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The Jackrabbit Dairy & Food Review

Department of Dairy and Food Science

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Winter 2019

# Jackrabbit Dairy and Food Review

Vikram V. Mistry

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# Jackrabbit Dairy & Food Review

Winter 2018-2019

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**, Associate Professor, Dairy Production  
**Matthew Badura**, Assistant Director, First Year Advising  
**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**, David A. Thompson Endowed  
Department Head and Professor  
**Maristela Rovai**, Assistant Professor/SDSU Extension  
Dairy Specialist, Dairy Production

### 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**, Manager,  
Institute of Dairy Ingredient Processing  
**Curtis Braun**, Extension Field Specialist, Food Safety  
**Shouyun Cheng**, Post-Doctoral Research Associate  
**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**, Senior Secretary  
**Jayne Raabe**, Program Assistant I  
**Raunak Shukla**, Industrial Food Engineering Technologist  
**Poonam Singha**, Post-Doctoral Research Associate  
**Vijay Sundaram**, Research Associate II  
**Khrupa Vijayaragavan**, Post-Doctoral Research Associate



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## MESSAGE FROM THE DEPARTMENT HEAD



Greetings from the Department of Dairy and Food Science at South Dakota State University. This newsletter is a compilation of the department's 2018 activities. I am particularly pleased to note undergraduate enrollment is at a record high with 125 majors. This is the result of excellent scholarship support from generous donors, continuing 100 percent placement, outstanding faculty members and resources. Graduate student enrollment has also remained high at nearly 40 between our three majors. Graduate and undergraduate students come from approximately 13 states and 15 countries. Generous donors provided scholarship support of approximately \$153,000 for the academic year.

Faculty productivity was impressive in 2018 as the department secured over \$1.5 million in external grants through 24 projects to support research, graduate students and researchers. This reflects an approximately 29 percent increase over the previous year. Student accomplishments were equally impressive. Examples include nationally competitive scholarships from National Dairy Promotion and Research Board, National Dairy Shrine, Institute of Food Technologists, Minnesota Milk, John Brandt Memorial and others. The Products Judging Team, coached by Dr. Lloyd Metzger, placed first nationally, holding a record of nine first place finishes out of 10 consecutive years. The Dairy Cattle Judging Team, coached by Dr. Jill Anderson, and Dairy Challenge Team, coached by Melissa Schmitt, also were very competitive.

As reported last year, we have been engaged in developing plans for further strengthening our already robust dairy production program. As a step towards this, we redefined one of our faculty positions to place emphasis on herd management to complement the existing strength in nutrition. A new faculty member for this position, Isaac Salfer, will begin his appointment in spring 2019. In the next phase of this plan to enhance the dairy production program, we have launched discussions that will lead to comprehensive renovations/rebuilding of the Dairy Research and Training Facility with the goal of providing state-of-the-art education and research opportunities that will prepare students for the future. This project is in the very early phases of development and will entail detailed planning followed by fundraising in the coming months. Another major need that is also in the early phases is the renovation of food science laboratories within Berg Agricultural Hall. The department received a major boost from alumnus David A. Thompson who has provided a very generous contribution for endowing the position of department head. Through this endowment, Thompson has made a lasting impact not just on the department but also on the students and industry. As we continue to strengthen our programs and facilities and progress towards fulfillment of our vision of being a national and international leader in dairy and food education, research and extension, I invite you to join us in spreading the word about the outstanding opportunities in our department and visit us at [www.sdstate.edu/ds](http://www.sdstate.edu/ds) or better yet, in person.

Vikram V. Mistry

David A. Thompson Endowed Department Head and Professor

## DAVID A. THOMPSON ENDOWMENT



David A. Thompson, a 1964 dairy manufacturing graduate of SDSU, has made a very generous contribution to the department to endow the position of Department Head. Thompson has had a very illustrious career in the dairy industry for which he was named distinguished alumnus in 2017. His generous endowment will help the department and its programs excel in all areas. Dr. Vikram Mistry, department head, will be the first holder of this endowed position. Further details of this generous gift are at <https://www.sdstate.edu/news/2018/09/david-thompson-endowed-chair-dairy-and-food-science-announced>.

## MARK YOUR CALENDAR

Central Plains Dairy Expo, March 26-27, 2019, Convention Center, Sioux Falls

Dairy & Food Science Scholarship Banquet, Wednesday, April 10, 2019, 6:00 p.m., Club 71, Dana J. Dykhouse Stadium

## NEW FACULTY AND VISITORS

### NEW FACULTY AND STAFF



**Shouyun Cheng** joined the department as a postdoctoral research associate. Cheng holds a Ph.D. in agricultural biosystems, and mechanical engineering from SDSU, an M.S. in chemical engineering from Taiyuan University of Technology, China, and a B.S. in chemical engineering from Shandong University of Science and Technology, China. At SDSU, his work will be in the areas of lactose and dairy additives.



**Poonam Singha** joined the department as a postdoctoral research associate. Singha holds a Ph.D. in agricultural biosystems and mechanical engineering from SDSU, an M.Tech. in food technology and biochemical engineering from Jadavpur University, India, and a B.Tech. in food technology from Techno India University, India. In her role at SDSU she will work on improving food quality of North American grown oats.



**Krupa Saagar Vijayaragavan** joined the department as a postdoctoral research associate. Vijayaragavan holds a Ph.D. in chemical engineering from Michigan Technological University, India; an M.S. in chemical engineering from Wayne State University and a B.S. in chemical engineering from R. V. College of Engineering, India. In his role at SDSU he will work on filtration-based research for dairy ingredient development.

### 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 (UAB), Spain, visited the department in summer 2018. Caja chairs the Group of Research in Ruminants (G2R) at the university. Maristela Rovai, assistant professor, hosted Caja.

