



NATIONAL DAIRY FOODS RESEARCH CENTERS

RESEARCH AND APPLICATIONS RESOURCES



APPLICATIONS
LABS



FACILITIES AND
EQUIPMENT



TECHNICAL TRAINING
AND SHORT COURSES



TECHNICAL
ASSISTANCE

NATIONAL DAIRY FOODS RESEARCH CENTERS



National Dairy Foods Research Centers, supported by the National Dairy Council, help dairy companies bring innovative products that use dairy and dairy ingredients to consumers safely. Established in 1987, the network is made-up of six dairy centers encompassing over 16 universities across the United States. The mission of the Centers is to conduct research, educate professionals, transfer knowledge to industry and create dairy products and ingredients with improved health, safety, quality, and functionality.

Each Center has a comprehensive array of expertise and resources including dairy pilot plants to accomplish this mission. The Centers transfer knowledge to industry by developing future professionals, offering technical assistance, providing technical training and short courses. Applications labs within the dairy centers assist in concept creation, prototype development, trouble shooting, scale-up, sensory, and consumer evaluation.

Over the last 30 years, the dairy centers have contributed significantly to the steady growth of the dairy industry.



ABOUT THE NATIONAL DAIRY COUNCIL

For 100 years, National Dairy Council (NDC), the non-profit organization funded by the dairy checkoff program and managed by Dairy Management Inc. (DMI), is committed to research, education, and science-based communications. NDC works with and through industry, academic, government and commercial partners to drive pre-competitive, demand-building research in product, nutrition, and sustainability. The NDC program provides a comprehensive approach to dairy innovation and leverages the expertise of National Dairy Foods Research Centers, major universities, government agencies, as well as other leading scientific organizations and trade associations.



ABOUT DAIRY MANAGEMENT INC.

Dairy Management Inc.™ (DMI) is funded by America's nearly 43,000 dairy farmers, as well as dairy importers. Created to help increase sales and demand for dairy products, DMI and its related organizations work to increase demand for dairy through research, education and innovation, and to build trust in dairy foods, farms and businesses.

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CALIFORNIA DAIRY FOODS RESEARCH CENTER



**Dairy Innovation Institute,
California Polytechnic State
University-San Luis Obispo, CA**

www.dptc.calpoly.edu



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OVERVIEW

The California Dairy Foods Research Center is a comprehensive effort to bring the full capabilities of the Dairy Innovation Institute at California Polytechnic State University at San Luis Obispo, along with other Cal Poly departments and programs, and other institutions within California to support the dairy industry from farm to table. Working with the California Dairy Research Foundation (CDRF), whose purpose is to promote research and development activities that benefit dairy producers and processors in the consumer marketplace, the scientists, technologists and other experts continue to work with the industry to provide innovative solutions that support the nation's dairy industry and the global marketplace. The California Dairy Foods Research Center conducts applied and strategic dairy research and development in the areas of product technology and

utilization, products for health enhancement, food quality, and food safety. The applications and outreach programs facilitate innovative uses of dairy foods and ingredients by the food industry. Facilities at the Dairy Innovation Institute are state-of-the-art, equipped with advanced and routine analytical equipment, dairy foods pilot plants, and a commercially licensed dairy processing facility. The Dairy Innovation Institute serves as the focal point to draw upon expertise and resources from throughout Cal Poly and other collaborating institutions in the packaging, engineering, business, chemistry, microbiology and other disciplines. Adjacent to the Dairy Innovation Institute is the Cal Poly university dairy farm, where fresh milk is available for research and development activities. Research from campus laboratories at Cal Poly also focuses on investigating the health benefits of specific high-value milk components for commercial application.

