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The Jackrabbit Dairy & Food Review

Department of Dairy and Food Science

Winter 2018

Jackrabbit Dairy and Food Review

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Jackrabbit Dairy & Food Review

Winter 2017-2018

Dairy and Food Science Department, Alfred Dairy Science Hall, South Dakota State University, Brookings, SD 57007-0647

DAIRY & FOOD SCIENCE DEPARTMENT

Faculty

Sanjeev Anand, Professor, Dairy Manufacturing
Jill Anderson, Assistant Professor, Dairy Production
Howard Bonnemann, Lecturer, Dairy Manufacturing
Alvaro Garcia, Agriculture and Natural Resources Program Director/Professor
Srinivas Janaswamy, Assistant Professor, Food Science
Padmanaban Krishnan, Professor, Food Science
Sergio Martinez-Monteagudo, Assistant Professor, Dairy Manufacturing
Lloyd Metzger, Professor, Alfred Chair in Dairy Education, Dairy Manufacturing
Johan Osorio, Assistant Professor, Dairy Production
Vikram Mistry, Professor and Department Head and Interim Associate Dean for Academic Programs
Maristela Rovai, Assistant Professor/SDSU Extension Dairy Specialist, Dairy Production
C.Y. Wang, Professor, Food Science

Emeritus Faculty

Robert Baer currently lives in the Black Hills area
David Henning currently lives in Wisconsin
John Parsons currently lives in Arizona
David Schingoethe currently lives in Brookings

Staff

Steve Beckman, Filtration Technologist
Curtis Braun, Extension Field Specialist, Food Safety
Tasha Crane, Agricultural Foreperson, Dairy Research and Training Facility
Tracey Erickson, Extension Dairy Field Specialist
John Haberkorn, Manager, Davis Dairy Plant
Akimoto Ichinomiya, Assistant Manager, Davis Dairy Plant
Peter Linke, Manager, Dairy Research and Training Facility
Monica Markwed, Secretary, Dairy Bar
Kristi Prunty, Secretary
Jayne Raabe, Senior Secretary
Ahmed Salama, Post Doctorate Associate
Melissa Schmitt, Assistant Manager, Dairy Research and Training Facility
Raunak Shukla, Industrial Food Engineering Technologist
Sushil Singh, Food Engineering Technologist
Vijay Sundaram, Research Associate II

MESSAGE FROM THE DEPARTMENT HEAD



Greetings from the Dairy and Food Science Department at South Dakota State University! Amidst busy schedules, each year seems to go by rapidly, but it is only when one reflects on the year past that the significance of accomplishments becomes evident. We were particularly pleased in 2017 to welcome new staff members; Curtis Braun, Extension food safety specialist, and Dr. Ahmed Salama, post doctorate for instruction in dairy production. The expertise of these individuals will help us strengthen our food safety and dairy production programs. Our on-going recruiting efforts have been successful. In fall 2017 we had a record 119 undergraduate majors from 15 states around the U.S. For our students hosting of the Annual Conference of the Midwest Regional American Dairy Science Association Student Affiliate Division took center stage early in the year. After intensive planning for about a year, the club welcomed to campus approximately 400 students and advisors to Brookings in February and executed a most informative, thoughtful and enjoyable program. In recognition of their excellence, the Dairy Club was voted club of the year for the College of Agriculture and Biological Sciences.

Scholarship awards, courtesy of generous donors, were over \$150,000 this year. The products judging team received third place. The dairy cattle judging team placed third overall at the intercollegiate contest in Madison, Wis. Kirby Krogstad placed first overall in the contest. Faculty productivity was impressive: in fiscal year 2017 Dairy and Food Science faculty members secured over \$1.2 million in external grants through 22 projects to support research, graduate students, and researchers. This reflects an approximately four-fold increase from 10 years ago. Student accomplishments were equally impressive. One such example is National Dairy Promotion and Research Board Scholarships. Since 2003, one hundred and four of our students have been recipients of these scholarships, constituting approximately 38 percent of all scholarships awarded nationally! In 2017 three of our students were recipients out of 11 nationally. Students also received other national scholarships such as National Dairy Shrine, Institute of Food Technologists, and others. There were numerous other student accomplishments, which are listed in this newsletter.

In 2017 we engaged a professional marketing agency to help us identify specific needs in Dairy Production teaching and research programs. This study involved interviews with numerous professionals in the industry, ultimately generating a report that highlighted our strengths as well as possible directions for the future. The recommendations involved building on the unique strength of combined dairy manufacturing and dairy production programs and placing additional focus on herd management aspects for teaching and research in dairy production. We are now in the process of implementing these recommendations as we also being to develop our strategic plan under the new university plan. Employment opportunities for our graduates are outstanding; placement is 100 percent. To further enhance recruiting, we employed a comprehensive social media marketing campaign to alert prospective students about the exciting opportunities in dairy and food science. I invite you to join us in spreading the word about the outstanding opportunities, and to visit us at www.sdstate.edu/ds or better yet, in person.

Vikram Mistry

2017 GRADUATES

Ph.D.

Juan Sanchez-Duarte, Production

M.S.

Taghreed Almalki, Manufacturing
Taylor Aubrey, Production
Shivali Jindal, Manufacturing
Dalia Khan, Manufacturing
Kali Linville, Production

B.S. Manufacturing

Kaelyn Dammann
Morgan Goche
Mitchell Jazdzewski

Krista Johnson
Katelyn Johnson
Mohammad Khawaja
Rachel Larson
Shayna Popkes
Makayla Reed

B.S. Production

Brennen Albrecht
Jacob Bierstedt
Brandon Hawkins
Jacob Johnson
Katelyn Johnson
Mohammad Khawaja

Brianna Lee
Laura McMartin
Eric Metzger
Makayla Reed
Megan Schaefer
Chelsea Schossow
Jacob Stadick
David Wick

B.S. Food Science

Brady Bury
Joshua vonWinckelmannBelrose



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NEW FACULTY AND VISITORS

NEW FACULTY AND STAFF



Curtis Braun joined the department in fall 2017 as an Extension Field Specialist—Food Safety. He has extensive food processing, food safety, quality control, quality assurance, and industry experience, including better process control certification from the University of California to help local food entrepreneurs review their production of acid and acidified foods. Braun holds a B.S. in nutrition dietetics from the University of Minnesota, St. Paul, and a MBA from University of St. Thomas. He has spent nearly a decade in the food industry, mostly at General Mills, as external supply chain quality manager, food safety and quality technical manager, ingredient manager, regional auditor, ingredient specification and labeling coordinator and finished product labeling coordinator. He will be responsible for helping South Dakota food entrepreneurs by coordinating basic food testing and shelf-stability analysis, understand regulatory jurisdiction for foods other than canned and baked goods, and assist with other marketing aspects regarding food safety and food labeling. In addition, he will work with various partners such as the S.D. Department of Health, FDA and many more to ensure that safety standards are in place at levels of the food system.



