AUTM Partnering Forum

Food Safety and Food Ingredient Partnering Forum

Technologies represented: Updated on 7/3/18

Food Ingredients Related					
Patent/IP Status	**Tech ID**	**Technology Title**	**Organization**	**Organization Contact**	**Comments**
Nutraceutical-Related					
PCT file; PCT/US17/40898	7416	Stable Pro-vitamin Derivatives of Tetrahydrofolate for the Treatment of Folate Deficiencies	Center for Technology Licensing at Cornell University	Jeff Fearn	Patrick Stover
U.S. patent No 8,192,734	4170	Microbial Phytase-based Supplement for Bone Reinforcement	Center for Technology Licensing at Cornell University	Phillip Owh	Xingen Lei
US Application filed, 15/307,418	6696	Microalgal Biomass to Treat Iron Deficient Anemia	Center for Technology Licensing at Cornell University	Phillip Owh	Xingen Lei
US Application filed, 15/326,837	6770	Microalgae for Fish-Oil Enriched Chicken Meat	Center for Technology Licensing at Cornell University	Phillip Owh	Xingen Lei
International Patent Protection (#14/714,457) filed in the USA	KSURF # 12-25	StarchSpherulites with Controlled Enzyme Digestability	Kansas State University	Ken Williams	
U.S. Patent No. 9,458,252	KSURF # 08-36	Starch Esters and the Method of Preparation	Kansas State University	Ken Williams	
U.S. patent application serial No. 62/561,745		Probiotic treatment of gut inflammation	Iowa State University Research Foundation	Dario Valenzuela	ISURF Case 4644
U.S. patent application serial No. 62/519,937		Neurotransmitter transport in probiotic	Iowa State University Research Foundation	Dario Valenzuela	ISURF Case 4568

U.S. patent 7,854,946		Non-Steroidal Anti-Inflammatory Plant Compounds for Nutraceutical or Pharmaceutical	Iowa State University Research Foundation	Dario Valenzuela	ISURF Case 3460
Taste/Texture/Aroma -Related					
Issued U.S. Patent # 9,188,568; No foreign patent rights		Method/Apparatus for Analysis and Characterization of Aromas	University of California, Davis	Robin L. Stears	UC Davis Case # 2012-462
Calorie-Related					
US Application filed, 15/768,554	6649	An Economical and Chemical-free Method to Reduce Bitterness & Off-Flavors of Stevia	Center for Technology Licensing at Cornell University	Jeff Fearn	Syed Rizvi
U.S. Patent Application #15/322,541	KSURF # 2014-011	Gelatin Based, Low-Calorie Gummy Dog Treats	Kansas State University	Bret Ford	
Preservation-Related					
US 9017692	T2012-002	Paenibacterin: A Broad Spectrum Antimicrobial	Ohio State University	Ann Marie Flammag	Antimicrobial
Patent pending PCT/US2018/033473		An effective treatment to prevent freeze induced egg yolk gelation	Iowa State University Research Foundation	Mark Juetten	ISURF case 4724
Other					
Provisonal filed	T2017-385	Formation of pyranoanthocyanins, a more stable natural colorant derived from fruit and vegetable pigments, with enhanced resistance to bleaching for food applications	Ohio State University	Ann Marie Flammag	Natural Color Enhancement
PCT - Pub. #: WO 2017/205173	T2016-253	Black Goji Anthocyanins for Natural Blue Colorant	Ohio State University	Ann Marie Flammag	Natural Color
PCT Filed		Natural, Food Coloring Additives that Can Create Customized Colors	University of California, Davis	Eugene Sisman	UC Davis Case # 2016-661
US Application filed, 14/657,560	6422	Healthful Food Made from Liquid Whey and Fruit Pomace Byproducts	Center for Technology Licensing at Cornell University	Jeff Fearn	Syed Rizvi
US Provisional Application filed	7935	Enzymatically-triggered Microsomes for Controlled Release of Agents in Cheese (or other food mixtures)	Center for Technology Licensing at Cornell University	Jeff Fearn	Ali Abbaspourrad