RESEARCH FOCUS

The California Dairy Foods Research Center offers significant expertise in and resources for research and development involving dairy products and ingredients. Research is industry-driven and can address the specific needs of companies in research or applications. Current research includes:

- Cheese technology (flavor, texture, yield, starter culture performance functional properties)
- Milk, dairy ingredients and dairy products quality (sensory, functionality, composition, physical properties manufacturing efficiency) and shelf-life
- Process development (membrane and other concentration/fractionation processes, UHT and other heat treatments, and non-thermal processes)
- Product development, dairy ingredients applications (prototypes, nutritional labels) and flavor lexicons
- Dairy nutrition and health (probiotics, bioactives)
- Dairy quality assurance (food safety, environmental stewardship, testing methods development)



DAIRY INGREDIENTS APPLICATION PROGRAM

This program provides technical support to manufacturers, users and marketers of dairy proteins, dairy carbohydrates, and dairy fat-based powders and concentrates such as non-fat dry milk (NFDM), skim milk powder (SMP), milk protein concentrate (MPC), whey protein concentrate (WPC), lactose, delactosed permeate (DLP), butter and milkfat. It involves transfer of existing research information, technical training, preparation of information bulletins, providing solutions/information on technical product applications issues, and carrying out targeted short-term projects to address specific applications needs, including new food and product development. Approximately 8,270 square feet of processing area is available in the pilot plant facilities. Applications support and specialized analytical capabilities are also available. Sensory expertise is available for food and beverages by QDA style descriptive testing and affective/consumer testing with the use of Compusense® Five or Compusense at-hand software. The plant is fully equipped for all traditional unit operations for the manufacture of dairy foods and ingredients, and is licensed by the state of California for commercial manufacture of dairy foods. Additionally, space is available to accommodate specialized equipment for research and development projects on a short-term basis. Four chemistry labs support work in the areas of microbial, physical and chemical analyses of dairy foods and ingredients.

For additional information, visit
www.dptc.calpoly.edu/content/facilities





FACILITIES AND EQUIPMENT

California Polytechnic State
University, San Luis Obispo



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EQUIPMENT

- » HTST – 270 to 600 gallons per hour for ice cream mix, milk, etc., and associated cold milk separator, batch tanks (1×80 gallons, 2×100 gallons, 1×200 & 1×300 gallons with heating and cooling, 1×400 gallons with heating, 2×500 gallons), pasteurized surge tanks, CIP systems, etc. (HTST is a legally sealed unit by the state of California)
- » 1/2 to 1 gallon plastic federal rotary filler
- » Scholle filler for 3- to 6-gallon bags
- » Microthermics UHT (direct and indirect heating) with clean-fill hood and aseptic homo (25 L/hr)
- » Continuous ice cream freezer (Hoyer Frigus SF 600) (50 to 150 gallons/hr)
- » Ingredient feeder (Hoyer Addus FF 2000 C2) (10 to 200 L/hr)
- » Sawvel cup filler–pint to 3.5 oz.; 35 cups/minute (pint)
- » Emery Thompson batch ice cream freezer (40 qts.)
- » Egli continuous pilot-scale butter churn (1 to 2 lbs/min)
- » PMS 30-gallons/hr HTST with two-stage homogenizer
- » Technogel 100 L/hr continuous ice cream freezer
- » Marriott Walker rising film evaporator (100 lbs/hr evaporative capacity)
- » Open-water jacketed cheese vats (Stoelting 500 gallons, Stoelting 3 to 50 gallons, Kusel 2 to 100 gallons with drain table)
- » Two Universal 50-gallon specialty cheese vats
- » 150-gallon Damrow Double-O enclosed cheese vat
- » Blentech process cheese cooker (50 to 100 lbs.)
- » Stefan process cheese cooker (5 lbs.)
- » Suprema pasta filata system (mixer/molder and cooker/stretcher)
- » Koch vacuum packaging system (1- to 40-lb. block)
- » Miscellaneous tanks and pumps
- » High-shear Silverson mixer
- » 4 Groen process steam kettles (40 to 60 gallons)
- » 2 APV conical bottom swept-surface processors (100 gallons)
- » Legal batch pasteurizer system (200 gallons)
- » 4-booth sensory evaluation area with test/preparation kitchen and Compusense software system
- » Controlled atmosphere cold storage (approx. 3,000 sq. ft.)
- » Cold storage (-15 to -40 F) (approx. 200 sq. ft.)
- » Spiral-wound DDS UF and RO system (50 to 100 L/hr)
- » Niro Pilot R-12 MF/UF/RO system (60 to 90 gal. feed/min)
- » Niro Filterlab spray dryer FLG-60 (60 lb/hr. water evaporation rate, capable of drying milk, whey and agglomeration)
- » Small pilot-scale supercritical carbon dioxide fluid extraction system