Ahmed Salama joined the department in fall 2017 as post-doctorate associate. His specific responsibilities include teaching of dairy production classes at both the undergrad and grad levels. Dr. Salama has a Ph.D. in animal science from Universitat Autònoma de Barcelona in Spain. Before coming to SDSU, he was researcher/lecturer at Universitat Autònoma de Barcelona. He has also been a visiting scientist at universities in Sweden, Switzerland, France and Illinois. He has more than 10 years of experience teaching animal science (animal production systems, small ruminants production, rabbit production, ethnology and ethology, and anatomy and animal physiology) as well as research in these areas.

VISITORS

Dr. Gerardo Caja, professor and an animal scientist from the Department of Animal and Food Sciences, Veterinary Faculty at the Autonomous University of Barcelona, Spain, visited the department in summer 2017. Dr. Caja chairs the Group of Research in Ruminants (G2R) at the university. Assistant professor Dr. Maristela Rovai hosted Dr. Caja.

Juan Castillo, Zomorano University, Honduras, and **Nathaly Carpinelli** and **Rodrigo Chaves Barcellos Grazziotin**, Universidade Federal de Pelotas, Brazil, visited the department for various periods as interns under Dr. Osorio.

Leyby Guiffaro, National University of Agriculture, Honduras, is on a one-year internship, working with Dr. Rovai and Steve Beckman.

Randy Gross, former president of Holstein Association, USA and retired assistant branch manager of Northwest Farm Credit Services of Washington State, served as visiting instructor in dairy production classes. Gross's wealth of experience was most valuable to our students.

April Johnson, Tuskegee University; and **Aaliyah Partman**, University of Maryland, were undergraduate researchers in the dairy and food science department at SDSU during the summer. Their mentors were Drs. Anand and Anderson under a USDA grant.

Dinakar Panyam, M.S.'92, innovations partnerships and licensing manager, Nestle, Oakland, Cal., visited the department to discuss opportunities for collaborative work. and presented a seminar on Nestle and a technology innovations seminar. Dr. Panyam received his M.S. in dairy science from SDSU in 1992 and Ph.D. from Penn State.

Walt Wosje, alumnus and retired CEO of Michigan Milk Producers and retired manager of the CWT program of the National Milk Producers Federation served as guest lecturer in several of our classes and conducted individualized practice interviews for our students.

Numerous other visitors from industry such as **Dr. Neil Michael**, manager of Global Technical Services and **Chris Sorenson**, ruminant account manager from Arm & Hammer Animal Nutrition also visited the department for conducting seminars, or research with faculty members.

DAIRY CLUB



2017 Dairy Club officers were: Cole Hoyer, president; Audrey Souza, vice president; Kristin Erf, secretary; Katelyn Groetsch, treasurer; Erika Franzen-Ackerman and Abigail Hopp, historians; Jacob Weg and Angela Wick, activities coordinators; and Abigail Hopp, Dairy Digest editor. Advisors were Dr. Jill Anderson, John Haberkorn, Dr. Sergio Martinez-Monteagudo, Peter Linke and Melissa Schmitt. Club members hosted ADSA-SAD regional conference in Brookings in February, bringing to campus approximately 400 students and advisors from universities from around the Midwest. In June, club members hosted youth at the 14th annual Jackrabbit Dairy Camp. Fifty k-12 participants from five states attended. Other club activities throughout the past year included the South Dakota State Fair, Ag-Bio Ice Cream Social, National Ag Day, Relay for Life, World Dairy Expo and cheese boxes for which students cut, packaged and shipped almost 8,000 pounds of cheese around the country under the leadership of co-chairs Angela Wick, Cole Hoyer and Eric Ode. In November, club members travelled to Toronto, Canada, to attend the Royal Canadian Agricultural Fair. Along the way, they also visited dairy farms and plants.

FOOD SCIENCE CLUB



2017 Food Science Club officers were: Bipin Rajpurohit, president; Tanvee Deshpande, vice president; Aliza Sigdel, secretary; Beatrice Manu, treasurer; Lexi Snyder, fundraising chair; Emily Resch, activities chair; Maggie Becher, publicist. Dr. Padmanaban Krishnan, advisor. Club members attended the Institute of Food Technologists (IFT) subsection meeting in Marshall, Minn. In September, the club kicked off the 2017-2018 academic year with a pizza party to welcome new and returning club members. Members also participated in a fundraising activity, and to start the spring semester, hosted a potluck event. Additional activities this year include attendance at the Minnesota Farm Fest, volunteer services, Ag Friday and Ag Saturday at the Washington Pavilion, product development competition with IFT and field trips to food companies.

MARK YOUR CALENDAR

Central Plains Dairy Expo, March 27-29, 2018, Convention Center, Sioux Falls

Dairy & Food Science Scholarship Banquet, Monday, April 9, 2018, 6:00 p.m., Club 71, Dana J. Dykhouse Stadium

JUDGING ACTIVITIES

DAIRY CATTLE



The season kicked off with two competitions on the same weekend in September. The junior team, comprised of Carla Bromenschenkel, Katelyn Groetsch, Dennissen Nelson and Kyle Tews, competed in the Select

Sires/Accelerated Genetics Intercollegiate contest in Viroqua, Wis. The team placed 12th overall and Nelson placed fifth high individual in milking short-horns. The senior team, comprised of Kristin Erf, Cole Hoyer, Kirby Krogstad and Andrew Socha, competed in Harrisburg, Pa., at the 49th annual All-American Intercollegiate Dairy Cattle Judging Contest. They placed eighth high team overall and fifth in Jersey team. Also worth noting, Hoyer placed sixth high individual. The highlight of the season was the senior team's performance at the 97th annual World Dairy Expo Intercollegiate contest in Madison, Wis. The team placed third high team overall. Krogstad was first overall individual in the contest and Erf was 10th. In addition, the team was first and Erf was first placed individual in Jerseys. The team also placed first in Ayrshires, third in Holsteins and fourth in Red and Whites. Teams were both coached by Dr. Jill Anderson and Michaela Della.

DAIRY PRODUCTS



SDSU's Dairy Products Judging Team placed third in All Products at the 2017 Collegiate Dairy Products Evaluation Contest in Milwaukee. SDSU has a long history at this contest having won the national championship 23 times it's 95-year history.