US Provisional Application filed	7988	Methods to Enhance & Thermally Stabilize Red Color of Beet Extracts	Center for Technology Licensing at Cornell University	Jeff Fearn	Ali Abbaspourrad
US Patent issued, 8,354,259	3906	Lactase-Bound Polystyrene Microspheres	Center for Technology Licensing at Cornell University	Jeff Fearn	Joseph Hotchkiss
U.S. Provisional Patent filed July 9, 2018.		D-1432, Sorghum Lines with high 3-deoxyanthocyanidin metabolites expressed in the roots for use as a food colorant.	Texas Tech University Plant and Soil Science	David P. McClure	Available for Licensing or Research Collaroration
U.S. Utility 14/355,890 pending filed 05/02/2014. EU application 12845470.9 pending filed 06/02/2014.		D-0760, Supplement to Enhance Growth Rate of Bacilus and Yeast for Probiotics and Industrial Applications	Texas Tech University Plant and Soil Science	David P. McClure	Licensed to Lytegro Ltd who is looking to sublicense to U.S. partners
U.S. patent 7,910,308		"Healthy Beef": Fatty Acid Synthase Genetic Markers Associated with a Healthier Fatty Acid Composition	Iowa State University Research Foundation	Dario Valenzuela	ISURF case 3499
Food Safety-Related					
IP Status	**Tech ID**	**Technology Title**	**Organization**	**Organization Contact**	**Comments**
Harvesting-Related					
U.S. Provisional application 62,594,808 was filed 12/05/2017.		D-1381, Reduction of Pathogens in food products ultilizing a multiple inhibitionsystem with Lactic Acid Bacteria	Texas Tech University Plant and Soil Science	David P. McClure	Available for Licensing.
U.S. Utility application 14,585,850 was filed 12/30/2014.		D-0932, Use of Lactic Acid and other Probiotic Bacteria to Reduce Pathogens in Lymph Nodes of Livestock Animals	Texas Tech University Plant and Soil Science	David P. McClure	Available for Licensing.
Processing-Related					
U.S. Patent Application has been published - # 20160088853; No foreign patent rights		Disinfectant Process for Fresh Produce	University of California, Davis	Eugene Sisman	UC Davis Case # 2013-547

U.S. Patents # 7,975,427; 8,726,564; 8,733,015; No foreign patent rights		Rapid Disinfection/Disinfestation of Food/Perishables/Commodities	University of California, Davis	Raj Gururajan	UC Davis Case # 2002-160
Provisional Patent Application Filed		Food Sanitation Method Using Anti-Microbial Particles	University of California, Davis	Eugene Sisman	UC Davis Case # 2017-874
U.S. Utility Patent 8,956,673 issued 02/17/2015. Applications also issued in Candada, Japan, Mexico and Australia.		D-0504, Method and System for Preserving Food through Low Temperature Microwave Radiation	Texas Tech University Plant and Soil Science	David P. McClure	Licensed to MicroZap Inc. who is looking to sublicense to U.S. partners.
Distribution-Related					
Sensor/Detection-Related					
Provisonal filed	T2017-325	Unmanned Aerial System Stinger-Suspended Crop Health Sensing	Ohio State University	Ann Marie Flammag	
No patents	T2017-157	Remote Sensing Image Processing Algorithm for Assessing Plant Population at Emergence	Ohio State University	Ann Marie Flammag	
No patents	T2015-244	Computer-Assisted Photographic Image Analysis System to Analyze Wheat	Ohio State University	Ann Marie Flammag	
U.S. Patent Application has been published - # 20160003753; No foreign patent rights		Non-invasive Method for Detecting Food Spoilage	University of California, Davis	Barbara A. Boczar	UC Davis Case # 2012-383
U.S. Patent Applcation has been published - # 20170268031; No foreign patent rights		Method/Device for Bacteriophage Detection	University of California, Davis	Eugene Sisman	UC Davis Case # 2014-571
U.S. Patent Applcation filed; No foreign patent rights		Non-Destructive Detection of Concealed Damage in Raw Nuts	University of California, David	Robin L. Stears	UC Davis Case # 2017-082