SUPPORTING ANALYTICAL EQUIPMENT

Fast-performance liquid chromatography

Separation analysis and isolation of proteins from milk, whey and dairy products

Pulsed field gel electrophoresis

DNA-based differentiation of probiotic lactic acid bacteria

Gel electrophoresis acrylamide

Analysis of proteins and peptides: native, denaturing, urea, gradient and two-dimensional

Preparative isoelectric focusing

Isolation and characterization of proteins

Gel densitometer

Individual protein concentration determination

Polymerase chain reaction thermal cycler

DNA characterization, bacteria identification and determination, gene manipulation, etc.

ELISA plate reader

Multiple antibody and enzymatic assays for milk product component analysis or microbiological safety

Membrane transfer platform

Northern, southern and western blots of RNA, DNA, and protein analysis and identification

Dot blot instrument

Antibody and enzyme quantification and titration

Ultracentrifuge

Sedimentation of milk and cellular components

Phase contrast microscope

Microbiological analysis of spores

Digital imager

Quantification and record-keeping of dairy product sample structure and composition

Pilot plant scale affinity chromatography column

Large scale-up of laboratory affinity chromatography procedures

Gas pycnometer, tap density, powder flowability

Characterization of bulk density, particle density and angle of repose

Gas chromatography / mass spectrometry (GC / MS)

Flavor and other compound characterization and identification

High-pressure liquid chromatograph (HPLC)

Protein and peptide analysis of dairy foods

Laser diffraction particle size analyzer

Particle size and particle size distribution of dry dairy powders, emulsions and colloidal dispersions

Texture analyzer

Texture profile analysis, firmness, etc.

Hunter colorimeter

Whiteness, color intensity and hue, appearance of dairy foods and ingredients

Differential scanning calorimeter (DSC)

Thermal properties of milk components

Block digestion and distillation system

Nitrogen/protein analysis

Autotitration system

Determination of buffering capacity

High-throughput nitrogen analyzer

Quantification of total milk protein, casein and whey protein content of foods

Fourier transform infrared analysis

Milk component analysis

Water activity meter

Water activity measurement

Countertop food dehydrator

Food dehydration

NOTE 1: In addition to the specialized equipment available, the Dairy Innovation Institute routinely carries out chemical (fat, protein, ash, total solids, pH), physical (viscosity, color) and microbiological (APC, yeasts, molds, coliform, lactobacilli) analyses and related research, plus the development of dairy foods and ingredients.

NOTE 2: In addition, Cal Poly works with several departments on campus (Materials Engineering, Biological Science, and Food Science & Nutrition) for more specialized expertise, instrumentation, and processing equipment.



COURSES, SYMPOSIA AND EVENTS

- Annual Dairy Ingredients Symposium
- Short Course: Manufacture of Cheese, Grading and Sensory Analysis
- Short Course: Manufacture of Ice Cream
- Short Course: Economics of Cheese Manufacture for Small Businesses
- Short Course: Manufacture of Cultured Dairy Products



RESEARCHERS AND STAFF

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Dairy foods and health: prebiotics, bioavailability of minerals, and prevention of cell damage in small intestine and colon environments