The team placed first in Cheddar cheese, second in butter and yogurt, third in milk, fifth in ice cream and seventh in cottage cheese. Fifty-five undergraduate and graduate contestants from 14 universities in the U.S. and Canada participated in the contest. SDSU team members were Bennet Baker, Katelyn Johnson, Krista Johnson and Steve Beckman. Dr. Lloyd Metzger, SDSU professor of dairy science and Alfred Chair in Dairy Education, was coach and Natasha Laska Scherber, SDSU graduate student, assisted. Johnson placed third overall and first in yogurt, and fourth in butter, milk and Cheddar cheese. Baker placed eighth overall and seventh in yogurt and Cheddar cheese. Johnson was 10th overall and placed first in Cheddar cheese. In the graduate student contest, Beckman placed fifth overall and was first in cottage cheese and third in yogurt. The Wisconsin Cheese Makers Association hosted the contest and USDA and more than 35 dairy associations, companies and suppliers were sponsors.

DAIRY CHALLENGE



SDSU participated in the 16th Annual North American Intercollegiate Dairy Challenge® (NAIDC) held in Visalia, Calif. The 230 students from the U.S. and Canada who attended are training for careers in the

dairy industry as farmers, researchers, educators, financial analysts, nutritionists, farm service providers and veterinarians. The team members were Cord Nossen, Megan Schaefer, Chelsea Schossow and Jacob Weg. Melissa Schmitt and Dr. Osorio coached the team with assistance from Brandon Hawkins and Brianna Lee. Collegiate teams visited seven dairy farms in California, as part of their training to help farmers evaluate and adapt management to optimize success and animal care. Each team received information from a dairy, including production and farm management data and, after an in-person inspection of the dairy, teams interviewed the herd owners. Each team developed a farm analysis and recommendations for nutrition, reproduction, milking procedures, animal health, housing and financial management. The event culminated with teams presenting recommendations and then fielding questions from the judges. The official judges included dairy producers and industry experts in dairy finances, reproduction, nutrition and animal health. Presentations were evaluated for accuracy of analysis and recommendations, with awards presented at a final banquet.

STUDENT ACCOMPLISHMENTS

Taylor Gilmore was a member of 2017 Icebox Classic Speech Award, Jackrabbit Forensics Team. She placed third in extemporaneous speaking, first in impromptu speaking and first in after dinner speaking.

Taylor Aubrey, graduate student in dairy production received a Dakota Farmers Union scholarship.

Sanne de Bruijn, dairy production and dairy manufacturing major was selected to be the college's Ag Bio Ambassador.



Dairy Club hosted the Midwest Regional Conference of ADSA-SAD in February. Members traveled to Nashville during spring break and to the Royal Agricultural Fair, Toronto, Canada, in the fall. They were voted the college's 2017 Club of the Year and received the 2017 Student Organization Outstanding Program Award. The 2018 officers are: Abby Hopp, president; Sanne de Bruijn, vice president; Ashley Maus, secretary; Jenna Van Wyk, treasurer; Denver Stage and Angel Kasper, activities coordinators; and Katelyn Groetsch and Lauren Libbesmeier, historians.

Karla Rodriguez-Hernandez, Ph.D. student in dairy production received the Dr. April Brooks Woman of Distinction Award—Student category. She also placed first in the Gamma Sigma Delta research poster contest and third in the Sigma Xi contest.

Aliza Sigdel and **Joshua vanWinckelmannBelrose** presented posters at 2017 Upper Midwest Regional Honors Conference at SDSU.

Bipin Rajpurohit and **Waleed Alrayyes**, graduate students in food science were selected to participate in the American Association of Cereal Chemists International (AACCI) Student Research Leadership Program. Bipin also received first place in M.S. oral paper presentation in the Sigma Xi contest.

Fernanda Rosa, recipient of the 2017 Kemin ADSA Travel Grant, also presented an online undergrad class in dairy calf Rearing for the Universidad de La Salle, Bogota, Colombia, which focused on new developments related to the evaluation of health status in dairy calves. She received third place in the Gamma Sigma Delta Ph.D. poster presentation contest.

Devandra Paudel, food science graduate student received first place in the Gamma Sigma Delta and Sigma Xi M.S. poster presentation contests.

Neha, Ph.D. dairy student under the supervision of Dr. Anand received honorable mention at Sanford Research Center's "Its All About Science" Post Doc/Graduate Poster Presentation Contest. She placed third in the Graduate Student 3-Minute Thesis Contest at the ADSA annual meeting, Pittsburgh, Pa., and received the Joseph F. Nelson graduate scholarship.

Natasha Laska Scherber, **Nancy Awasti**, **Maryam Enteshari** and **Ahmed Hammam**, comprised the first runner-up team coached by Dr. Metzger in the Idaho Milk Products Association New Products Contest.

Audrey Souza, **Kirby Krogstad** and **Jacob Weg** received National Dairy Promotion and Research Board Scholarships from 19 given nationwide.

Kristin Erf, dairy manufacturing major, received the National Dairy Shrine/DMI Milk and Dairy Product Scholarship at the World Dairy Expo.

Abby Hopp, dairy production major received the Maurice Core scholarship of National Dairy Shrine scholarship at the World Dairy Expo.

Shivali Jindal's M.S. thesis supervised by Dr. Anand was selected for the SDSU Distinguished Master's Thesis Award and was nominated it for the Midwestern Association Graduate Schools Distinguished Master's Thesis Award by the graduate school. Her thesis, "Biofilm Formation by Common Dairy Sporeformers on Native and Modified Stainless Steel Surfaces," can be viewed at openprairie.sdstate.edu/etd/1149/.

Katherine Lake received a Griffith undergraduate research award under the mentorship of Dr. Krishnan. She will study the effects of mixing bowl geometry and mixer types on bread loaf volume and crumb texture of bread.

Kirby Krogstad received the college's Undergraduate Engagement Award under the mentorship of Dr. Anderson. His research will evaluate ruminal fiber digestibility of ethanol corn co-products by dairy cows.

Derek Tramp received an Orville and Enolia Bentley Undergraduate Research Award under the mentorship of Dr. Krishnan to study rheology and composition oat-based flour for the production of healthy oat-based foods from South Dakota agriculture.

PROFESSIONAL ACTIVITIES OF FACULTY AND STAFF

Faculty and students together presented numerous papers including refereed publications in scientific journals, abstracts, presentations, book chapters, extension publications, theses or dissertation, and SDSU Extension presentations. All publications are listed on our website at www.sdstate.edu/ds.

