Two strains of nonstarter lactobacilli increased the production of flavor compounds in soft cheeses. By Milesi et al., page 5020. Cheese aroma is produced by enzymatic reactions, mainly via bacterial catabolism of fat, protein and carbohydrates and their derived compounds. Lactobacillus plantarum 191 and Lactobacillus casei 190, when added into soft cheeses as adjunct cultures together with Streptococcus thermophilus as primary starter, increased free amino acids content and production of volatile compounds. Levels of diacetyl and acetoin (2 key odorants of soft cheeses) were also higher in cheeses with the adjunct strains studied. Aroma of cheeses with and without lactobacilli differed.

Angiotensin-converting enzyme inhibitory activity of milk fermented by wild and industrial Lactococcus lactis strains. By Rodríguez-Figueroa et al., page 5032. Because diet has a role in the prevention and treatment of hypertension, research has focused on the manufacture of fermented dairy products with anti-hypertensive effects. Our results suggested that fractions from milk fermented by wild Lactococcus lactis strains isolated from artisanal dairy products or commercial starter cultures presented higher antihypertensive activity than those produced by strains isolated from vegetables. Therefore, the isolation source of L. lactis may be a key point for the screening of useful strains in the production of antihypertensive dairy foods.

The characterization of the most-liked reduced-fat Havarti-type cheeses. By Ritvanen et al., page 5039. The objective of this study was to find out which type of reduced-fat Havarti-type cheeses are preferred. Respondents (n = 153) were regular consumers of reduced-fat cheeses. Finnish consumers rated 10 reduced-fat cheeses according to preference. Subsequently, experts performed a sensory quantitative descriptive analysis on the same cheeses. In addition, information on fat, salt, and free amino acids was gathered. The results were compared with consumer hedonic ratings. The preferred cheeses had a pale appearance, sticky texture, and rich flavor. However, consumers diverged in their preferences such that they could be grouped according to the desired characteristics of cheeses. The consumers were similar in what they disliked: the least preferred cheeses were the ones with the lowest flavor intensity. In addition, the consumers preferred those cheeses with a high salt content.

Impact of fat reduction on flavor and flavor chemistry of Cheddar cheeses. By Drake et al., page 5069. Low-fat Cheddar cheese has a different flavor to full-fat cheese, not only because of a decrease in milkfat flavor but also because of differences in the concentration of some key flavor compounds. Two off-flavors, rosy and burnt, were more apparent in low-fat cheese, and some key flavor compounds that were at higher levels in low-fat cheese than in full-fat cheese were identified as being the most probable cause of these flavors. The lower milkfat content of low-fat cheese also changes the chemical and physical properties of cheese, which can influence the perception of flavor compounds. This study demonstrates the complex nature of research needed to manufacture a low-fat cheese with sensory flavor attributes that are similar to those of full-fat cheese.

Vitamin D content and variability in fluid milks from a US Department of Agriculture nationwide sampling to update values in the National Nutrient Database for Standard Reference. By Patterson et al., page 5082. The US Food and Drug Administration requires that vitamin D fortified milk have at least 400 IU of vitamin D/quart and may have up to 600 IU/quart. Five types of fortified milk were collected, skim, 1%, 2%, whole, and 1% fat chocolate milk, from 24 different supermarkets, and analyzed individually for vitamin D₃. Sample values were variable but the average vitamin D content of all the milk types exceeded the 400 IU label value. These data have been used to update food composition information in the USDA National Nutrient Database for Standard Reference.

Development and application of a processing model for the Irish dairy industry. By Geary et al., page 5091. A processing sector model was developed to simulate dairy product manufacture in Ireland. Outputs include the quantity of product manufactured, net milk values, and component values of milk (protein and fat). Two scenarios were evaluated with differing portfolios representing the Irish product mix in 2000 and 2008, respectively, where 27, 39, 21, and 13% and 43, 30, 13, and 14% cheese, butter, skim milk powder, and whole milk powder were produced. Within both scenarios, 3 milk compositions were considered: (1) typical Irish Holstein-Friesian, (2) Jersey, and (3) the New Zealand strain of Holstein-Friesian. Across both scenarios, Jersey milk yielded a higher net return (€308, €326) relative to Irish Holstein-Friesian (€248, €261) and New Zealand Holstein-Friesian (€274, €289) milk.