THE CENTER FOR DAIRY RESEARCH



University of Wisconsin-Madison

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OVERVIEW

The Center for Dairy Research (CDR) is located within a licensed, operating dairy plant on the University of Wisconsin-Madison campus and is one of the premier dairy research centers in the world. Building on Wisconsin's tradition as the "Dairy State," the Center explores functional, flavor and physical properties of cheese/cheese products and other milk components used as ingredients and as finished products. CDR researches cheese making and dairy protein processing/separation procedures, use of dairy ingredients in foods, and technologies for product safety and quality. More than 30 researchers and scientists are involved in conducting basic and applied dairy research. Collectively, the CDR staff has over 250 years of food industry experience, which creates a unique mix of academic and industry perspectives to help address any challenges facing the dairy industry. The facilities (including two pilot plants) and equipment are extensive, allowing the Center to not only create new products, uses and processes, but also to meet the unique needs of the food industry. Annually, the CDR provides specialized training and short courses to over 1,400 industry personnel.

RESEARCH FOCUS

- Functional properties of cheese, cheese products and cultured dairy products
- Functional dairy proteins (casein alternatives, milk protein concentrate (MPC), modified whey protein concentrate (WPC), etc.) and ingredients
- Dairy-based beverages
- Dairy food safety and quality systems
- Dairy processing (membrane filtration, drying, separation, etc.)
- Cheese technology (coagulation, yield, performance, ripening)
- Specialty cheese

CHEESE

The University of Wisconsin-Madison has a long and proud history of cheese research and outreach. The CDR extends the art and science of cheese making into the realm of specialty cheese innovation, as well as cheese as an ingredient. Its licensed cheese makers/scientists provide industry with training programs, research facilities, cheese making protocols for specific end use, and leading-edge technologies for adjusting the texture, taste and/or functionality of cheese in food applications.

The CDR cheese making pilot plant is located within the University of Wisconsin-Madison Dairy Plant, a licensed, operating dairy. This setting allows for flexibility in all aspects of the cheese making process. The pilot plant is designed for manufacture of any retail cheese variety (fresh, cream, cottage, hard, soft, semisoft, surface-ripened, molded and eyed), process cheese and cheese food, plus cold pack.

CDR cheese applications staff, through consultation, pilot plant trials, applications, sensory and analytical laboratory evaluation, and on-site trials and visits, works in a confidential manner with all entities of the dairy industry. From dairy producers and manufacturers to ingredients suppliers and equipment manufacturers, applications staff works with the entire cheese distribution system, including foodservice, retail, wholesale, brokers, converters, warehouses, executive chefs and quick-service restaurants – wherever cheese is used in food application systems. Staff members also provide direct technical support for the end use of natural, process and cold pack cheeses, as well as cheese in food applications.

DAIRY PROTEIN/INGREDIENTS

CDR has an extensive program focusing on dairy ingredients. Working on a confidential basis, the program strives to meet the needs of regional and national dairy ingredient processors and food manufacturers. These needs include process, product and applications support. The dairy ingredient program and applications lab offer technical support for whey, buttermilk, nonfat dry milk, permeate, whey protein concentrate (WPC), whey protein isolate (WPI), individual whey proteins, milk protein concentrates and isolates, milk protein fractions and native whey protein. Services include training and seminars, process development, process troubleshooting, ingredient functionality testing and prototype development. Application areas of expertise are beverages, baked products, confections, dairy products, energy bars, cultured products, and prepared foods.

ANALYTICAL SERVICES

Analytical services are offered to support projects carried out at the Center for Dairy Research. CDR provides comprehensive chemical and microbiological testing services and follows EURACHEM-CITAC Guide CG-2 as quality assurance guideline of nonroutine and R&D analysis of samples. Tests performed include crude protein, casein, true protein, milkfat, total solids, mineral content by reference methods, enzymatic and HPIC determination of lactose and galactose, protein profiles of milk and milk products by capillary electrophoresis, cheese proteolysis and determination of particle size analysis. Rheological tests performed include texture profiles, cheese meltability and functional properties of milk products.

Microbiological dairy food safety and quality tests are routinely determined, including tests for coliforms, standard plate count, plus yeast and mold. Shelf life and microbial challenge studies also are performed.