Dr. Sanjeev Anand, a faculty member since 2006, teaches and conducts research in the areas of dairy microbiology and food safety. He has mentored 25 undergraduate researchers, six Ph.D. and 17 M.S. students. Dr. Anand's research is in the areas of biofilm development and control, control of spores in dairy processing, non-thermal methods for improving product quality, encapsulated dairy products with enhanced health benefits, Listeria control in ice cream, and general food safety education. He is the current department representative to the Functional Genomics Core Facility, Van D. and Barbara B. Fishback Honors College, H. M. Brigg's Library, and a member of the Ag Bio P & T Committee. The Journal of Dairy Science recognized two of his research papers as editor's choice. He currently serves on the editorial board of the Journal of Dairy Science, and as a member of the Dairy Foods Division, American Dairy Science Association.



Dr. Jill Anderson, who joined the department as assistant professor in 2012, teaches several classes, and has established a research program in ruminant nutrition, with an emphasis on calves and heifers. Dr. Anderson has served as advisor to 11 graduate students and nine undergraduate researchers. She is currently serving as vice president of Midwest ADSA. She is coach of the dairy cattle judging team and a co-advisor to the Dairy Club. She received the College of ABS teacher of the year award.

Howard Bonnemann has been on the faculty since 1997 and teaches a wide range of classes. He serves as academic advisor to all undergraduate students in the department. He is the assessment coordinator for the department and the college representative on the University Assessment Committee and is also the department curriculum coordinator. Howard has conducted many FFA dairy products judging clinics across the state. He serves as the executive secretary for the S.D. Dairy Association.

Tracey Erickson is Extension dairy field specialist based in the Watertown Regional Center. Tracey is the past chair of the I-29 Moo University Consortium which promotes dairy education in the five states of S.D., N.D., Minn., Iowa and Neb. She is the secretary of the South Dakota Dairy Fieldmen's Association and serves on the board of directors of the Central Plains Dairy Foundation which invests in positive, proactive programming supporting the dairy industry in the I-29 corridor. She co-coordinates the youth 4-H Dairy Cattle Evaluation and serves as an advisor to the 4-H dairy cattle program in South Dakota. Tracey also serves on the Dairy Fest committee, coordinating the youth education events. She is now also the coordinator for the newly formed S.D. Dairy Ambassador program for SDSU students and serves on the Professional Advisory Council representing SDSU/NFE Extension employees.

John Haberkorn is the manager of the Davis Dairy Plant. In this role, he developed and led several new programs for the plant, including student edition cheeses, GMP program, development and production of a large range of flavored cheeses and a positive release program. All initiatives involve extensive student training. He also provided tours of the plant to numerous groups. John was co-advisor to the Dairy Club.

Dr. Srinivas Janaswamy completed his first year as a faculty member in Food Science and initiated his teaching program as well as research in carbohydrate applications. He travelled to China and Kenya to develop research collaborations. In Kenya he visited the International Potato Center and met 2016 World Food Prize winner, Dr. Jan Low.

Dr. Padmanaban Krishnan conducts research in food science and teaches several food science classes. He is president of the Great Plains subsection of the Institute of Food Technologists and co-chair of the Vitamins, Lipids and Minerals Technical Committee of the American Association of Cereal Chemists International. Great Plains Subsection of IFT recognized him as outstanding section volunteer. Dr. Krishnan works collaboratively with university and food industry scientists in the areas of wheat, corn and oats research and value added processing. He directs the activities of the Crop Quality Laboratory on the SDSU Innovation Campus. He served on grant

review panels for NIFA. He has a patent pending for Vacuum Dough Expansion System for predicting bread dough rheological behavior.

Peter Linke is manager of the Dairy Research and Training Facility. While overseeing all aspects of farm operations, he also helps coordinate all research and teaching activities at the farm. He developed and led the implementation of several upgrades at the farm including cow comfort and installation of a Cow Manager system. The farm hosted hundreds of k-12 for activities such as Little I and FFA judging, and Dairy Camp. Pete was co-advisor to the Dairy Club.

Dr. Sergio Martinez-Monteagudo joined the department in spring 2016 and added to the manufacturing program new expertise in unit operations, including high-pressure homogenization and cavitation. He teaches dairy chemistry and processing classes for undergraduates and lab techniques, and seminar for graduate students. He is co-advisor to the department graduate student safety committee.

Dr. Lloyd Metzger served as director of the Midwest Dairy Foods Research Center and the executive secretary of the North Central Cheese Industries Association. Member—ADSA Dairy Foods Milk Protein and Enzyme Committee, and member of the editorial board of the Journal of Dairy Science. He has served as coach of the dairy products judging team and participated as an expert judge at the World Cheese Contest. Dr. Metzger was a member of the College of ABS Dean's Faculty Advisory Council. He conducted short workshops on cheese making for several groups.

Dr. Vikram Mistry served as associate director of the Midwest Dairy Foods Research Association. He served on the boards of the American Dairy Association of South Dakota, American Dairy Science Association Foundation, and advisor to the North Central Cheese Association and the South Dakota Dairy Producers. Beginning July 2017 he was appointed as interim associate dean for academic programs for the College of ABS, in addition to being department head.

Dr. Johan Osorio joined the department in fall 2016. He has expertise in nutrigenomics. He was an invited speaker in Lisbon, Portugal, for a seminar on amino acid nutrition in dairy cattle and at the University of Guadalajara, Mexico, to talk about nutrigenomics in dairy cows. Additionally, he was invited to speak at Central Plains Dairy Expo in Sioux Falls. He served as advisor to three graduate students and hosted three interns. He also co-taught the dairy farm operations class and served as co-coach for the Dairy Challenge team.



Dr. Maristela Rovai, started as Extension dairy specialist in 2014 and has developed comprehensive programs including Dairy Tool Box Talks—An Educational Pilot program. She teaches Dairy Spanish both undergraduate and graduate students and in spring 2018, Physiology of Lactation. The aim of the Dairy Spanish course, that covers basic grammar, cultural differences and dairy issues, is to increase Spanish fluency of our students and state dairy industry work force. In 2016, she initiated a program called "Semillas" for k-12 children to promote the dairy industry and educate them about career and other opportunities. She conducted a workshop for 4-H and high school students in Minnesota on lactation which involved a hands-on demonstration of a real udder dissection. Dr. Rovai also led a dairy workforce development effort through the Puerto Rico educational collaboration program. She co-taught a course, Optimizing Milk Quality: From Employee Training Strategies to Hospital Management, for the University of Idaho Extension at the National Mastitis Council Regional Meeting as well as various seminars for middle managers/herdsmen participants on aspects of dairy cow management in Idaho.

Dr. David Schingoethe, distinguished professor emeritus, retired in 2011. He resides in Brookings and continues to serve the department, most recently as chair of a faculty search committee that led to the hiring of a faculty member.