Protein oxidative changes in whole and skim milk after ultraviolet or fluorescent light exposure. By Scheidegger et al., page 5101. Changes in milk proteins at the primary or higher structural levels produced by ultraviolet or fluorescent light exposure of
milk (whole or skimmed) were studied. Protein light oxidation was determined by the formation of protein carbonyls and dityrosine and changes in the molecular weights (protein fragmentation and polymerization). Photo-oxidation did not influence digestion by pepsin or clotting by rennet. These results would be useful to determine lighting conditions in the dairy industry in general and for cheese making in particular.

Short communication: Temperature sensibility of *Prototheca blaschkeae* strains isolated from bovine mastitic milk. By Marques et al., page 5110. Bovine mastitis associated with microalgae of the genus *Prototheca* has been reported worldwide. Algae in this genus are extremely resistant to several antimicrobials, physical treatments, and chemical agents. Furthermore, these organisms have been described with a potential zoonotic risk. With this study, the authors provide information on the susceptibility (reduced growth) of this emerging agent (especially *Prototheca blaschkeae*) to the temperature/time ratios generally used in the milk processing industry.

Short communication: The water footprint of dairy products: Case study involving skim milk powder. By Ridoutt et al., page 5114. Concerns about climate change, global water scarcity, and world population growth are causing many to question the sustainability of current food production systems, and especially the role of meat and dairy products. Using a recently developed life cycle assessment-based methodology, the water footprints of whole milk and skim milk powder from one of Australia’s major dairy regions were calculated. Results revealed that dairy products can be produced with minimal potential to contribute to freshwater scarcity. Life cycle assessment-based water footprints are a more useful sustainability indicator than a product’s virtual water content.

Energy expenditure, urea kinetics, and body weight gain within a segregating resource family population. By Lahann et al., page 5118. The aim of the study was to investigate the variability of the regulation of nutrient flow and turnover in cattle with common beef and dairy background. Therefore, energy and nitrogen metabolism were studied in bulls of 5 F2 half-sib families generated by crossbreeding Charolais (beef) with German Holstein (dairy). Low energy expenditure was associated with high average body mass gain, and changes in urea kinetics were reflected by muscle protein content in the carcass, indicating phenotypic differences in bulls with common beef and dairy genetic backgrounds.

Evaluation of data loggers, sampling intervals, and editing techniques for measuring the lying behavior of dairy cattle. By Ledgerwood et al., page 5129. Lying behavior in dairy cattle can provide insight into how cows interact with their environment and is an indicator of cow comfort. We tested the accuracy of the Onset Pendant G data logger (Onset Computer Corp., Bourne, MA) for measuring lying behavior in dairy cattle using 4 sampling intervals and 3 filters that corrected short, potentially erroneous, readings. The data logger accurately measured all aspects of lying behavior (lying on left side, total lying time, number of lying bouts, and length of lying bouts) when the sampling interval was ≤30 s and short readings of lying and standing were filtered from the data set.

Effect of flunixin meglumine and carprofen on pregnancy rates in dairy cattle. By von Krueger and Heuwieser, page 5140. Embryonic losses in the first weeks after breeding contribute to low pregnancy rates in dairy cattle. Progesterone production is important for embryonic survival. Antiinflammatory drugs such as flunixin meglumine or carprofen can inhibit synthesis of prostaglandin F2α, to support embryonic survival. The objective of this study was to evaluate the effect of these 2 drugs approximately 2 wk after insemination on pregnancy rates in dairy cattle. Pregnancy rates did not differ between untreated controls and treated cattle. It is not recommended to treat dairy cattle with flunixin meglumine or carprofen 2 wk after insemination to improve reproductive performance.

Feeding rolled barley grain steeped in lactic acid modulated energy status and innate immunity in dairy cows. By Iqbal et al., page 5147. This study investigated the hypothesis that feeding dairy cows rolled barley grain steeped in 0.5% lactic acid (LA) could improve metabolic health and immune status. Indeed, the results showed beneficial improvements in energy status and innate immune response as indicated by enhanced plasma glucose, cholesterol, and insulin and lower concentrations of serum amyloid A and plasma haptoglobin in cows fed the treated diet. We conclude that feeding rolled barley grain steeped in LA improves energy metabolism and innate immunity in lactating dairy cows.

