https://doi.org/10.3168/jds.2020-18183>.

Lipopolysaccharide inhibits triglyceride synthesis in dairy cow mammary epithelial cells by upregulating miR-27a-3p, which targets the *PPARG* gene. *By Wang et al., page 989.* Our research found that lipopolysaccharide can cause the upregulation of miR-27a-3p in dairy cow mammary epithelial cells, further inhibiting the expression of the *PPARG* gene and inhibiting the synthesis of milk fat in mammary epithelial cells. Our results are intended to provide a new theoretical basis for lipopolysaccharide-induced inhibition of milk fat synthesis in dairy cow mammary epithelial cells.

<https://doi.org/10.3168/jds.2020-18270>.

Effects of a proinflammatory response on metabolic function of cultured, primary ruminal epithelial cells. *By Kent-Dennis and Penner, page 1002.* As a consequence of ruminal acidosis and subsequent translocation of microbe-associated molecular patterns, ruminal epithelial cells (REC) may initiate a local inflammatory response. The effects of such a response on REC metabolic function have not been elucidated. This study investigated the effects of lipopolysaccharide (LPS)-induced inflammation on metabolic function of cultured primary REC. When exposed to LPS, REC tended to utilize more glucose; however, utilization of short-chain fatty acids was not affected. Exposure to LPS increased gene expression of *GLUT1*, *MCT4*, *MCU*, and *IGFBP3*. Protein expression of BDH1 tended to decrease with LPS exposure. The results suggest that inflammation in REC may influence cell metabolism and lead to greater glucose requirement.

<https://doi.org/10.3168/jds.2020-19092>.

Effect of duration of exposure to diets differing in dietary cation-anion difference on Ca metabolism after a parathyroid hormone challenge in dairy cows. *By Vieira-Neto et al., page 1018.*

Objectives were to determine the length of exposure to an acidogenic diet that would elicit increased response to parathyroid hormone-induced changes in blood Ca in prepartum cows. Cows fed the acidogenic diet developed metabolic acidosis within 24 h after starting the treatment; however, increased blood ionized Ca was observed later. On d 3, cows fed the acidogenic diet had greater increases in ionized Ca and total Ca in response to parathyroid hormone, which were also observed in subsequent challenges on d 8 and 13. Acidogenic diet increased urinary Ca loss but increased gastrointestinal Ca absorption, resulting in no difference in Ca balance.

<https://doi.org/10.3168/jds.2020-19127>.

Effects of local or systemic administration of meloxicam on mammary gland inflammatory responses to lipopolysaccharide-induced mastitis in dairy cows. *By Caldeira et al., page 1039.*

Meloxicam, a nonsteroidal anti-inflammatory drug, is commonly used for the treatment of mastitis in dairy cows to reduce pain and support animal welfare. We investigated whether meloxicam administered intramammarily and systemically affected the immune response in the mammary gland. Meloxicam itself did not promote inflammation in the mammary gland. During lipopolysaccharide-induced mastitis, meloxicam did not diminish the concentrations of markers for blood-milk barrier integrity, milk immune components, or the mRNA abundance of proinflammatory factors in mammary tissue. Instead, intramammary meloxicam expedited the increase in somatic cell count during the challenge with a low dose of lipopolysaccharide.

<https://doi.org/10.3168/jds.2020-18691>.

Hepatic transcriptomic adaptation from prepartum to postpartum in dairy cows. *By Gao et al., page 1053.*

The liver plays a pivotal role in facing periparturient metabolic and immune-related challenges. Increased understanding of the biological adaptations of the liver during the periparturient period is crucial to decrease the incidence of metabolic and immune-related diseases during the periparturient period for the dairy farm. A whole-transcriptomic analysis associated with large statistical power was conducted to uncover the biological adaptation of the liver during the periparturient period. The present study can help develop strategies to improve animal health and performance and, as a consequence, increase dairy profitability.

<https://doi.org/10.3168/jds.2020-19101>.