Dr. C. Y. Wang became a full-time faculty member in the department in the food science program. He was previously the associate dean of research and Extension in the College of Education and Human Sciences. Dr. Wang co-advises a graduate student and teaches the food product development class.

DISTINGUISHED ALUMNI



Each year, SDSU selects distinguished alumni in recognition of their outstanding achievements and contributions. In 2017, **Dave Thompson**, B.S. '64 received this honor at a ceremony on campus in October. Thompson's career began with a production position at Abbott in Mitchell, S.D., manufacturing Similac infant formula. Within 10 years, he became vice president of operations with the Ross Division of Abbott Laboratories. Among his duties were talking with Russia and Ireland about building Similac plants there. In 1981, he moved to Abbott's corporate office in Chicago, where he was vice president of materials. A year later he was named vice president of human resources for Abbott worldwide. In 1983, Thompson was named senior vice president of Abbott and president of Abbott Diagnostic Division. During his 12 years at the helm, the division grew its revenue from \$200 million to more than \$2 billion. It was in 1985 that Abbott introduced the first licensed test to detect HIV in blood. After retiring from Abbott in 1995, he became lead director for Exact Sciences Corp., which has developed the first non-invasive test for colon cancer. Thompson provides scholarship support to the dairy manufacturing and food science department. He also provided substantial contribution towards the construction of the Davis Dairy Plant.

Roger Scheibe, retiring industry relations manager at Midwest Dairy was selected as Advocate of the Year at the Ag United Annual Luncheon in recognition of his over 40 years of work with the dairy industry.

DAIRY FACILITIES

The **Davis Dairy Plant** attracts tours from a wide range of visitors, including schools, alumni, prospective students, professionals, and many others, including those that are curious about the manufacture of dairy products. A virtual tour of the plant is available at www.sdstate.edu/dsl/. The plant processes approximately 1 million pounds of milk annually, converting it to 25,000 pounds of cheese, 20,000 gallons of fluid milk, 40,000 gallons of ice cream and 1,600 pounds of butter. One day a week is set aside for maintenance and repair, inventory and environmental cleaning. Through the comprehensive programs developed by the plant manager, John Haberkorn, students receive excellent hands-on training for product manufacture, quality assurance, product development and general plant management. The plant employs and trains approximately 40 students part-time. The Student Edition Cheese program gives students firsthand experience in the development and marketing of a new product. Students develop the idea for cheese flavor. Students manufacture the new cheese at the plant and ensure that it meets standards. Once the cheese completes a positive release, it is packaged and labeled. The label features the type of cheese and the name of the originating student. The plant hosted numerous processing companies for research projects. In 2017, we once again extended invitations to all our Jackrabbit Dairy Council members and donors for the dairy plant project to come to campus for conducting interviews for summer internships and permanent positions. In all, 18 companies visited the department and conducted 142 interviews and follow-up onsite interviews. Job offers for permanent positions and summer internships are being finalized.



Student edition cheeses aging in the Davis Dairy Plant.

Our **Dairy Research and Training Facility** has approximately 130 certified and registered milking cows and 300 animals in total. This includes approximately 50 Brown Swiss. The herd is used for research projects primarily in nutrition and for teaching. In addition, K-12 students also benefit from it through the Dairy Camp and cattle judging contests that are hosted at the farm. Olivia Bartel and Aaron Beaner serve as student managers. Manager Peter Linke and assistant manager Melissa Schmitt undertook extensive facilities upgrades, specifically to address cow comfort. Tasha Crane serves the DRTF as ag foreman and has the duty of feeding and maintenance. DRTF staff and students showed our Holstein and Brown Swiss at the S.D. State Fair, receiving high placings. Faculty members and graduate students routinely use the facility to conduct research projects that involve calves, heifers, as well as lactating cows.



Cattle from the DRTF received high placings at the South Dakota State Fair. From left to right: Olivia Bartel, Laura Frye, Melissa Schmitt and Chelsea Smith.

YEARS OF SERVICE

Jayne Raabe received recognition for 30 years of service to SDSU. Raabe is senior secretary and joined the department in 1987 as secretary.

Vikram Mistry received recognition from Dr. Don Marshall, interim dean of the College of ABS, for 30 years of service. Mistry is a professor and department head. He joined the department as an assistant professor in 1986.



SAY "CHEESE!"



The 2017-18 freshmen class made a field trip to Bel Brands in Brookings.

SCHOLARSHIPS

Our students were once again the beneficiaries of the generosity of alumni, friends and industry, receiving approximately \$153,000 in scholarships 2017-2018.

UPPER CLASS SCHOLARSHIPS

Agropur, Inc. Dairy Manufacturing, \$2,000
 Agropur, Inc. Dairy Production, \$2,000
 Agropur/Jay Headley Memorial, \$1,500
 Alfred Herman Rishoi Memorial (2/\$575), \$1,150
 Alltech, \$1,500
 Associated Milk Producers, Inc., \$1,000
 Bel Brands USA, \$3,000
 Clyde G. Helsper Memorial, \$1,000
 Dairy Club (3/\$500), \$1,500
 Dairy Connection, \$1,000
 Dairy Farmers of America, \$400
 Dairy Fest (2/\$500), \$1,000
 Dairy Manufacturing, \$2,375
 David A. Thompson—Manufacturing/Food, \$5,000
 David A. Thompson—Manufacturing, \$5,000
 David H. Henry Memorial in Ag & Bio Sciences, \$1,000
 David J. and Darlene K. Schingoethe, \$1,000
 Dean Foods—Sioux Falls, \$1,250
 Derrall, \$500
 Ed and Jennifer Bick—Food Science, \$1,000
 Emery Bartle Memorial, \$7,500
 George Marx, \$1,000
 Gibert T. and Olga Gilbertson Memorial, \$450
 H. C. Olson, \$500
 J. J. Yee, \$500
 James Marvel Memorial, \$350
 Joan (Hegerfeld) and Alan Baker – Food Science, \$1,000
 John Anderson Memorial (2/\$3,000), \$6,000
 John C. Gross, \$1,000
 Joseph Van Treeck, \$1,500
 Kemps, LLC, \$1,500
 Kenneth I. Gross, \$1,000

Kirk and Dorothy Mears Memorial, \$1,000
 Land O'Lakes Dairy Science, \$250
 Leprino Foods, \$4,000
 Midwest Dairy Association (2/\$3500), \$7,000
 N. Central Cheese Ind. Assoc. (2/\$1,000, 2/\$2,000), \$6,000
 Ode Family, \$500
 Pete Behrends Memorial, \$3,000
 Ralph Rogers Memorial, \$400
 Robert Chamberlain Scholarship in Food Science, \$1,600
 Rogers Dairy, \$1,000
 Ross Baker, \$500
 Ryan Graber Memorial, \$1,000
 Saputo Cheese, \$2,000
 Schuch Family, \$1,250
 South Dakota State Dairy Association (2/\$1,500), \$3,000
 Shirley Seas Memorial, \$450
 Susan Hawkins, \$2,000
 T. M. Olson, \$650
 Todd and Erica Stahl, \$1,000
 Valley Queen Cheese Factory, \$7,500
 Walt and Yvonne Wosje, \$1,000
 WOW Logistics Donald E. Utschig, \$1,000