Readability of visual and electronic leg tags versus rumen boluses and electronic ear tags for the permanent identification of dairy goats. By Carné et al., page 5157. Leg tags were evaluated for 12 mo in dairy goats. Rumen boluses and visual and electronic ear tags were also tested. Because of the circumference of the metatarsus, official leg tagging of goat kids was not recommended at 5 mo of age. In adult goats, only the readability of leg tags (98.5%) and one type of attached transponder (98.3%) fulfilled the official identification requirements (>98%); however, 1.5% of leg tags caused limping. Suitable visual and electronic identification of dairy goats can be achieved.
with leg tags, although further developments are required to allow tagging at an early age.

Characterization of glucagon-like peptide 2 pathway member expression in bovine gastrointestinal tract. *By Connor et al.*, page 5167. Glucagon-like peptide 2 (GLP-2) is a hormone released from specialized cells in the mammalian gut that promotes growth and reduces loss of cells lining the intestinal tract, and enhances nutrient absorption and barrier function. The functions of GLP-2 in the gut of cattle and other ruminants are not well studied. In this study, GLP-2 pathway gene expression was evaluated in 9 regions of the bovine gut at different stages of development and lactation. Our findings support a functional role of GLP-2 in cattle and suggest that GLP-2 therapy may be useful to improve intestinal function and nutrient absorption in ruminants.

Effect of milk yield characteristics, breed, and parity on success of the first insemination in Dutch dairy cows. *By Inchaisri et al.*, page 5179. Knowledge on success rate of first insemination in various lactation stages is important for the decision of whether to start or delay insemination of a cow. The aim was to identify factors that contribute to successful first insemination. Milk yield at the first insemination date, interval from calving to first insemination, and the insemination time (before or after time of peak milk yield) were suitable predictors for successful first insemination, and the influence of parity, breed, calf status, and month of insemination on successful first insemination were confirmed.

Ethyl pyruvate diminishes the endotoxin-induced inflammatory response of bovine mammary endothelial cells. *By Corl et al.*, page 5188. Inflammatory responses during coliform mastitis are difficult to control with the currently available therapeutics. Endothelial cells can modulate the severity of inflammation by producing proinflammatory mediators upon endotoxin exposure. The objective of this study was to determine the in vitro efficacy of ethyl pyruvate to control endotoxin-induced vascular inflammatory reactions. Ethyl pyruvate significantly reduced gene expression of proinflammatory cytokines, adhesion molecules, and enzymes involved in eicosanoid biosynthesis in mammary endothelial cells. The ability of ethyl pyruvate to effectively inhibit the expression of potent vascular proinflammatory mediators, combined with the fact that ethyl pyruvate is safe for human consumption, may make ethyl pyruvate an attractive candidate as a therapeutic in ameliorating the severe pathogenesis associated with coliform mastitis.

A field study on characteristics and diversity of gene expression in the liver of dairy cows during the transition period. *By Graber et al.*, page 5200. Characteristics and the inter-individual variation of candidate genes in the liver of dairy cows were studied on-farm during adaptation to lactation. The candidate genes encoded enzymes and nuclear receptors involved in metabolic processes in the liver. The field study included 232 dairy cows. Blood and liver samples were collected in wk 3 prepartum and wk 4 and 13 postpartum. Cows experienced a marked metabolic load in early lactation and responded with up- and down-regulation of nearly all genes. The observed inter-individual variation for the genes may aid in understanding the genetic component underlying optimal adaptive performance in dairy cows.

Risk factors for dirty dairy cows in Norwegian freestall systems. *By Ruud et al.*, page 5216. The aim of this cross-sectional field study was to describe cow cleanliness in Norwegian freestall-housed dairy herds and to examine risk factors regarding thigh cleanliness. Cow cleanliness, housing, and management-related variables were recorded in 232 herds. The cows were relatively clean on the udder and belly, dirty on thigh and the rear part of the body, and dirtiest on the legs. Risk factors for dirty thighs were high numbers of cows per stall, no sawdust, a low-positioned upper head-rail, liquid manure consistency, less tame cows, high relative humidity, and a low or high indoor temperature.

Definitions and diagnosis of postpartum endometritis in dairy cows. *By Dubuc et al.*, page 5225. This study defined and compared diagnostic criteria for postpartum endometritis in dairy cows. Endometritis definitions were based on detrimental effects on subsequent reproductive performance. Cytological and clinical diagnostic criteria were assessed. Endometritis diagnosed based on cytology (cytological endometritis) and on vaginal discharge (clinical endometritis) had poor agreement and additive detrimental effects on reproduction, which suggested that they may represent different conditions. Data suggested that purulent vaginal discharge terminology may be more descriptive than clinical endometritis because most cows with purulent vaginal discharge did not have endometrial inflammation.