Increasing the length of an estradiol with progesterone timed artificial insemination protocol with 2 controlled internal drug release devices

improves pregnancy per artificial insemination in lactating dairy cows. *By Pereira et al., page 1073.* Timed artificial insemination (AI) protocols that use estradiol and progesterone developed to have higher progesterone at prostaglandin treatment can be improved by increasing protocol length from 9 to 10 d. Increasing the length of an estradiol and progesterone-based timed AI protocol resulted in a greater ovulation near timed AI and pregnancy per AI in cows without heat stress and in cows with a corpus luteum at the beginning of the protocol. These results are associated with longer time for follicle development with higher circulating progesterone at the time of the first prostaglandin treatment and are likely to be an optimization of hormonal environment during follicle development. <https://doi.org/10.3168/jds.2020-18872>.

The potential of volatile organic compound analysis in cervicovaginal mucus to predict estrus and ovulation in estrus-synchronized heifers. *By Pluta et al., page 1087.* The study describes the temporal changes in the volatile compounds in the mucus of heifers, which can contribute to the precise detection of estrus and ovulation. <https://doi.org/10.3168/jds.2020-19024>.

Heat stress affects some physiological and productive variables and alters metabolism in dairy ewes. *By Mehaba et al., page 1099.* In the current study, we evaluated the effect of heat stress (HS; 28–35°C) on dairy ewes. Compared with thermoneutral conditions (15–20°C), HS reduced feed intake (–11%) and increased body temperature (+0.77°C), but milk yield did not vary. Milk of HS ewes contained less fat (–16%) and protein (–14%) but greater somatic cells (+5%), which might negatively affect cheese yield. Despite eating less, HS ewes were unable to use body fat reserves, but they kept blood glucose levels similar to those of control ewes. Overall, ewes were negatively affected by HS, and the findings of this study will help in establishing nutritional strategies to alleviate these effects. <https://doi.org/10.3168/jds.2020-18943>.

Response to a glucose tolerance test in early-lactation Holstein cows receiving a supplementation of biotin, folic acid, and vitamin B₁₂. *By Duplessis and Girard, page 1111.* Biotin, folates, and vitamin B₁₂, among other vitamins, are involved in energy and protein metabolism in mammals. As cows face many challenges in the transition from nonlactating to lactating, this study evaluated whether supplementation with these vitamins could improve insulin sensitivity during this period due to their role in metabolism. Current results suggest that folic acid and vitamin B₁₂ supplementation improved insulin response, whereas biotin supplementation decreased insulin sensitivity

following intravenous glucose administration to early-lactation cows. <https://doi.org/10.3168/jds.2020-19333>.

CRISPR-Cas9-mediated knockout of GCN2 reveals a critical role in sensing amino acid deprivation in bovine mammary epithelial cells. *By Edick et al., page 1123.* This study investigated the role of GCN2 in sensing amino acid deprivation in bovine mammary epithelial cells. GCN2 activated the integrated stress response, resulting in upregulation of key genes involved in maintaining amino acid homeostasis in response to combined deprivation of arginine, leucine, and lysine and, notably, arginine alone. Knockout of GCN2 in bovine mammary epithelial cells by gene editing reduced activation of the key proteins in the integrated stress response, demonstrating a critical role for GCN2 in adapting to amino acid deprivation. <https://doi.org/10.3168/jds.2020-18700>.

Differing planes of pre- and postweaning phase nutrition in Holstein heifers: I. Effects on feed intake, growth efficiency, and metabolic and development indicators. *By Rosadiuk et al., page 1136.* This study investigated the effects of pre- and postweaning planes of nutrition on intake and development in Holstein heifers up to 25 wk of age. Increased planes of nutrition resulted in greater productivity, average daily gain, and indicators of growth and development during both the pre- and postweaning phases. Despite improved indicators of growth and development in the preweaning period in heifers offered more milk, there was very little indication that preweaning nutrition affected postweaning growth and performance. <https://doi.org/10.3168/jds.2020-18809>.