AWARDS

Alfred and Hilde Tobkin Memorial (4/\$125), \$500
 Arnold Hippen Dairy Challenge (4/\$200), \$800
 Dairy Judging Manufacturing, \$150
 Dairy Judging Production, \$150
 Forbes Leadership, \$300
 LeRoy Graber-Ford, \$300
 Howard Voelker Memorial (4/\$250), \$1,000
 Non-Dairy Science Student Dairy Club, \$500

INCOMING DAIRY STUDENTS

Clyde G. Helsper Dairy Fieldmen's Association, \$1,000
 Dairy Science Faculty \$650
 Dairy Science Scholarships (1/\$1,500, 4/\$1,250,

5/\$1,000, 1/\$500), \$12,000
 Howard Voelker Freshman Dairy Production, \$1,000
 Idaho Milk Processors Association (2/\$2,000), \$4,000
 Midwest Dairy Association (3/\$1250), \$3,750
 Royal and Helen Doner Freshman in Dairy Prod., \$400
 S.D. Dairy Fieldmens Association (7/\$1000), \$7,000
 S.D. State Dairy Assoc. (1/\$1,250, 2/\$1,000), \$3,250
 Valley Queen Cheese Factory Freshmen, \$1,000
 William and Marge Kallemeyn & Sons, \$1,200

INCOMING STUDENT SCHOLARSHIPS

Campanile, \$600
 Jackrabbit Achievement, \$1,000
 Scholars Weekend Student, \$6,000
 Yellow and Blue (6/\$1,000, 3/\$2,000), \$12,000

GRADUATE STUDENT SCHOLARSHIPS

Dairy Recognition and Education Foundation (1/1,700, 1/\$2,700, 3/\$2,000), \$10,400
 Delbert and Robert Breazeale Memorial, \$1,100



Recipients of the Agropur Inc. dairy scholarships, some of the more than \$150,000 in scholarships offered for SDSU dairy and food science students.

DAIRY AND FOOD SCIENCE STUDENTS

GRADUATE STUDENTS

Production, Master of Science
 Michaela Della, Hartville, Ohio*
 Lydia Olagunju, Nigeria*
 Sonia Rodriguez-Jimenez, Spain*
 Chelsea Schossow, Houston, Minn.*
 Lauren Shearer, Brookings

Production, Ph.D.
 Carl Kass, Bruce
 Rhea Lawrence, Aurora
 Karla Rodriguez-Hernandez, Mexico
 Nirosh Senevirathne, Sri Lanka
 Fernanda Trindade Rosa, Brazil

Manufacturing, Master of Science
 Khalid Alsaleem, Saudi Arabia*
 Pratibha Chaudhary, India*
 Ahmed Hammam, Australia*
 Megan Huegli, Hartford, Wis.
 Natasha Scherber, Canton
 Jae Young Sim, South Korea*

Manufacturing, Ph.D.
 Nancy Awasti, India
 Steven Beckman, Lincoln, Neb.
 Maryam Enteshari, Iran
 Dipakkumar Mehta, India
 Shayanti Minj, India*
 Achyut Mishra, Nepal*
 Neha, India
 Venkateswarlu Sunkesula, India
 Prathistha Verma, India*
 Hiral Vora, India

Food Science, Master of Science
 Patra Akaya, Nigeria*
 Brady Bury, Webster*
 Tanvee Deshpande, India*
 Most Farzana Yesmin, Bangladesh*
 Kara Konst, Chandler, Az.*
 Beatrice Manu, Ghana*
 Theodore Mohr, New Ulm, Minn.
 Devendra Paudel, Nepal
 Bipin Rajpurohit, India
 Aliza Sigdel, Nepal*

Food Science, Ph.D.
 Waleed Alrayyes, Kuwait
 Mohamed Elfaruk, Libya*

UNDERGRADUATE STUDENTS

Manufacturing
 Joshua Blasé, Twin Lakes, Wis.
 Jared Bowers, Hayti
 Rebecca Cantwell, New Lenox, Ill.
 Lauren Chirnside, Lees Summit, Mo.
 Ryan Christie, Sioux Falls*
 Cord Cnossen, Hereford, Texas
 Jennifer Domanski, Grand Rapids, Mich.*
 Daniel Domenichini, Tampa, Fla.*
 Kristin Erf, Oakdale, Minn.*
 Megan Gaulke, New London, Minn.*
 Samantha Gjerde, Sunburg, Minn.*
 Parker Grieme, Valley Springs
 Cole Halvorson, New Ulm, Minn.
 Anna Hemenway, Huron
 Jacob Jewett, Glencoe, Minn.
 Gramm Johnson, Fulton
 Alysha Madsen, Corona
 Gregory Reeter, Volga
 Thijs Reuvekamp, Elkton*
 Shelby Riddle, Sioux Falls
 Rebecca Roberson, Akron, Iowa*
 Sarah Rossbach, Hanska, Minn.*
 Daniel Sharp, Bath*
 Han Si, China: Manufacturing
 Alexandra Snyder, Dell Rapids
 Zachary Sousa, Milbank
 Mitchell Timp, Le Mars, Iowa
 Sijin Wang, Binhaixinqu Tianjin, China*
 Jordan Zemlicka, Watertown

Production
 Olivia Bartel, New London, Wis.
 Morgan Beckmann, Rose Creek, Minn.*
 Caleb Blaisdell, Starbuck, Minn.
 Hailey Bowman, Paso Robles, Calif.*
 Colten Carlson, Willmar, Minn.
 Kaitlyn Carlson, Kirkland, Ill.