Efficacy of in vitro embryo transfer in lactating dairy cows using fresh or vitrified embryos produced in a novel embryo culture medium. *By Block et al.*, page 5234. Transfer of fresh embryos produced in vitro into lactating recipients resulted in higher pregnancy rates than after timed artificial insemination, especially for repeat-breeder cows. Thus, the potential for using embryos produced in vitro to increase fertility of lactating cows was demonstrated.

Technical note: Comparison of rectal and vaginal temperatures in lactating dairy cows. *By Vickers
et al., page 5246. The most commonly used method to identify illness in dairy cows is measuring body temperatures with a rectal thermometer. The use of vaginal temperatures is becoming more common in research, but the relationship between vaginal temperature and rectal temperature has never been determined. This study demonstrated a high correlation between rectal and vaginal temperature in cows that recently calved and a moderate correlation in peak-lactation dairy cattle. The results illustrate a pronounced circadian rhythm in body temperature in recently calved cows, suggesting that caution is required when using a single temperature reading to diagnosis illness.

**Technical note:** Effects of an epinephrine infusion on eye temperature and heart rate variability in bull calves. By Stewart et al., page 5252. Eye temperature measured using infrared thermography is proposed as an indicator of autonomic nervous system activity insofar as it reflects changes in blood flow in the capillary beds of the conjunctiva. The aim was to determine whether epinephrine infusion would initiate eye temperature changes in calves. Eye temperature decreased in response to an epinephrine infusion, which supports the hypothesis that changes in eye temperature are mediated by the sympathetic nervous system. Infrared thermography is a noninvasive method to assess autonomic nervous system activity for evaluating the welfare of cattle.

**In vitro evaluation of cashew nut shell liquid as a methane-inhibiting and propionate-enhancing agent for ruminants.** By Watanabe et al., page 5258. Cashew nut shell liquid (CNSL), a byproduct of cashew nut production, was evaluated for its potency as a new feed additive for ruminants by a series of in vitro experiments. Supplementation of CNSL reduced methane production and enhanced propionate production without a detrimental effect on feed digestibility. These fermentation changes were associated with rumen microbial shift possibly caused by selective activity of CNSL against rumen microbes. The results indicate that CNSL may be useful for improving the energetic efficiency of feed utilization in ruminants.

**Effect of prepartum anionic supplementation on periparturient feed intake, health, and milk production.** By DeGroot et al., page 5268. Increasing dietary anions of the diet for cows during the last 3 wk of gestation maintained blood calcium concentration at calving and through the initiation of lactation. Prepartum dry matter intake was unaffected by anionic supplements but postpartum milk yield and feed intake were increased by supplementing anions in the prepar- tum diets.

**Effect of feeding alfalfa hay or Tifton 85 bermudagrass haylage with or without a cellulase enzyme on performance of Holstein cows.** By Bernard et al., page 5280. Few studies comparing the nutritional value of genetically improved and adequately managed warm season grass cultivars and alfalfa have been carried out with lactating cows. Results of this trial indicate no difference in performance of lactating cows fed diets supplemented with either Tifton 85 bermudagrass or alfalfa at 12% of the ration dry matter. Supplementing the diet with fibrolytic enzymes had no effect on cow performance. Tifton 85 bermudagrass can be used to provide up to 12% of the dietary dry matter without affecting performance of high-producing dairy cows.

**Effects of chemically or technologically treated linseed products and docosahexaenoic acid addition to linseed oil on biohydrogenation of C18:3n-3 in vitro.** By Sterk et al., page 5286. Decreasing the extent of rumen biohydrogenation of C18:3n-3 may increase postruminal C18:3n-3 flow and improve the proportion of C18:3n-3 in milk. Therefore, biohydrogenation kinetics of C18:3n-3 from several chemically or technologically treated linseed products and docosahexaenoic acid addition to linseed oil were evaluated in vitro. Formaldehyde-treated crushed linseed and extruded whole linseed decreased the extent of rumen biohydrogenation of C18:3n-3 and might therefore show a potential use in the ruminant diet to increase postruminal C18:3n-3 flow and improve its proportion in milk.