U.S. Patent Application #15/543,712	KSURF # 2015-001	Digital PCR Rapid Detection of Virulent E. coli in Meat Products	Kansas State University	Bret Ford	
International Patent Protection (#15/329,395) filed in USA	KSURF # 2014-017	Detection of Proteases and Lipases from Psychrotropic Bacteria in Milk and Milk Products	Kansas State University	Caronda Moore	
U.S. Utility 15/563,838 pending filed 10/02/2017		D-1113, Biomarkers to Indentify Specific Sertypes of Salmonella in Real Time	Texas Tech University Plant and Soil Science	David P. McClure	Available for Licensing
U.S. Utility Patent 9,995,735 B2 issued June 12, 2018		D-1121, Method to Infect Ground Meat with Salmonella	Texas Tech University Plant and Soil Science	David P. McClure	Available for Licensing
Packaging-Related					
WO 2017/155890	T2016-058	Novel Antimicrobials to Control Campylobacter	Ohio State University	Ann Marie Flammag	These compounds can be added to packaging material or administered orally to animals
PCT Application Filed, PCT/US2018/038913	7903	UV-curing Coating of Active Compounds onto Plastic Surface for Industrial Scale Production	Center for Technology Licensing at Cornell University	Jeff Fearn	Julie Goddard
Other					
US 9,402,891	T2011-065	A Novel Vectored Vaccine Against Human Norovirus	Ohio State University	Ann Marie Flammag	
Provisional filed	T2018-157	Control of Salmonella in poultry using new generation small molecule growth inhibitors.	Ohio State University	Ann Marie Flammag	
Provisional in process	T2018-175	Small molecule modulators of Avian Pathogenic E. coli (APEC) virulence as a means to control avian collibacillosis	Ohio State University	Ann Marie Flammag	
Provisional in process	T2018-162	Small molecule growth inhibitors of avian pathogenic E. coli (APEC) as a means to control APEC infections in poultry	Ohio State University	Ann Marie Flammag	
Provisional filed	T2017-396	Composition and oral delivery of nanoparticle based Salmonella vaccine for poultry	Ohio State University	Ann Marie Flammag	

US 8,961,915 US 9,364,787 US 9,808,758	T2014-036	Spray Acid Wet Scrubbers to Recover Ammonia Emission from Poultry Houses and Manure Composting Facilities to produce Nitrogen Fertilizer	Ohio State University	Ann Marie Flammag	
Food Related Projects and Research					
		SDSU Dairy and Food Science Department Summary (see following pages)	South Dakota State University	William Aylor	

Dairy and Food Science Department
South Dakota State University

https://www.sdstate.edu/ds

Areas of Expertise: Dairy Production, Dairy Manufacturing, Food Science, Food Safety

Faculty Members

- Dr. Sanjeev Anand, Professor – Dairy Manufacturing, Microbiology, Food Safety
- Dr. Jill Anderson, Associate Professor – Dairy Production, Cattle and Heifer Nutrition
- Howard Bonnemann, Lecturer – Dairy Manufacturing
- Dr. Srinivas Janaswamy, Assistant Professor – Food Science, Food Chemistry, Carbohydrates
- Dr. Padmanaban Krishnan, Professor – Food Science, Food Processing, Chemistry
- Dr. Sergio Martinez-Monteagudo, Assistant Professor – Dairy Manufacturing, Unit Operations, Dairy Engineering
- Dr. Lloyd Metzger, Professor – Dairy Manufacturing, Dairy Ingredients, Dairy Chemistry
- Dr. Johan Osorio, Assistant Professor – Dairy Production, Cattle Nutrition, Nutrigenomics
- Dr. Maristela Rovai, Assistant Professor, Extension Specialist, Lactation
- Dr. C. Y. Wang, Professor, Food Science, Food Chemistry

Additional Personnel

- Curtis Braun, Extension Food Safety Field Specialist
- Tracey Erickson, Extension Dairy Field Specialist
- John Haberkorn, Manager, Davis Dairy Plant
- Peter Linke, Manager, Dairy Research and Training Facility

Facilities

Dairy Research and Training Facility: 130 milking Holsteins and Brown Swiss dairy cattle. Set up for research in dairy calf, heifer and cattle nutrition and management research and teaching.