Theodore Czech, Watertown
 Brooke Engstrom, Renville, Minn.*
 Taylor Gilmore, Dillsburg, PA
 Dillon Gratz, Atwater, Minn.*
 Conner Graves, Pukwana*
 Katelyn Groetsch, Albany, Minn.
 Katie Hendrickson, Estelline*
 Abigail Hopp, Chatfield, Minn.
 Hannah Horchem, Tremont, Ill.*
 Cole Hoyer, West Salem, Wis.
 Jacob Johnson, Heron Lake, Minn.
 Joseph Kalina, Montgomery, Minn.
 Jessica Kerfeld, Melrose, Minn., Production
 Josie Kindwall, Cherokee, Iowa*
 Kirby Krogstad, Eyota, Minn.
 Chandler Kurth, Stewart, Minn.
 Hallie Lingen, Balaton, Minn.*
 Calissa Lubben, Edgerton, Minn.*
 Dennissen Nelson, Lonsdale, Minn.*
 Madison Okerstrom, Shafer, Minn.
 Jacob Post, Chandler, Minn.
 Kaleigh Powell, Liberty, Ill.*
 Alexandra Preszler, Roscoe
 Julius Sachs, Eyota, Minn.
 Madeline Scalise, Albion, Pa.
 Cole Schock, Salem*
 Cody Schroeder, Marshall, Minn.
 Chelsea Smith, Brookings
 Margaret Socha, Rogers, Minn.*
 Audrey Souza, Milbank
 Megan Struss, New Ulm, Minn.
 Jackson Sudbeck, Hartington, Neb.
 Walker Sundstrom, Lynden, Wash.
 Kyle Tews, Hutchinson, Minn.
 Paige Thielen, Eden Valley, Minn.
 Jennifer Thill, Forest Lake, Minn.
 Jenna Van Wyk, Remsen, Iowa
 Taelyn Virus, Hebron, Neb.*
 Maisie Walter, Montrose, Minn.*
 Molly Watson, Cooperstown, N.Y.*
 Jacob Weg, Worthington, Minn.
 Angela Wick, Jordan, Minn.
 Andrew Wilwerding, Freeport, Minn.*
 Andrew Wolter, Perry, Iowa*

Production and Manufacturing
 Bennet Baker, Elysain, Minn.
 Carla Bromenschenkel,
 Brownton, Minn.
 Hersain Cancino, Saint Peter, Minn.
 Sanne de Bruijn, Pollock
 Theodore Jacoby, Ballwin, Mo.*
 Danielle Jax, Waltham, Minn.*
 Jessica Kerfeld, Melrose, Minn.
 Ashley Maus, Freeport, Minn.*
 Kayla Post, Chandler, Minn.
 Elizabeth Schwartzhoff,
 Lansing, Iowa*

Food Science
 Maggie Becher, Somerset, Wis.
 Tanner Davis, Freson, Calif.*
 Jill Folsland, Baltic
 Rachel Hepfner, New Hope, Minn.
 Logan Johnson, Rosholt
 Momoka Kamada, Sapporo, Japan*
 Holly Larson, Medford, Minn.*
 Lydia Meredith, Kokato, Minn.*
 Uday Mishra, New Delhi, India*
 Clarissa Ober, Glencoe, Minn.,
 Emily Resch, Spirit Lake, Iowa
 Lily Schimke, Stewartville, Minn.
 Katelyn Smith, Canby, Minn.
 Karl Vallin, Eagan, Minn.*
 Maria Velazco Fasce, Venezuela
 Joshua vonWinckelmannBelrose,
 Sioux Falls

Manufacturing and Food Science
 Mohit Manoj Kotkar,
 Nimala Convent, India

*New students in 2017-2018

OUTREACH

Area Dairy Expos



Alumni, students, staff, and faculty of the department participated in Central Plains Dairy Expo in Sioux Falls, World Ag Expo in Tulare, Cal., and the World Dairy Expo in Madison, Wis. Faculty and students also participated in the Washington Pavilion Ag Day events in Sioux Falls, demonstrating various dairy and food activities to participants as well as at the Minnesota Corn Growers Assoc-

iation Farm Fest where students and faculty handed out 4,700 cookies made on campus from distillers grains.

North Central Cheese Industries Association



Dr. Lloyd Metzger serves as executive secretary and Dr. Vikram Mistry as advisor to the North Central Cheese Industries Association. The annual meeting was held in Rochester, Minn., in October. Over 130 cheese makers and

suppliers from the upper Midwest attended. Alumnus Kirk Baldwin was elected president, filling the vacancy of outgoing president, alumnus Wendy Devney. Another alumnus, Neil Kucker was named an honorary life member.

Jackrabbit Dairy Drive

Roger Scheibe, industry relations director of the Midwest Dairy Association, and alumnus, collaborated with SDSU athletics and industry for the fourth Jackrabbit Dairy Drive at a football game on campus. The purpose of the event was to honor dairy producers, promote the dairy industry.

Faculty Hosts Teachers-in-Training

Howard Bonnemann hosted Erin Otte-Meyer and Anavi Ngo, high school chemistry teachers in training, in June 2016 while they received training in the chemistry of dairy products. Otte-Meyer and Ngo were participants in the chemistry teacher training program in the SDSU Chemistry and Biochemistry Department. They will use their dairy chemistry training to deliver information to their students in Wisconsin.

EXTENSION

Dairy Fest

The 4th Annual Dairy Fest was held at the Swiftel Center in Brookings in June. The Dairy Fest steering committee consists of dairy industry representatives and dairy producers and is the host of the two-day event. Proceeds from the event were used in the form of two scholarships in the SDSU Dairy Science Department at \$500 each to support the future of youth in the dairy industry. The festival began with a "Got Milk" Gala on Friday, June 2, hosting 180 participants and featured various dairy products in food entrées, while educating the attendees about the region's dairy industry. That same day, 150 youth from area after-school/summer programs participated in the interactive dairy workshops making test tube cheese and learning about the

NEW STUDENTS



SDSU's new dairy and food science students for school year 2017-18.

industry. A carnival was held on Saturday where participants learned about the dairy industry from milk production to product processing. Volunteers included SDSU Dairy Club, SDSU dairy science faculty, dairy producers and dairy industry people to coordinate the events hands-on activities, teaching youth and their parents about dairying, where the milk goes, how it is turned into dairy products and the nutritional value of dairy products. The carnival also included tours to the local Golden Dakota dairy farm and the Davis Dairy Plant. An estimated 1,200 consumers who went through the carnival learning about the dairy industry.

I-29 Moo University

The I-29 Moo University includes Extension from SDSU, NDSU, ISU, UMN, UNL and dairy producer organizations in the five states, along with the Minnesota Dairy Initiative representatives. They were very active during 2017 with a wide range of programs and tours. The group also started the I-29 Moo University e-Newsletter, as a joint effort of Extension articles and latest happenings. They are presently reaching people across the globe with their newsletter. The programs have been very well attended and are detailed at www.facebook.com/I29MooUniversity/ as well as www.iGrow.org.

World Dairy Expo and World Ag Expo

The Dairy and Food Science Department and the South Dakota Department of Agriculture shared a booth at the World Dairy Expo in Madison, Wis., and World Ag Expo in Tulare, Cal. The booth highlighted the dairy development efforts and dairy education and research activities and opportunities in South Dakota. Many interested people and alumni stopped by to learn about the South Dakota dairy industry and education and to say hello.