**A high dose of monensin does not reduce methane emissions of dairy cows offered pasture supplemented with grain.** By Grainger et al., page 5300. We examined the effects of a high dose of monensin, topdressed on a grain supplement twice daily at milking times, on enteric methane emissions and milk production of cows receiving ryegrass pasture and grain. Monensin did not improve milk production of grazing dairy cows. No effect of monensin on enteric methane emissions was observed, indicating that monensin cannot be promoted as a viable mitigation strategy for dairy cows grazing ryegrass pasture supplemented with grain.

**Effects of feeding increasing levels of wet corn gluten feed on production and ruminal fermentation in lactating dairy cows.** By Mullins et al., page 5329. Eight Holstein cows were used to examine the effects of feeding increasing dietary levels of wet corn gluten feed (WCGF). Cows consuming diets with greater concentrations of WCGF consumed more feed and produced more milk, and concentrations of milk
components did not differ. Increased dietary WCGF decreased ruminal pH and fiber digestion at 24 h, possibly because of decreased mean particle size of diets. Overall, results indicate that adding WCGF to dairy rations can increase milk yield, and this increase appears to be driven, at least in part, by an increase in feed intake.

**Transfer of melamine from feed to milk and from milk to cheese and whey in lactating dairy cows fed single oral doses.** By Battaglia et al., page 5338. This experiment evaluates the transfer of melamine from feed to milk and from milk to cheese in lactating dairy cows fed different doses of melamine (0.05, 0.50, 5.00, or 50.00 g/cow). About 3.8% of melamine ingested was excreted in milk (except in cows fed the 0.50-g dose), with the concentration in milk being between 0.019 and 35.105 mg/kg. During cheese making, about 85% of milk melamine was recovered in the whey fraction and only 1 to 3% in cheese. Milk, whey, and cheese could represent a hazard for consumers if cows accidentally ingest high doses of melamine (i.e., 5 or 50 g/cow).

**Variability in feed and total mixed ration neutral detergent fiber and crude protein analyses among commercial laboratories.** By Hristov et al., page 5348. This study was conducted to assess the variability in amylase-treated neutral detergent fiber (aNDF) and crude protein analyses of feed and total mixed ration samples among feed analysis laboratories. Variability in aNDF was particularly large for low-amylase-treated feeds. The results emphasize the need for commercial feed analysis laboratories in the United States to closely follow the standardized method for aNDF.

**Relationships between endometritis and metabolic state during the transition period in pasture-grazed dairy cows.** By Burke et al., page 5363. Endometritis at 6 wk after calving in pasture-grazed dairy cows was associated with lower plasma albumin throughout the calving transition period and a greater challenge to liver function with lower plasma Mg in early lactation. Similar preceding conditions are observed in delayed ovulation, supporting evidence for a common underlying condition for uterine infection and prolonged anovulation, two major factors that reduce the fertility of dairy cows.

**Evaluation of potential carryover effects associated with limit feeding of gravid Holstein heifers.** By Kruse et al., page 5374. Ninety-six Holstein heifers (400 ± 6 kg) were offered control or limit-fed diets for 180 d and then evaluated for growth, feed efficiency, rumen digesta volume, nutrient excretion, and lactation performance. Limit-fed heifers consumed less dry matter, and had greater gain and improved feed efficiency compared with control-fed heifers. Rumen pH, volatile fatty acids, and rumen digesta volume were unaffected by limit feeding during the 180-d growth trial. Limit feeding did not affect lactation body weight, dry matter intake, rumen digesta volume, or milk and milk-component yields of cows during their first lactation. No appreciable carryover effects of limit feeding dairy heifers were observed.

**Antilipolytic and lipolytic effects of administering free or ruminally protected nicotinic acid to feed-restricted Holstein cows.** By Pescara et al., page 5385. Transition dairy cows mobilize nonesterified fatty acids (NEFA) from adipose tissue to support lactation. If mobilization is excessive, fatty acid and ketosis may occur. Nicotinic acid is a feed additive that can reduce NEFA mobilization and prevent metabolic disorders if it reaches the abomasum for absorption. Research was conducted to determine a dose of nicotinic acid that suppresses NEFA and avoids the previously observed rebound above baseline concentrations following termination of treatment. The lowest effective dose for reducing plasma NEFA concentration in partially feed-restricted, nongestating, nonlactating cows was 3 mg of nicotinic acid/h per kg of body weight; however, the rebound in plasma NEFA occurred.