Davis Dairy Plant: On-campus state-of-the art dairy processing facility set up for production, research and teaching and equipped with heat exchangers, pasteurizer, centrifugal separator, homogenizer, ice cream freezers, membrane separations, evaporater, spray dryer, cavitator, process cheese cooker, research space.

Laboratories: Newly renovated labs with HPLC, Nitrogen determination, electrophoresis, freeze dryers, rheometer, microscopy and numerous other equipment pertinent to dairy and food research.

Current Areas of Research

Process interventions for enhancing microbial quality, safety, and nutrition of dairy foods. Dr. Sanjeev K. Anand

Evaluation of different dietary energy sources on growth performance and metabolism of replacement dairy heifers. Dr. Jill Anderson

Carbohydrate based carriers of bioactive compounds. Dr. Srinivas Janaswamy

Value enhancement of health, nutrition and economic traits of cereal grains. Dr. Padmanaban Krishnan

Engineering technologies for novel applications in dairy manufacturing. Drs. Sergio Martinez-Monteagudo and Sanjeev Anand.

Manufacture of dairy-based ingredients. Dr. Lloyd Metzger

Utilization of advanced molecular biology and sensor systems techniques to improve health and performance in dairy cattle. Dr. Johan Osorio and Jill Anderson

Davis Dairy Plant,
Institute for Dairy Ingredient Processing,
and the Alfred Laboratory for Dairy Foods Analysis
Dairy & Food Science Department

The Davis Dairy Plant, Institute for Dairy Ingredient Processing (IDIP), and the Alfred Laboratory provide dairy and food an efficient and valuable way to research, develop and test new ingredients and processes.

A. Products Previously Manufactured *(this list continues to grow & expand regularly)*

- Liquid milk and cream products
- Milk protein liquid concentrates & powder (MPC 42, 56, 70, 80)
- Whey protein liquid concentrates & powder (WPC 35, 55, 80)
- Traditional & Process cheese
- Cream & Ice Cream
- Lactose permeate
- Delactose whey
- Mineral or ash permeate
- Serum protein fractionation
- Whey protein hydrolysates
- Micellar casein concentrate
- Buttermilk ingredients
- Non-dairy Products, such as Pea Protein, Rice Protein, Egg protein etc.

B. Unit operations, Processes, and Raw Materials Available

- Many of the unit operations and processes are connected to a modern Human Machine Interface (HMI) and PLC center, which allows for control and measurement of various process parameters.

1. Membrane Filtration [Microfiltration (MF), Ultrafiltration (UF), Nanofiltration (NF), and Reverse Osmosis (RO)]

All the filtration units provide commercially scalable data and opportunities for dairy & protein beverage manufacturers in a batch or continuous mode operation. The units, particularly a four-stage MF/UF and high-pressure NF / RO, are highly sophisticated in automation and control similar to a large-scale commercial system.

2. Novel Processing Technologies

Including an ultrasonic processor, and a hydrodynamic cavitator for viscosity manipulation, and microbiological reduction in liquids. Papers have been published by SDSU faculty & research students showing reduced microbiological counts in milk from the application of cavitator technology.

3. Evaporator and Dryers

Two spray dryers, including a pilot-scale NIRO dryer, and a two-stage production scale dryer with a primary drying chamber, timing belt and fluid bed dryer. Multiple pass falling film evaporator with a high concentration finisher and single stage flash cooler.

5. Separation and Homogenization

Two paring-disc centrifugal separators for heavy and light phase separation; and two high-pressure (3,500 psi) homogenizers for particle size homogenization purposes

6. Cheesemaking Equipment

Four standard cheese vats (2 x 500 lb; 1 x 1,000 lb; 1 x 2,500 lb), with the largest being a modern "horizontal" cheese vat. Hoops for 20 lb blocks of cheese, along with an A-frame press. Vacuum-sealer and a temperature-controlled aging room. A 20 lb batch process cheese cooker with direct culinary steam injection.