Differing planes of pre- and postweaning phase nutrition in Holstein heifers: II. Effects on circulating leptin, luteinizing hormone, and age at puberty. *By Bruinje et al., page 1153.* This study investigated the effects of differing pre- and postweaning planes of nutrition on prepubertal serum leptin concentrations, luteinizing hormone (LH) profiles, and age at puberty in Holstein heifers. Increasing the preweaning plane from 5 to 10 kg of whole milk/d increased circulating leptin concentrations and enhanced LH pulses at 15 wk of age. Increasing the postweaning plane from 70 to 85% of concentrate dry total mixed ration resulted in greater leptin concentrations by wk 25, which was also associated with an earlier onset of puberty. Findings imply that increasing the pre- and postweaning nutritional planes enhanced endocrine profiles associated with reproductive development. <https://doi.org/10.3168/jds.2020-18810>.

Evaluation of colostrum bioactive protein transfer and blood metabolic traits in neonatal lambs in the first 24 hours of life. *By Zhu et al., page 1164.*

Colostrum proteins play a central role in the health status of neonatal ruminants. Colostral immunoglobulin G, lactoferrin, α -lactalbumin, and β -lactoglobulin were quantified in gastrointestinal digesta and blood in lambs. Almost all colostrum lactoferrin, α -lactalbumin, and β -lactoglobulin disappeared in the gastrointestinal tract in a time-dependent manner, whereas immunoglobulin G was prone to intact uptake into the blood, particularly within the first 12 h, according to apparent absorption efficiencies. These findings provide novel information for exploring the selective absorption of colostrum compounds in the small intestine of lambs.

<https://doi.org/10.3168/jds.2020-18340>.

Graduate Student Literature Review: Understanding the genetic mechanisms underlying mastitis. *By Miles and Huson, page 1183.*

The prevention and control of mastitis preoccupies producers, veterinarians, and researchers alike. Within various mitigation strategies lies the breeding objective of selecting for cows that display natural mastitis resistance, and much progress has been made in this respect. However, understanding the genetic mechanisms underlying mastitis has proven difficult because of its complex nature and the overwhelming environmental effect. This review provides a brief background on mastitis, illustrates current understanding of the genetics influencing mastitis and the application of this knowledge, and discusses challenges and limitations in understanding these mechanisms and applying these findings to genetic improvement strategies.

<https://doi.org/10.3168/jds.2020-18297>.

Graduate Student Literature Review: Challenges and opportunities for human resource management on dairy farms. *By Mills et al., page 1192.*

We reviewed the literature in 5 areas of human resource management on dairy farms: (1) professional accreditation and professional development, (2) extension activi-

ties, (3) the role of the advisor, (4) standard operating procedures, and (5) employee training. Key findings from available research are reviewed and areas that warrant further investigation are identified.

<https://doi.org/10.3168/jds.2020-18455>.

Symposium review: Precision technologies for dairy calves and management applications. *By Costa et al., page 1203.*

Precision dairy technologies (PDT) are becoming common on dairy farms, but milk-fed calves are typically not monitored automatically. We review research on the use and application of PDT in the management of performance and health of calves. Evidence suggests that accelerometers, automated feeding systems, and temperature monitoring devices have commercial application in the management of dairy calves. We also discuss the PDT potential for monitoring positive and negative calf welfare indicators and potential future directions for research in precision dairy technology.

<https://doi.org/10.3168/jds.2019-17885>.

Symposium review: Linking activity-sensor data and physiology to improve dairy cow fertility. *By Cerri et al., page 1220.*

The use of automation in estrus detection of dairy cows and its potential to maximize data use, effects on fertility, and integration into reproduction programs are discussed in this review. Estrous behavior and intensity have an important positive effect on fertility, and this relationship seems to be associated with progesterone concentrations, ovulation, and the endometrial environment. This review describes how reproductive programs with strong reliance on estrus detection are efficient and could maximize data use from activity monitoring systems to improve decision making at the farm level. Further studies should focus on the endocrine and molecular mechanisms that drive this association as well as on detailed data science tools to improve the use of data for reproductive programs and genomic predictions associated with estrus and fertility.

<https://doi.org/10.3168/jds.2019-17893>.