**Effects of corn silage hybrids and dietary non-forage fiber sources on feed intake, digestibility, ruminal fermentation, and productive performance of lactating Holstein dairy cows.** By Holt et al., page 5397. The current study was performed to determine whether feeding brown midrib corn silage without or with nonforage fiber sources in the lactation diet would improve productive performance of dairy cows. Feeding brown midrib corn silage (28.0% dry matter on average) compared with conventional corn silage had limited effects on intake, digestibility, and milk production when fed in high-forage diets to early lactating dairy cows. Feeding a relatively high dietary proportion of high-quality alfalfa hay (24.8% dry matter on average) may dilute the nutritive benefits of brown midrib corn silage and nonforage fiber sources in diets assessed in our study.

**Short communication: Feed restriction around insemination did not alter birth sex ratio in lactating dairy cows.** By Meier et al., page 5408. Feed restriction during the first 14 d of mating did not affect the birth sex ratio (proportion of male calves born) in lactating dairy cows. However, associations between precalving body condition, milk fat to protein ratio, and birth sex ratio were evident. These associations predicted a greater proportion of male calves born to cows calved in lower body condition precalving, cows gaining body condition from calving to mating, and cows with lower milk fat to protein ratios.
Genetic correlations between measures of Mycobacterium bovis infection and economically important traits in Irish Holstein-Friesian dairy cows. By Bermingham et al., page 5413. Tuberculosis in cattle is caused by infection with Mycobacterium bovis. Resistance to M. bovis infection is heritable in cattle. The objective of this study was to determine the genetic association between susceptibility to M. bovis infection and economically important traits in Irish Holstein-Friesian dairy cattle. The results of this study suggest that selection for increased survival may reduce susceptibility to M. bovis infection, while selection for reduced somatic cell score and increased fat production and body condition score may increase susceptibility to M. bovis infection within the national Holstein-Friesian dairy herd.

Accuracy of direct genomic values derived from imputed single nucleotide polymorphism genotypes in Jersey cattle. By Weigel et al., page 5429. Genotypes and phenotypes of 1,762 Jersey sires (1,446 training set, 316 testing set) were used to evaluate the predictive ability of direct genomic values for important dairy traits when a large proportion of single nucleotide polymorphism (SNP) genotypes were imputed, rather than measured directly. The average correlation across traits between direct genomic values (before progeny testing) and predicted transmitting abilities (after progeny testing) was 70.6% when all 42,552 SNP genotypes were used. When genotypes for 93.1, 96.6, 98.3, or 99.1% of loci were masked and imputed in the testing set, correlations were 68.5, 64.8, 54.8, or 43.5%, respectively. When the same percentage of loci were masked and imputed in 50% of sires in the training set as well, correlations were 65.7, 63.2, 53.9, or 49.5%. These results indicate that a breeding scheme combining high-and low-density assays, coupled with imputation of missing genotypes, can provide accurate genomic predictions while decreasing the cost of genotyping.

Genetic analysis of calf and heifer losses in Danish Holstein. By Fuerst-Waltl and Sorensen, page 5436. In this investigation, the genetic background of mortality in Danish Holstein female calves and heifers was analyzed. Frequencies of mortality were 3.2% and 9.4% for the first 30 days and until first calving, respectively. Heritabilities of mortality were low, ranging from not significantly different from zero to 0.08 for different age classes and linear and threshold models. Genetic and phenotypic variation seemed to be sufficiently high to genetically improve the trait calf and heifer mortality. A routine genetic evaluation is suggested.

Imputation of genotypes from different single nucleotide polymorphism panels in dairy cattle. By Druet et al., page 5443. For selection or research purposes, dairy bulls and cows are genotyped for thousands of genetic markers. It is expected that commercial arrays based on 3,000 to more than 600,000 markers will be used in cattle. One strategy to combine data from animals genotyped on different marker panels is the prediction of missing markers, called imputation. Imputation techniques were applied to a dairy cattle sample genotyped for 45,000 single nucleotide polymorphisms and achieved error rates below 1%. The same techniques were then successfully applied to combine data sets of dairy bulls from different European countries genotyped on 2 distinct marker arrays.