K-12 STUDENTS

Dairy Camp

The Dairy Club hosted the 13th annual Dairy Camp in June for youth ages 8-18. Activities included training on care of heifers, judging, exploring the reproduction tract and digestive system, visit to the SDSU dairy plant, making ice cream, clipping and showing cattle, and entertainment. Participants displayed what they learned at a showmanship contest on the final day of the camp. Parents were invited to attend the show.



High School Visits

Recruiting students is a year-round activity and a priority. Dairy Science Ag-Bio Ambassadors visited several high schools throughout the year in South Dakota, Iowa and Minnesota. In addition, the department visited schools and career fairs in Minnesota and South Dakota.

WHERE ARE THEY NOW?

Tori Boomgaarden, B.S. '08, Dairy Manufacturing. R&D Scientist, Kemps, LLC, Rochester, Minn.

Renee Brown, B.S. '76, Dairy Manufacturing. Account Manager, DuPont Nutrition and Health, New Century, Kan.

Wade Gustafson, B.S. '00, Dairy Production. Dairy Management Instructor, Ridgewater College, Willmar, Minn.

Melanie Hamelton, B.S. '88, Dairy Manufacturing. Director Supplier FSQA, US Foods, Rosemont, Ill.

Dan Hinrichs, B.S. '88, Dairy Production. Large Farm Area Sales Manager, DFA, Zumbrota, Minn.

Todd Stahl, B.S. '91, Dairy Production. Exec. Director, Animal Management, Sab Biotherapeutics. Sioux Falls



CHANGE SERVICE REQUESTED

RESEARCH HIGHLIGHTS

The Agricultural Experiment Station and external grants support faculty research activities with approximately \$1 million in research expenditures annually. The broad areas of research are as follows.

Manufacture of Dairy Based Ingredients Dr. Lloyd Metzger. The overall goal of the project is to develop and improve manufacturing processes to produce dairy-based ingredients that have an extended shelf life and for utilization in domestic and international markets. 1) Model the drying characteristics of dairy-based ingredients to maximize the efficiency of the drying process and accelerate the development of new dairy-based ingredients. 2) Develop a lab scale crystallization system and analysis protocols that for evaluation of modified manufacturing processes that improve the efficiency of lactose and permeate manufacture. 3) Develop and evaluate membrane based manufacturing processes for isolating or concentrating components in various dairy products including milk, whey, permeate and delactosed permeate.

Carbohydrate Based Carriers of Bioactive Compounds Dr. Srinivas Janaswamy. 1) Preserve the structural form of a BC until the time of delivery, and 2) effectively deliver the preserved form to the physiological target. The following two objectives will provide a comprehensive evaluation of the proposed research strategy. 1) Explore the effectiveness of various carbohydrate-based carriers in encapsulating BCs. 2) Assess the stability and bioavailability of encapsulated BCs.

Process Interventions for Enhancing Microbial Quality, Safety, and Nutrition of Dairy Foods Dr. Sanjeev Anand. 1) To improve microbial quality and shelf life of milk and dairy products. 1.1) To understand sporulation behavior of common spore formers during milk powder manufacture 1.2) To apply non-thermal technologies, such as cavitation, to control common dairy spore formers. 2) To improve microbial safety of dairy processes. 2.1) To control dairy pathogens such as *Listeria* by risk analysis, through response surface models. 3) To develop novel dairy products containing probiotics. 3.1) To develop a spray-dried health formulation based on whey protein hydrolysate and probiotics encapsulation.

Utilizations of Advanced Molecular Biology and Sensor Systems Techniques to Improve Health and Performance in Dairy Cattle Drs. Johan Osorio and Jill Anderson. Improve the health and consequently the postpartum performance of transition dairy cows through either nutrigenomic approaches or sensor systems. Validate the activation of peroxisome proliferator-activated receptor (PPAR) via specific fatty acids and determine new transcription factors (TF) that have greater direct activation by fatty acids through advanced molecular techniques such as gene reporter technology (GRT). Determine novel transcription factors (TF) that respond directly to other dietary nutrients or compounds such as amino acids, trace minerals, vitamins, etc. Validate and confirm the in vitro novel transcription factors (TF)

uncovered in Objectives 1 and 2 at a complete animal level through in vivo experiments in lactating dairy cows. Improve automated sensor systems for early detection of postpartum diseases or disorders at the subclinical stage by combining sensor data with biomarkers of health status.

Engineering Technologies for Novel Applications in Dairy Manufacturing Drs. Sergio Martinez-Montegudo and Sanjeev Anand. The overall objective of this research program is to generate scientific understanding of the behavior of dairy systems and their individual components during manufacturing. Specific objectives: To characterize engineering parameters of high-pressure homogenization. To investigate the efficacy of combined pressure-temperature on safety and selected quality parameters of dairy beverages. To evaluate the role of pressure on emulsion stability within a wide range of processing conditions.

Management Systems to Improve the Economic and Environmental Sustainability of Dairy Enterprises (Rev. NC-1119) Dr. Jill Anderson. Optimize calf and heifer performance through increased understanding of feeding strategies, management systems, well-being, productivity and environmental impact for productivity and profitability. Improve dairy cow management decisions through nutrient utilization, well-being and profitability. Analyze whole farm system components and integrate information into decision-support tools to improve efficiency, enhance profitability, and environmental sustainability.

Evaluation of Different Dietary Energy Sources on Growth Performance and Metabolism of Replacement Dairy Heifers Dr. Jill Anderson. Determine how different dietary energy sources affect calf and heifer growth, nutrient digestion, metabolism, and reproductive development. Determine if energy and protein from distillers grains can replace energy and protein from forage sources in growing dairy heifer rations in precision feeding scenarios. Determine how particle size of the ration forage with slowly degradable concentrate sources influences total tract digestion of feedstuffs in precision-fed rations for dairy heifers. Determine how much supplemental fat can be fed in replacement of starch from corn in moderate forage (> 50%) heifer diets. Long-term goal. Determine if manipulation of the energy sources in diets of dairy heifers can decrease age at puberty and breeding, and therefore shorten the time it takes to initiate lactation without negatively impacting milk production of primiparous cows.

Value Enhancement of Health, Nutrition and Economic Traits of Cereal Grains Dr. Padmanaban Krishnan. *Objectives:* The goals of this project are to enhance the health, food functional, nutritional and economic value of cereal grain crops grown in the state and region. Improved and enhanced food production and increased monetary and health value cash crops such as wheat, oats and corn will result from the effort.