**Sergio David Lasso Ramirez, Jessica Halfen, Chavez Baarcellos Garaaiotin and Dely Chavez Garay** visited the department for various periods as interns under Johan Osorio Esteves and Sergio Martinez Montegudo.

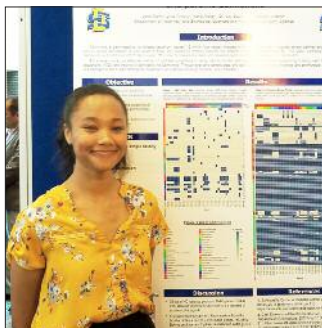
**Randy Gross**, former president of the Holstein Association, USA, and retired assistant branch manager of Northwest Farm Credit Services of Washington State, served as visiting instructor in dairy production classes. Gross' wealth of experience was most valuable to our students.

**Dr. Wenhao Li**, associate professor, College of Food Science and Engineering, Northwest A&F University, Yangling, Shannxi, China, is spending a year with Srinivas Janaswamy on research work in the area of carbohydrates.

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

**Dr. Alen Dzidic** of the University of Zagreb served as guest speaker for Physiology of Lactation.

**Daniel Mbogo**, research associate at the International Potato Center in Nairobi, Kenya, visited the department for a joint project on sweet potato-based bread working towards improving bioavailability of beta-carotene and researched with Srinivas Janaswamy.



Jene Martin

**Mikayla Johnson**, Tuskegee University, and **Jene Martin**, University of California-San Diego, were undergraduate researchers in the Department of Dairy and Food Science during the summer. Their mentors were Jill Anderson and Sanjeev Anand under a USDA grant.

## JUDGING ACTIVITIES

### DAIRY CATTLE



The 2018 Dairy Cattle Judging year kicked off in January with two teams competing in Fort Worth, Texas. Team 1 was comprised of Abigail Hopp, Katelyn Groetsch and Dennisen Nelson, and Team 2 was comprised of Carla Bromeschenkel, Jackson Sudbeck and Kyle Tews. Team 1 placed 10th overall, and Team 2 placed

13th. In mid-September the new junior team comprised of Colten Carlson, Brooke Engstrom, Ashley Maus and Jenny Thill competed at the Accelerated Genetics/Select Sires Intercollegiate competition in Viroqua, Wis. They placed 14th overall. The same weekend the senior team comprised of Abigail Hopp, Dennisen Nelson, Kyle Tews and Katelyn Groetsch competed in the Invitational Youth Dairy Cattle Judging contest at the All-American Dairy Show in Harrisburg, Pa. They placed 13th overall. The senior team also competed at the Intercollegiate National Contest in Madison, Wis., during World Dairy Expo. The team placed first in Brown Swiss, and Abigail Hopp was first individual in Brown Swiss. Overall the team placed 14th. To wrap up the season a team including Abigail Hopp, Brooke Engstrom and Ashley Maus competed in early November at the Collegiate Dairy Cattle Judging contest held as part of North American International Livestock Exposition (NAILE). They placed 15th overall. Jill Anderson and Michaela Della served as coaches for the year.

### DAIRY PRODUCTS



SDSU's Dairy Products Judging Team placed first in all products at the 2018 Collegiate Dairy Products Evaluation Contest, held April 18 in Milwaukee, Wis. SDSU has won the national championship 24 times in the 96-year history of the contest. A total of 49 undergrad and graduate

contestants from 15 universities in the U.S. participated. In dairy products judging, students evaluate the appearance, texture and flavor of six dairy products (milk, butter, Cheddar cheese, ice cream, yogurt and cottage cheese). SDSU team members were Megan Struss, Greg Reeter, Anna Hemenway and Ahmed Hammam. The team was coached by Lloyd Metzger and Bennet Baker. Struss placed first overall, third in yogurt, fifth in ice cream and seventh in Cheddar cheese and yogurt. As the top overall judge, she received the Robert Rosenbaum Award. Reeter placed third overall, first in butter and second in yogurt. Hemenway was eighth overall, second in butter and third in yogurt. In the graduate student contest, Hammam placed sixth overall and was first in ice cream. The contest was hosted by the Wisconsin Cheese Makers Association and sponsored by the USDA and more than 35 dairy associations, companies and suppliers.

### DAIRY CHALLENGE



SDSU participated in the 17th Annual North American Intercollegiate Dairy Challenge (NAIDC) held April 12-14 in Visalia, Calif. The 235 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 Olivia Bartel, Kelli Berger, Caleb Blaisdell and Audrey Souza. Melissa Schmitt coached the team with the assistance of Chelsea Schossow and Jacob Weg. To help farmers evaluate and adapt management to optimize success and animal care, participants visited dairy farms in California. Each team received information including production



and farm management data. After an in-person inspection, students interviewed the owners. Each team developed a farm analysis and recommendations for nutrition, reproduction, milking procedures, animal health, housing and financial management. Team members presented their recommendations and then fielded questions from judges. Presentations were evaluated for accuracy of analysis and recommendations, with awards presented at a final banquet. Abigail Hopp and Alexandra Preszler also participated in the Dairy Challenge Academy. Student-participants analyzed and developed recommendations for an operating dairy; however, the academy was organized in mixed-university teams with two advisers to help coach these younger students.