Deterministic models of breeding scheme designs that incorporate genomic selection. By Pryce et al., page 5455. A variety of ways exist in which breeding schemes can be organized to exploit advances in DNA marker technology through genomic selection. Here, genomic selection schemes are projected to give higher rates of genetic progress and at the same time decrease rates of inbreeding compared with traditional progeny testing. Even higher rates of gain are achieved when the schemes include reproductive technologies. It is likely that breeding companies will move rapidly to alter their breeding schemes to make use of genomic selection because benefits to both the breeding companies and the industry are considerable.

Genetic variation of natural antibodies in milk of Dutch Holstein-Friesian cows. By Ploegaert et al., page 5467. Defense mechanisms of dairy cows against disease rest partly on their naturally present disease resistance capacity. Natural antibodies form a soluble part of the innate immune system, being defined as antibodies circulating in healthy animals without prior intentional antigenic stimulation. Genetic parameters of natural antibodies binding 4 different antigens in bovine milk were estimated to study opportunities for genetic improvement of the innate immune system. Intraherd heritability ranged from 0.10 to 0.53 for different natural antibodies. The high genetic correlations (ranging from 0.45 to 0.99) indicated a common genetic basis for the levels of different natural antibodies. It was concluded that levels of natural antibodies can be improved through selection.

Recursive relationships between milk yield and somatic cell score of Canadian Holsteins from finite mixture random regression models. By Jamrozik and Schaeffer, page 5474. Relationships between milk yield and somatic cell score on the same test-day in first-lactation dairy cows can be better described by assuming causal phenotypic relationships between these 2 traits, modeled separately for healthy cows and cows infected with mastitis, than by a standard multiple-trait model. Milk yield had a negative phenotypic effect on the level of somatic cell score on the same test-day in the first lactation of Canadian Holsteins, slightly
different in healthy cows compared with cows affected by putative subclinical mastitis. This resulted in different patterns of genetic and environmental correlations between these 2 traits, depending on health status. Changes in rankings of sires for somatic cell score between healthy and mastitic daughters are possible.

**Marker imputation with low-density marker panels in Dutch Holstein cattle.** By Zhang and Druet, page 5487. For selection or research purposes, dairy bulls and cows are genotyped for thousands of genetic markers. Low-density single nucleotide polymorphism arrays with fewer markers (e.g., 3,000) have recently been developed to reduce genotyping costs. To use these arrays, it is necessary to predict the missing genotypes by using a process called imputation. Two imputation techniques were tested with 384 to 6,000 single nucleotide polymorphisms per array in a Dutch dairy cattle sample. With 3,000 markers, allelic imputation error rates were between 3 and 4%. The error rate was strongly dependent on marker density and on the relationship between target and reference individuals (genotyped at higher density).

**Relationships between milk protein composition, milk protein variants, and cow fertility traits in Dutch Holstein cattle.** By Demeter et al., page 5495. Milk protein composition can be changed by selective breeding to improve manufacturing properties of milk. However, the effect of those selection strategies on reproductive performance is unknown. Results of this study can be used to assess the correlated effects of selection for milk protein composition on reproduction, thereby allowing for better evaluation of breeding programs before implementation. A positive phenotypic relationship was found between greater relative concentrations of α_{S1}-casein within total milk protein and female reproductive performance. Results suggest that selecting for desirable protein fractions or protein variants for improved manufacturing properties would have no negative effect on cow fertility.

**Digesters and demographics: Identifying support for anaerobic digesters on dairy farms.** By Sanders et al., page 5503. Anaerobic digestion on dairy farms can be a source of multiple benefits, including renewable energy and reduced odor. This project segments consumers by their support of this technology and suggests that potential support for digesters and the large dairy farms on which they are generally found can be evaluated using demographic and socioeconomic descriptors of potential installation areas.

**Evaluation of calf milk pasteurization systems on 6 Pennsylvania dairy farms.** By Elizondo-Salazar et al., page 5509. Pasteurization of waste milk is one option to reduce risks associated with spreading diseases through bacteria in milk while utilizing a valuable, low-cost, liquid feed source for calves. This study evaluated 6 on-farm pasteurization systems to determine the effectiveness of pasteurization and measure bacterial counts in milk fed to calves. The results indicated that pasteurization can be very effective in lowering bacterial contamination of milk. However, on the farms studied, bacteria numbers increased significantly after pasteurization and, in some cases, bacteria numbers in milk fed to calves were similar to prepasteurization levels.