7. HTST Pasteurizers

High temperature short time (HTST) pasteurizers allow for heating liquids to high temperatures for few seconds to pasteurize or otherwise kill pathogenic bacteria. One HTST can be configured to customer specific temperature and hold times.

8. Ice Cream Manufacturing Equipment

A Breddo likwifier for mixing powders into liquids. An ice cream mix storage tank. Flavor-addition tank, and inline (200 L/hour) continuous ice cream freezer. Variegate and inclusion equipment. Three-gallon, ½-gallon, and 8 oz cup ice cream fillers. Two large freezer rooms for hardening ice cream.

9. Raw Materials & General Equipment

Raw whole milk, cream (raw or pasteurized), and skim (raw or pasteurized) is sourced from the SDSU Dairy Farm. Other dairy-based products (permeate, WPC80 concentrate, cheese brine, and others) can be sourced to the Dairy Plant.

Many general equipment are available including various sized tanks (20 to 6,000 gal capacity, with glycol cooling, and agitation), butter churn, liquid bag-in-box filler, milk cans, carts, and ancillary wares

10. Microbiological Determination

Through an associated microbiological laboratory, the total plate count, and coliform counts can be conducted on products.

C. Alfred Laboratory Methods & Analysis

Located on the 3th floor of Alfred Dairy Science Hall at SDSU is an advanced & state of the art research lab facility.

The product characterization & analysis is focused on components below:

- Total Solids
- Ash
- Total protein
- Non-protein nitrogen
- Fat or cream (Mojonnier method)
- Protein profiles
- Organic acids & sugars
- Lactose

The instrumental analytical capabilities are:

i. Kjeldahl Protein analyzer

Used for measuring total protein of dairy ingredient products and helpful for analyzing true protein and non-protein nitrogen

ii. Rheometer for rheological properties

Measuring flow behavior & characteristics of viscoelastic materials

iii. High Pressure Liquid Chromatography (HPLC)

Qualitative and quantitative measurement of organic acids and sugars present in dairy products

iv. Capillary Electrophoresis for protein profiling

Qualitative analysis and identification of different protein fractions in dairy

v. Rapid Viscoanalyzer

Manufacturing process cheese using dairy ingredients on bench scale equipment. Measuring functional property such as viscosity

vi. Texture profile analyzer

Determination of textural and functional properties for cheese & process cheese

vii. Muffle furnace for ash & minerals

Determination of ash or minerals by incineration at 550 deg C

Lab of Sanjeev Anand
Professor, Dairy Manufacturing (Food Safety Specialization)
Dairy and Food Science Department

Areas of current research (Ongoing projects)

1. Biofilm development and control in dairy processing plants

    - Dairy separation membranes and stainless steel contact surfaces
    - Surface modifications of SS and pilot scale studies
    - New generation cleaners based on enzymes and quorum disruptors
    - Constitutive microflora of membrane biofilms and their control

2. Controlling sporeformers and endospores in dairy processing environments

    - Understanding sporulation and spore germination
    - Regression modelling and response surface approach for population kinetics
    - Controlling sporeformers and endospores in dairy processing using alternative techniques such as hydrodynamic cavitation
    - Developing inline processes for control of thermoduric sporefomers

3. Understanding and controlling Listeria risk in dairy processing environments and dairy products

    - Understanding risk from injured cells during processing of ice cream
    - Developing risk assessment models based on logistic regression and cluster plots
    - Understanding behavior of Listeria in dairy processing environment with emphasis to 'resident Listeria', persistence studies through whole genome sequencing and colonization potential

4. Developing dairy based dietary health formulations

    - Developing encapsulation technique for trapping probiotics in protein hydrolysates
    - Developing health and dietary formulations with enhanced bioactivity

All our research projects are conducted with active industrial collaborations. Some of the current and recent one include Valley Queen, Fairlife, Ecolab, Wells Enterprises Inc., Schreiber, Agropur etc., and utilizing the SDSU Davis Dairy Plant infrastructure for pilot scale trials.