## DAIRY CLUB



**2018 Officers:** Abigail Hopp, president; Sanne de Bruijn, vice president; Ashley Maus, secretary; Jenna Van Wyk, treasurer; Katelyn Groetsch and Lauren Libbesmeier, historians; Angelica Kasper and Denver Stage, activities coordinators; and Abigail Hopp, Dairy Digest editor. Advisers were Jill Anderson, John Haberkorn, Sergio Martinez-Monteagudo, Peter Linke and Melissa Schmitt. In January, club members attended the ADSA-SAD regional conference hosted by the University of Minnesota. Approximately 400 other students and advisers from universities across the Midwest attended. Over spring break, a group of members travelled to California. Along the way, they toured various dairy farms and a Lely manufacturing plant in addition to completing lots of sightseeing. In June, club members hosted youth at the 15th annual Jackrabbit Dairy Camp. Fifty-two participants, ranging in age from eight to eighteen, from three states attended. Other club activities included the South Dakota State Fair, CAFES ice cream social, National Ag Day, World Dairy Expo, and ditch cleaning. The club was also busy with cheese boxes for which students cut, packaged and shipped almost 8,000 pounds of cheese around the country under the leadership of co-chairs Jenna Van Wyk, Carla Bromenschenkel, Laura Frye and Ashley Maus.

## FOOD SCIENCE CLUB



**2018 Officers:** Maggie Becher, president; Emily Resch, vice president; Elise Emmick, secretary; Callie Koehl, treasurer; Elizabeth Steever, fundraising chair; Dana Edleman, activities chair; Jessica Christoffer, publicist; Allison Kolbe, publicist co-chair. Padmanaban Krishnan and Srinivas Janaswamy served as advisers. In August, the club kicked off the 2018-2019 academic year with a pizza party to welcome new and returning members. This year, the club has seen an increase in membership and held elections in October. In September, the club picked apples for the caramel apple bar at the September meeting. In October, the club picked pumpkins and had a pumpkin carving and painting event. In November, they conducted a fundraising activity, which involved selling Jackrabbit sugar cookies to employees and students in the College of Agriculture, Food and Environmental Sciences at SDSU.

## STUDENT ACCOMPLISHMENTS

Our students participate and compete in numerous activities throughout the year. Below are a few examples.

**Maggie Becher** received a competitive Joseph F. Nelson Award of SDSU for undergraduate research.



**Beki Cantwell, Anna Hemenway, Gramm Johnson** were featured on a KSFY story on the Davis Dairy Plant and opportunities in the dairy science major.

**Dairy Club** received first place for Chapter Year Book at the national ADSA annual meeting in Knoxville, Tenn.

**Sanne de Bruijn, Andrew Wilwerding and Rebekka Paskewitz** were recipients of National Dairy Promotion and Research Board Scholarships in a nationwide competition.

**Sanne de Bruijn, Dennisen Nelson, Katelyn Groetsch, Jenna Van Wyk and Angelica Kasper** were selected as S.D. Dairy Ambassadors in the first year of this program sponsored by Midwest Dairy. They promoted the dairy industry throughout the year through various events and media activities.

**Mohamed Elfaruk and Most Farzana** received Honorable Mention in the "It's all about Science" event in Sioux Falls. Both are graduate students under Srinivas Janaswamy.

**Maryam Enteshari**, doctoral student, was elected to Phi Tau Sigma, the Honor Society of Food Science and Technology.

**Laura Frye**, senior dairy manufacturing major, received the Youth Achievement Award of the National Brown Swiss Association.

**Dillon Gratz, Jessica Kerfeld and Margaret Socha**, received DHIA scholarships in a nationwide competition.

**Rebecka Hoffman** was a member of the South Dakota 4-H Dairy Judging Team at the World Dairy Expo in Madison, Wis.

**Kirby Krogstad, Abigail Hopp and Rebecca Roberson** received National Dairy Shrine Scholarships.

**Rhea Lawrence and Maryam Enteshari**, doctoral students, received John Brandt Memorial Scholarships from the Land O' Lakes Foundation.

**Sowmya Marka**, completed her master's degree under Sanjeev Anand and her paper in the Journal of Dairy Science received recognition as editor's choice.

**Ashley Maus and Calissa Lubben** were selected as Princess Kay finalists for the state of Minnesota from among 84 contestants and **Rebekka Paskewitz** was crowned the 65th Princess Kay of the Milky Way.

**Uday Mishra and Alexandra Preszler**, food science and dairy production students, respectively, received college undergraduate engagement award for undergraduate research.

**Neha Neha**, doctoral student in dairy manufacturing received the 2018 Joseph F. Nelson Graduate Scholarship.

**Johannah Nielsen** was a participant in the National 4-H Dairy Conference, Madison, Wis.

**Karla Rodriguez-Fernandez and Neha Neha**, both doctoral students, each received third place for ADSA presentations at the national annual meeting in Knoxville, Tenn.

**Fernanda Rosa**, doctoral student under Johan Osorio Estees received a Kemin 2018 ADSA Travel Grant.

**Fernanda Rosa, Rhea Lawrence and Aliza Sigdel**, graduate students in the department, competed in the Sigma Xi research presentation and poster contest.

**Margaret Socha, Denver Stage, Johannah Nielsen, Ethan Johnson and Elizabeth Krienke** received Minnesota Milk scholarships.

**Aliza Sigdel**, received a second-place award in the poster presentation at the fourth NDSU Annual Conference on Food for Health in Fargo, N.D. She also received a graduate research award (second place) from the Sigma Xi-SDSU chapter, the Institute of Food Technology (IFT)-Minn. chapter travel award to attend the 2018 IFT Annual Meeting and Food Expo in Chicago, and a student scholarship award from the IFT-Minn. chapter.

**Mohamed Elfaruk**, received a third-place award in the poster presentation at the fourth NDSU Annual Conference on Food for Health, Fargo, N.D.

## 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](http://www.sdstate.edu/ds).

**Dr. Sanjeev Anand** has been a faculty member since September 2006. He teaches and conducts research in the areas of dairy microbiology and food safety. He mentors undergraduate researchers as well as graduate students working towards master's and doctorate degrees. Anand's research is in the areas of biofilm development and control, control of spores in dairy processing, nonthermal methods for improving product quality, encapsulated dairy products with enhanced health benefits, Listeria control in ice cream, and general food safety education. He serves as the department representative to the Functional Genomics Core Facility (2007-present), the Van D. and Barbara B. Fishback Honors College (2013-present), Brigg's Library (2014-present), and member of CAFES P & T Committee (2016-19). He also serves on the editorial board for the Journal of Dairy Science (2017-2020), and is a member of the Dairy Foods Division and American Dairy Science Association (2017-19). He received the 2018 International Dairy Foods Association Teaching Award in Dairy Manufacturing at the annual meeting of the American Dairy Science Association and was an invited speaker at the U.S. Dairy Spore Seminar. Anand was the September 2018 featured faculty member: <https://www.youtube.com/watch?v=7c64gqhmcfI>.

**Dr. Jill Anderson** joined the department as an assistant professor in 2012. In 2018, she received tenure and promotion to associate professor. She teaches several classes and has established a research program in ruminant nutrition, with an emphasis on calves and heifers. Anderson has served as adviser to 11 graduate students and nine undergraduate researchers. She is currently serving as president of the Midwest ADSA. She is the coach of the dairy cattle judging team and a co-adviser to the Dairy Club.

**Howard Bonnemann** has been a faculty member since October 1997 and teaches a wide range of classes. He serves as academic adviser to all undergraduate students in the department. He is the assessment coordinator for the department and the College of Food, Agriculture and Environmental Sciences representative on the University Assessment Committee. He is also the department curriculum coordinator. Bonnemann has conducted many FFA dairy products judging clinics across the state. He serves as the executive secretary for the S.D. Dairy Association. In 2018, he received an NACADA advising award in recognition of his excellence in academic advising.

**Tracey Erickson** is an SDSU Extension dairy field specialist based in the Watertown Regional Center. Erickson received promotion to SDSU Extension field specialist III. She is the past chair of the I-29 Moo University Consortium, which is a collaborative outreach program for dairy education in the five states of South Dakota, North Dakota, Minnesota, Iowa and Nebraska. She serves as the secretary of the S.D. Dairy Fieldmen's Association. Presently, she is serving on the Central Plains Dairy Foundation Board of Directors, and helping to build the newly formed 501(C)3 Foundation with a mission of investing in positive, proactive programming to support the dairy industry in the I-29 corridor. Erickson serves on the Dairy Fest Committee, coordinating the youth education events. She is the coordinator for the S.D. Dairy Ambassador program sponsored by Midwest Dairy. She 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. Haberkorn is co-adviser to the Dairy Club.

**Dr. Srinivas Janaswamy** joined the department as an assistant professor in 2016. He teaches several food science classes and leads a research program on functional biopolymers with an emphasis on the design and development of novel carriers of bioactive compounds. The program also focuses on agricultural residues toward package materials and water purification. He has published 60 international peer-reviewed journal articles, edited one book and one special issue, and is currently serving as an editorial board member of "Carbohydrate Polymers." During 2018, he received funding from the Norman Borlaug Agriculture and Technology through USDA-FAS. He also received a Science Communications Fellowship from the S.D. Discovery Center in Pierre, S.D. Janaswamy advises six graduate students, two undergraduate students and one visiting scholar from Kenya.



**Dr. Padmanaban Krishnan** conducts research in food science and teaches several food science classes. He is past-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. 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. He serves as adviser to the Food Science Club.

**Peter Linke** is the 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 planned and oversaw numerous upgrades to the farm facilities. The farm hosted hundreds of k-12 for activities such as Little I, FFA judging and Dairy Camp. Linke was co-adviser 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-adviser to the department Graduate Student Safety Committee and to the Dairy Club.



**Dr. Lloyd Metzger** served as director of the Midwest Dairy Foods Research Center and the executive secretary of the North Central Cheese Industries Association. He is a member of the ADSA Dairy Foods Milk Protein and Enzyme Committee, and of the editorial board of the Journal of Dairy Science. Metzger has served as coach of the dairy products judging team and was an expert judge at the World Cheese Contest. The SDSU team placed first at the regional and national contests in 2018. 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, South Dakota Dairy Producers, American Dairy Science Association Foundation and adviser to the North Central Cheese Association and the South Dakota Dairy Producers. In 2018 he was named the David A. Thompson Endowed Department Head and Professor of the department.

**Dr. Johan Osorio** joined the department in fall 2016 with expertise in nutrigenomics. He was an invited speaker at several events, including in Florida, China and Brazil. He served as adviser to three graduate students and hosted several interns. He also co-taught the Dairy Farm Operations class.

**Dr. Maristela Rovai** started as an SDSU Extension dairy specialist in 2014 and has developed comprehensive programs including Dairy Tool Box Talks, an educational pilot program. She teaches Dairy Spanish to both undergraduate and graduate students and 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. She conducted numerous workshops throughout the year related to training farm employees.

**Dr. C. Y. Wang** co-advised a graduate student and taught the Food Product Development class. He retired in fall 2018 and moved to Western Carolina University in North Carolina as associate dean/professor. He was with SDSU for 25 years.

## YEARS OF SERVICE

**Dr. Padmanaban Krishnan** received recognition for 30 years of service to SDSU. Krishnan is currently a professor with expertise in food Science.

**Dr. Lloyd Metzger** received recognition for 15 years of service. Metzger is a professor and Alfred Chair with expertise in dairy manufacturing.