Dr. Srinivas Janaswamy
Assistant Professor, Food Chemistry
Biopolymer Structure & Functionality Laboratory
Department of Dairy and Food Science

- General Research Areas: Carbohydrate Chemistry; Carbohydrates and Health; Starch; Polysaccharides; Controlled release
- Specific Research Areas: Carbohydrate-based delivery systems of bioactive compounds; Starch digestion and bioavailability of nutrients; Water purification and treatment; Packaging materials from agriculture residues

Current Research Projects

1. Carbohydrate-based carriers of bioactive compounds
    - Exploring the effectiveness of polysaccharide matrices, starch matrices and porous starches to encapsulate, protect and deliver bioactive compounds
    - Assessing the stability and bioavailability of encapsulated compounds
2. Modulating starch digestion and postprandial hyperglycemia
    - Inhibiting enzymes activity to control postprandial glycemia through bioactive compounds towards managing diabetes, obesity and weight loss
3. Sweetpotato bread
    - Substituting wheat flour with orange flushed sweetpotato puree and developing breads that are rich in beta-carotene to address Vitamin A deficiency
    - Understanding the effect of beta-carotene and other anthocyanins on the starch digestibility and bioavailability of the nutrients upon digestion and uptake by caco-2 cells
4. Carbohydrate-micronutrients interactions toward developing functional foods
    - Studying interactions between starches and micronutrients, and developing edible films
5. Developing low-cost technologies to improve water quality and sustainable agricultural practices
    - Developing an economical and sustainable solution to treat water contamination and recycle the excess runoff nutrients as crop fertilizers
6. Biobased products from agriculture residues

- Extracting cellulose from renewable agricultural residues - corn stover, corn bran, wheat bran, wheat straw and sorghum bran - to make strong and biodegradable packaging films

Dr. Padmanaban (Padu) Krishnan
Professor, Food Chemistry and Processing
Department of Dairy and Food Science

Areas of research:

1. Quality evaluation of food crops using approved reference methods of analysis.

    - Food quality analysis of wheat, oats and corn.
    - Quality analysis support for wheat and oat breeding programs.
    - Wheat rheology and baking technology capability (milling, baking, end-use quality testing).

2. New food ingredients and food product innovation

    - Value added co-products of ethanol industry – food grade DDG
    - Selenium-biofortified vital gluten ingredient to strengthen bread flour

3. Rapid analysis of cereal grains by Near Infrared Reflectance Spectroscopy

    - Beta glucan, protein, oils, fatty acids, amino acids, total dietary fiber content and functional traits in baking (absorption, baking potential, etc.).

4. Novel dough evaluation using Vacuum Dough Expansion Tests to assess varietal and environmental influence on dough quality.

5. New uses of protein-enriched and fiber-enriched fractions of corn for health-promoting foods.

6. New analytical methods for natural folates and B-vitamins.

7. Development of food ingredients with glycemic response reduction in humans.

8. Production of shelf-stable grain-based foods for emergency feeding programs.

9. High temperature food processing for enhanced flavor of baked foods.

10. New food product development using high-value oat cultivars (oat beverage, high-protein oat bars, etc.).

Dr. Sergio Martinez-Monteagudo
Assistant Professor, Dairy Manufacturing
Dairy and Food Science Department

My research focus has been in engineering technologies for novel applications in dairy manufacturing, all with an eye towards industrial applications. Research activities includes:

1. Value-added opportunities for lactose utilization.
2. Converting Ice-cream wastewater into value-added chemicals.
3. Formulation and Manufacture of Reduced Sugar Dietary Supplements.
4. Converting dairy byproduct into natural low-calorie sweetening syrup.
5. Scale up of hydrodynamic cavitation technology for sporeformer control.
6. Improving milk powder functionality through emerging technologies.
7. Development of dairy ingredients.

South Dakota State University
Dairy and Food Science Department

Current Projects with Dairy and Food Science

A long history of Externally Funded Research

Currently Available Technologies
https://www.sdstate.edu/research/office-technology-transfer-commercialization/available-technologies

The Dairy and Food Science Department has been an active participant of the Midwest (formerly MN-SD) Dairy Foods Research Center since its inception in 1988. This Center has since been a major source of funding for Dairy Manufacturing research. Additional details about the South Dakota projects and others are available at the Midwest Dairy Foods Research Center website and at the National Dairy Council website.