## DAIRY FACILITIES

The **Davis Dairy Plant** has three objectives: education, research and development, and manufacturing dairy products. A virtual tour of the plant is available at [www.sdstate.edu/ds/](http://www.sdstate.edu/ds/). The Davis Dairy Plant processes approximately 1 million pounds of milk annually, converting it to 25,000 pounds of cheese, 40,000 gallons of ice cream, 1,600 pounds of butter and dried skim milk powder for the ice cream. One day a week is set aside for maintenance and repair, inventory and environmental cleaning. Through the very comprehensive programs developed by John Haberkorn, plant manager, students receive excellent hands-on training for product manufacture, quality assurance, product development and general plant management. The plant employs and trains approximately 40 part-time students. The Student Edition Cheese program gives students firsthand experience in the development and marketing of a new product. Students develop the idea for a cheese flavor, and then manufacture the new cheese at the Davis Dairy 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.

Throughout the year, the plant hosted numerous processing companies for research projects. In 2018, the department once again extended invitations to all our Jackrabbit Dairy Council members and donors for the dairy plant



A Davis Dairy Plant tour.

## 2018 GRADUATES

### B.S. Food Science

Jill Folsland  
Logan Johnson  
Clarissa Ober  
Lily Schimke  
Jinhao Zhao

Cody Schroeder  
Audrey Souza  
Megan Struss  
Jackson Sudbeck  
Walker Sundstrom  
Jacob Weg  
Angela Wick

### B.S. Manufacturing

Rebecca Cantwell  
Cord Cnossen  
Kristin Erf  
Anna Hemenway  
Gramm Johnson  
Gregory Reeter  
Shelby Riddle  
Alexandra Snyder

### B.S. Production and Manufacturing

Bennet Baker

### M.S. Food Science

Theodore Mohr, Food Science  
Devendra Paudel, Food Science

### M.S. Production

Sonia Rodriguez-Jimenez, Production  
Lauren Shearer, Production

### B.S. Production

Caleb Blaisdell  
Olivia Bartel  
Katelyn Groetsch  
Cole Hoyer  
Joseph Kalina  
Kirby Krogstad  
Dennisen Nelson  
Jacob Post

### Ph.D. Manufacturing

Nancy Awasti, Manufacturing  
Dipakkumar Mehta, Manufacturing  
Neha, Manufacturing

### Ph.D. Production

Karla Rodriguez-Hernandez, Production  
Nirosh Senevirathne, Production

project to come to campus to conduct interviews for summer internships and permanent positions. In all, 13 companies visited the department and conducted 145 interviews and follow-up onsite interviews. Job offers for permanent positions and summer internships are being finalized.

Our **Dairy Research and Training Facility** has approximately 130 certified and registered milking cows. Of the 300 animals in total, roughly 50 are 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 Dairy Camp and cattle judging contests that are hosted at the farm. Aaron Beaner, Mallory Gliszinski and Emily Rogers serve as student managers. This year, Peter Linke, manager, and Melissa Schmitt, assistant manager, undertook extensive facilities upgrades to address cow comfort. Dani Tews serves the DRTF as ag foreman and parlor manager. DRTF staff and students showed our Holstein and Brown Swiss at the State Fair, earning high placings. Faculty members and graduate students routinely use the facility to conduct research projects that involve calves, heifers and lactating cows.



Cattle from the DRTF received high placings at the South Dakota State Fair. From left to right: Emily Rogers, Chelsea Smith, Laura Frye and Peter Linke.

## DISTINGUISHED ALUMNUS



**Larry Tidemann** was recognized as one of six South Dakota State University 2018 Distinguished Alumni. He received his bachelor's and master's degrees in dairy science after which he served SDSU Extension for 32 years. Tidemann started as a county agent and rose to director until his retirement in 2004. Following retirement, he served in the South Dakota Legislature, first as representative and then as senator from 2011 to 2018. Throughout his distinguished career, he has been a strong advocate of SDSU and the department.

## WHERE ARE THEY NOW?

**Troy Gascoigne**, B.S.'92, Dairy Manufacturing. Vice President Operations, Prairie Farms, Rochester, Minn.

**Katie Halgerson**, B.S.'10, Dairy Manufacturing. Supervisor, Mini Baby Bel Development Account Manager, Bel Brands USA, Brookings

**Lyle Kruse**, B.S.'78, Dairy Production. Vice President U.S. Market Development, Select Sires, Plain City, Ohio

**Chadwick Larsen**, B.S.'96, Dairy Manufacturing. Director of FM Sales – Central Region. Barry Callebaut, Chicago, Ill.

**Shannon Seifert**, B.S.'04, Dairy Production. Farm Relations Manager, Midwest Dairy, Sleepy Eye, Minn.

**Brent Van Middendorp**, B.S.'15, Dairy Production and Dairy Manufacturing. Territory Sales Representative, Alltech, Brookings

**Mike Wolkow**, B.S.'96, Dairy Manufacturing. Senior Vice President of Operations, AMPI, New Ulm, Minn.

**Jonathan Ydstie**, M.S.'97, Dairy Production. Dairy Technical Services Manager, Quality Liquid Feeds, Milbank

## 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 @ \$600), \$1,200  
 Associated Milk Producers, Inc., \$1,000  
 Bel Brands USA, \$3,000  
 Clyde G. Helsper Memorial, \$1,000  
 Dairy Club (5 @ \$500), \$2,500  
 Dairy Connection, \$1,000  
 Dairy Farmers of America, \$400  
 Dairy Fest (2 @ \$500), \$1,000  
 Dairy Manufacturing, \$2,860  
 Dairy Science, \$500  
 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  
 Derald, \$750  
 Emery Bartle Memorial, \$7,500  
 George Marx, \$1,100  
 Gibert T. & Olga Gilbertson Memorial, \$450  
 H. C. Olson, \$500  
 Harbath, \$2,000  
 Idaho Milk Processors Association (2@ \$2000), \$4,000  
 James Marvel Memorial, \$400  
 John Anderson Memorial (2@ \$3000), \$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, \$1,100  
 Land O'Lakes—Region 65, \$300  
 Leprino Foods, \$4,000  
 Midwest Dairy Association (2 @ \$3500), \$7,000  
 North Central Cheese Industries Association (2 @ \$1000, 2 @ \$2000), \$6,000  
 Ode Family, \$500  
 Pete Behrends Memorial, \$3,000  
 Ralph Rogers Memorial, \$400  
 Robert Chamberlin—Food Science, \$1,800  
 Rogers Dairy, \$1,000  
 Ross Baker, \$500  
 Royal D. Doner and Helen B. Doner Dairy Production, \$400  
 Ryan Graber Memorial, \$1,000  
 Saputo Cheese, \$2,000  
 Schuch Family, \$750  
 SD State Dairy Association (2 @ \$1500), \$3,000  
 Shirley Seas Memorial, \$450  
 Susan Hawkins, \$2,000  
 T. M. Olson, \$700  
 Todd and Erica Stahl, \$1,000  
 Valley Queen Cheese Factory \$7,500  
 Walt and Yvonne Wosje, \$1,000

**AWARDS**  
 Alfred and Hilde Tobkin Memorial (4@ \$135), \$540  
 Arnold Hippen Dairy Challenge (4@ \$200), \$800

Dairy Judging Production, \$150  
 Dairy Judging Manufacturing, \$150  
 Forbes Leadership, \$300  
 LeRoy Graber-Ford, \$300  
 Howard Voelker Memorial (5 @ \$450), \$2,250  
 Non-Dairy Sci. Student Dairy Club (3 @ \$500), \$1,500

### INCOMING DAIRY STUDENTS

Clyde G. Helsper, Dairy Fieldmen's Assoc., \$1,000  
 Dairy Science Faculty, \$1,300  
 Dairy Science Scholarships (10 @ \$1000), \$10,000  
 Howard Voelker Freshman Dairy Production, \$1,000  
 Midwest Dairy Association (3 @ \$1000), \$3,000  
 S.D. Dairy Fieldmens Association (5 @ \$1000), \$5,000  
 S.D. State Dairy Association (1 @ \$1500, 1 @ \$1250, 2 @ \$2000), \$4,750  
 Valley Queen Cheese Factory Freshman, \$1,000  
 William and Marge Kallemeyn and Sons, \$1,200

### INCOMING STUDENT SCHOLARSHIPS

Campanile- Valedictorian (2 @ \$2000), \$4,000  
 Jackrabbit Achievement (3 @ \$2000, 10 @ \$1000), \$16,000  
 Jackrabbit Now (5 @ \$1000), \$5,000  
 Yellow and Blue (8 @ \$1000, 3 @ \$2000, 4 @ \$3000), \$26,000

### GRADUATE STUDENT SCHOLARSHIPS

Dairy Recognition and Education Foundation (1 @ \$2000, 2 @ \$1800, 2 @ \$1500), \$8,600  
 Delbert and Robert Breazeale Memorial, \$2,000  
 Dr. Vikram Mistry Endowment, \$2,000

## DAIRY AND FOOD SCIENCE STUDENTS

### GRADUATE STUDENTS

*Production, Master of Science*  
 Nathaly Carpinelli, Brazil\*  
 Michaela Della, Hartville, Ohio  
 Leyby Guifarro Rodriguez, Honduras\*  
 Lydia Olagunju, Nigeria  
 Chelsea Schossow, Houston, Minn.  
 Lauren Shearer, Brookings

### *Production, Ph.D.*

Carl Kass, Bruce  
 Rhea Lawrence, Aurora  
 Roshin Mohan, India\*  
 Niros Senevirathne, Sri Lanka  
 Fernanda Trindade Rosa, Brazil

### *Manufacturing, Master of Science*

Lee Alexander, Twin Brooks  
 Khalid Alsalem, Saudi Arabia  
 Pratibha Chaudhary, India  
 Ahmed Hammam, Australia  
 Megan Huegli, Hartford, WI  
 Collette Nyuydze, Cameroon\*  
 Natasha Scherber, Canton  
 Jae Young Sim, South Korea

### *Manufacturing, Ph.D.*

Nancy Awasti, India  
 Steven Beckman, Lincoln, Neb.  
 Maryam Enteshari, Iran  
 Shayanti Minj, India  
 Achyut Mishra, Nepal  
 Neha, India  
 Venkateswarlu Sunkesula, India  
 Kaavya Rathnakumar, India  
 Prathistha Verma, India  
 Hiral Vora, India

### *Food Science, Master of Science*

Patra Akaya, Nigeria  
 Muath Alessa, Saudi Arabia\*  
 Brady Bury, Webster  
 Tanvee Deshpande, India

Most Farzana Yesmin, Bangladesh  
 Kara Konst, Chandler, Ariz.  
 Beatrice Manu, Ghana  
 Bipin Rajpurohit, India  
 Aliza Sigdel, Nepal  
 Cecilia Wanjuu, Kenya\*

### *Food Science, Ph.D.*

Mohamed Elfaruk, Libya

### UNDERGRADUATE STUDENTS

#### *Manufacturing*

Hannah Berg, Pipestone, Minn.\*  
 Joshua Blase, Twin Lakes, Wis.  
 Jared Bowers, Hayti  
 Emma Brennan, Pewaukee, Wis.\*  
 John Butz, Cedar Rapids, Iowa\*  
 Ryan Christie, Sioux Falls  
 Jennifer Domanski, Grand Rapids, Mich.  
 Daniel Domenichini, Tampa, Fla.  
 Joseph Donnay, Kimball, Minn.\*  
 Erika Franzen-Ackerman, Fredericksburg, Iowa  
 Parker Grieme, Valley Springs  
 Cole Halvorson, New Ulm, Minn.  
 Jacob Jewett, Glencoe, Minn.  
 Ethan Johnson, Heron Lake, Minn.\*  
 Alysha Madsen, Corona  
 Lydia Meredith, Cokato, Minn.  
 Sophia Linnemann, Beatrice, Neb.\*  
 Brennen O'Reilly, Wayne, Neb.\*  
 John Oakley, Dakota Dunes\*  
 Sydney Peters, Winner\*  
 Thijs Reuvekamp, Elkton  
 Rebecca Roberson, Akron, Iowa  
 Sarah Roszbach, Hanska, Minn.  
 Daniel Sharp, Bath  
 Han Si, Tanggu, China  
 Zachary Sousa, Millbank  
 Kyle Swanson, Pukawana\*  
 Whitney Ten Napel, Ireton, Iowa\*

Mitchell Timp, Le Mars, Iowa  
 Sijin Wang, Binhaixinqu Tianjin, China  
 Jordan Zemlicka, Watertown

#### *Production*

Kayla Biel, Harmony, Minn.\*  
 Colten Carlson, Willmar, Minn.  
 Theodore Czech, Watertown  
 Isabel Davidson, Eagan, Minn.\*  
 Brooke Engstrom, Renville, Minn.  
 Carter Espinoza, Kasson, Minn.\*  
 Ryan Franz, Bingham Lake, Minn.\*  
 Taylor Gilmore, Dillsburg, Pa.  
 Katie Hendrickson, Estelline  
 Bailey Henschen, Correctionville, Iowa\*  
 Meghan Hettinga, Orange City, Iowa\*  
 Chase Hinsch, Goodhue, Minn.\*  
 Rebecka Hoffman, Dolton\*  
 Abigail Hopp, Chatfield, Minn.  
 Taylor Jerde, Northfield, Minn.\*  
 Morgan Kohl, Watertown\*  
 Elizabeth Krienke, Lester Prairie, Minn.\*  
 Chloe Lien, Spicer, Minn.\*  
 Calissa Lubben, Edgerton, Minn.  
 Johannah Nielsen, Russell, Minn.\*  
 Bo Noble, Faribault, Minn.\*  
 Madison Okerstrom, Shafer, Minn.  
 Lukas Pierson, Butterfield, Minn.\*  
 Kaleigh Powell, Liberty, Ill.  
 Alexandra Preszler, Roscoe  
 Julius Sachs, Eyota, Minn.  
 Courtney Schams, Dakota, Minn.\*  
 Chelsea Smith, Brookings  
 Margaret Socha, Rogers, Minn.  
 Kate Spadgenske, Menahga, Minn.\*  
 Kyle Tews, Hutchinson, Minn.  
 Jennifer Thill, Forest Lake, Minn.  
 Tiffany Van Buren, Waupun, Wis.\*  
 Jenna Van Wyk, Remsen, Iowa  
 Taelyn Virus, Hebron, Neb.  
 Maisie Walter, Montrose, Minn.

Sarah Weststeyn, Linden, Calif.\*  
 Andrew Wilwerding, Freeport, Minn.  
 Andrew Wolter, Perry, Iowa

#### *Production and Manufacturing*

Christina Boogerd, Hull, Iowa\*  
 Carla Bromenschenkel, Brownton, Minn.  
 Sanne de Bruijn, Pollock  
 Anna Donnay, Kimball, Minn.  
 Laura Frye, Logansport, Ind.  
 Theodore Jacoby, Ballwin, Mo.  
 Danielle Jax, Waltham, Minn.  
 Shelby Kuechle, Eden Valley, Minn.\*  
 Ashley Maus, Freeport, Minn.  
 Claire Plapp, Malta, Ill.\*  
 Kayla Post, Chandler, Minn.  
 Elizabeth Schwartzhoff, Lansing, Iowa  
 Denver Stage, Vesta, Minn.

#### *Food Science*

Maggie Becher, Somerset, Wis.  
 Max Camerer, Sergeant Bluff, Iowa\*  
 Jessica Christoffer, Round Lake, Minn.\*  
 Tanner Davis, Fresno, Calif.  
 Dana Edleman, Cambridge, Iowa\*  
 Elise Emmick, Carlisle, Iowa\*  
 Rachel Hopfner, New Hope, Minn.  
 Callie Koehl, Morris, Minn.\*  
 Allison Kolbe, Sac City, Iowa\*  
 Uday Mishra, Dwarka New Delhi, India  
 Claire Olson, Austin, Minn.\*  
 Somtochukwu Onyekwe, Chamberlain\*  
 Emily Resch, Spirit Lake, Iowa  
 Elizabeth Steever, Lennox\*  
 Karl Vallin, Eagan, Minn.  
 Maria Velazco Fasce, Barquisimeto, Venezuela

#### *Manufacturing and Food Science*

Mohit Manoj Kotkar,  
 Nimala Convent, India

\*New students in 2018-2019



## OUTREACH

### Area Dairy Expos



Alumni, students, staff and faculty of the department participated in the Central Plains Dairy Expo in Sioux Falls, World Ag Expo in Tulare, Calif., 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 Association Farm Fest. At the World Dairy Expo in 2018 the department hosted a reception for alumni.

### North Central Cheese Industries Association



Lloyd Metzger serves as executive secretary and Vikram Mistry as adviser to the NCCIA. The annual meeting was held in Sioux Falls in October. Over 130 cheese makers and suppliers from the upper Midwest attended. Alumnus Kirk Baldwin completed his term as president. A large number of alumni in the dairy industry typically attend the NCCIA.

### Jackrabbit Dairy Drive

Tom Peterson, 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 and promote the dairy industry.

## EXTENSION

### Dairy Fest

The fifth Annual Dairy Fest was held in June. Featured topics included: Increasing public awareness about careers in the dairy industry, the sustainability of the dairy industry, the economic impact of the dairy industry and dairy nutritional product information. Attendance was estimated at: Got Milk Gala—200 + attendees; Dairy Leadership Training—25 participants; Picowasa Dairy Art Painting Contest—19 participants, 3 volunteers; Fork to Farm—95 youth and 12 volunteers; Dairy Fest Carnival—more than 1,500 people and more than 60 volunteers. This included 25 youth and 10 adults of Latino heritage who were a part of the Semillas program and originated from dairies in the I-29 Corridor. SDSU Davis Dairy Plant Tours—more than 225 people with 6 volunteers. Old Tree Dairy Farm Tour—over 800 people with 25 volunteers. Sue McCloskey was the featured speaker at the Got Milk Gala and Leadership Training event.

### I-29 Moo University

In its 13th year, the I-29 Moo University collaboration has established a widespread learning community. This is a cooperative effort of South Dakota, Minnesota, Iowa, North Dakota, and Nebraska University Extension person-

nel along with producer associations in the five states. The objective of the various educational venues offered is to bring highly relevant and impactful research-based information to the dairy industry. Offerings included farm tours, a Dairy Beef Short Course, a Winter Workshop Series and a monthly e-Newsletter for producers and the industry.

### Spanish Workshop



For the third consecutive year, a Spanish workshop targeting the I-29 dairy workforce was offered at Central Plains Dairy Expo.

This year “Udder Dissection: Are we performing the milking procedures correctly? Let’s see what the gland says” provided 80 participants the opportunity to dissect two lactating udders and one beef cow udder for comparison. In addition, several on-site trainings including a milking school, maternity care and cattle handling to dairy producers in South Dakota, Iowa and Minnesota were also provided. The Dairy Extension team continues to provide assistance in interpretation during farm meetings and written farm protocols to the dairy workforce.

### Meat and Dairy Goat Workshop

South Dakota’s first Meat and Dairy Goat Workshop was held July 14, 2018, at SDSU in Alfred Dairy Science Hall. Eighty-three beginner and experienced goat producers from South Dakota, North Dakota, Minnesota, Nebraska and Iowa attended. The event featured industry expert presentations and hands-on training. This event was a joint collaboration effort between Value Added Agriculture Development Center (VAADC), South Dakota Specialty Producers Association (SDSPA) and South Dakota State University (SDSU) Dairy Extension.

## K-12 STUDENTS

### Dairy Camp



The Dairy Club hosted the 15th annual Dairy Camp in June for youth ages 8-18. Activities included training on care of heifers, judging, exploring the reproductive tract and digestive system, visit to the SDSU Davis 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.

### It’s All About Science

Srinivas Janaswamy demonstrated preparation of biobeads using polysaccharides to over 60 elementary, middle and high school students and general public. In addition, he presented at the S.D. Discovery Center to a similar set of students along with his graduate students Aliza Sigdel and Mohamed Elfaruk.

For more information visit [www.sdstate.edu/ds](http://www.sdstate.edu/ds)





CHANGE SERVICE REQUESTED

## RESEARCH HIGHLIGHTS

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

**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. Objective 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. Objective 2) Develop a lab-scale crystallization system and analysis protocols for evaluation of modified manufacturing processes that improve the efficiency of lactose and permeate manufacture. Objective 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. Goal 1: Improve microbial quality and shelf life of milk and dairy products. Objective 1.1: Understand sporulation behavior of common spore formers during milk powder manufacture. Objective 1.2: Apply nonthermal technologies, such as cavitation, to control common dairy spore formers. Goal 2: Improve microbial safety of dairy processes. Objective 2.1: Control dairy pathogens such as *Listeria* by risk analysis, through response surface models. Goal 3: Develop novel dairy products containing probiotics. Objective 3.1: Develop a spray-dried health formulation based on whey protein hydrolysate and probiotics encapsulation.

**Utilization 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 growth and development by improving feeding strategies, management systems, well-being, new technologies and environmental impacts for productivity and profitability. Optimize dairy cow performance and well-being by improving nutrition, forage utilization, technology and management. Evaluate whole farm system components and integrate information and technology to improve efficiency, profitability, environmental sustainability and social responsibility.

**Evaluation of Alternative Feed Ingredients and Developing Supplements on Growth Performance, Nutrient Utilization and Metabolism of Replacement Dairy Calves and Heifers** Dr. Jill Anderson. Determine how alternative feed ingredients and novel feed additives impact calf and heifer growth, nutrient digestion, metabolism and development. Objective 1: Determine the effects of novel fat supplements in diets for calves and heifers. Objective 2: Determine how alternative protein sources that are by-products or co-products of the biofuel industry or food industry work in diets for calves and heifers. Objective 3: Determine how complex carbohydrates and simple carbohydrates that are by-products of the food industry perform as feed supplements for calves and heifers.

**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.

**Carbohydrate Based Carriers of Bioactive Compounds** Dr. Srinivas Janaswamy. The overall objective of this project is the design and development of novel carbohydrate-based delivery systems for bioactive compounds (BCs) in food, pharmaceutical and medicinal applications. This project will evaluate the optimal conditions for entrapment and release of BCs in carbohydrate networks (oriented fibers, starches and porous starch granules) and establish the stability and bioavailability of entrapped BCs. Objective 1: Explore the effectiveness of various carbohydrate-based carriers in encapsulating BCs, and Objective 2: Assess the stability and bioavailability of encapsulated BCs.