SAFETY/QUALITY APPLICATIONS

Providing an active approach to safety and quality, the CDR staff performs audits of dairy facilities, solves problems for dairy plants and reviews dairy facilities' good manufacturing practice (GMP) programs. CDR staff works with facility personnel to improve their GMP program and establish or modify a HACCP program. Staff members also interpret government regulations related to specific dairy products and dairy facilities and provide technical expertise in HACCP implementation and compliance with the Committee for the Assurance of Wisconsin Dairy Product Safety requirements, as well as training on implementation of the Food Safety Modernization Act (FSMA).

In addition, cheese and dairy ingredients produced at CDR are monitored for microbial safety.

TURBO

The TURBO program, or Tech Transfer, University, Research and Business Opportunity, is an economic development initiative that supports the commercialization of novel dairy technologies and products. Whether your company is interested in licensing a CDR technology or working with CDR to develop a novel technology or product, the TURBO program can help bring your idea to the market. This assistance may include technical support, reimbursable grants, market research or another form of business assistance.

SENSORY ANALYSIS

CDR staff designs, conducts and summarizes sensory analysis of cheese and dairy ingredients, using modern sensory testing approaches including the use of FIZZ Networks software with trained panelists performing a wide range of consumer and quantitative tests to meet the customers' needs. Evaluations include flavor, body/texture and appearance profiles, as well as cheese functionality for shredding/slicing and cooking applications. Panels conducted range from trained to focus group, from descriptive to consumer.

FACILITIES AND EQUIPMENT

The CDR pilot plant facilities meet the needs of the dairy and food processing industry by offering access to smaller-scale equipment. The small-vat product development capability in the cheese pilot plant helps evaluate new cheese making processes. The dairy ingredient pilot plant has the capability to perform milk and whey processing of all types to produce beverages, yogurt, ice cream, sauces, spreads, dips and salad dressings. In addition, the applications lab at CDR has equipment to test the functionality of cheese as an ingredient, including a full line of foodservice pizza ovens. CDR also can evaluate the functionality of dairy ingredients and formulate dairy ingredients into baked products and confections. The chemical and microbiological laboratories extend more than 5,000 square feet and offer some unique testing capabilities.



FACILITIES AND EQUIPMENT

The Center for Dairy Research
UW-Madison
Pilot Plant Equipment

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CDR offers a full cheese making manufacturing line located in a state-licensed, state-inspected, operating dairy manufacturing facility. The natural cheese manufacturing line includes multiple raw storage tanks, separator, homogenizer, HTST and various membranes (RO, UF, MF) for full milk standardization based on any desired ratios or incorporation of any ingredient before pasteurization of cheese milk. CDR has the capabilities to manufacture any style and variety of cheeses.



EQUIPMENT

- » 30-gal. bulk starter preparation tank
- » pH meters with computer hookup to continuously monitor pH reading in 4 vats
- » 6 Stoelting 600-lb. vats with variable speed agitators and 1/4-in., 3/8-in. and 1/2-in. knives
- » Kusel 5,400-lb. scale up cheese vat
- » Kusel 600-lb. Double-O cheese vats (2)
- » Small 5-gal. capacity mini-cheese vats with automatic agitation with continuous pH monitoring (4)
- » Supreme steel fabricating cooker/ stretcher (mixer/ molder) Model 640 mixing machine; includes ends for string cheese, 5-lb. loaves with capability for 20-lb. block
- » Stoelting prepress with 4 separate pressing chambers (for pressing of eyed cheeses)
- » EBR curd mill for Cheddared slabs

- » Damrow horizontal cheese press with 2 air rams
- » Kusel 450 lb. portable cheese vat
- » Kusel A-frame vertical cheese press
- » DR Tech Carousel Cheese Vacuum Press for blocks and horns
- » Stainless steel cheese forms (Wilson 10-, 20- and 40-lb. block, perforated brick/Muenster hoops, 5-lb. round Muenster hoops)
- » Plastic cheese forms of various sizes and shapes, including 10-lb. wheels (both Crellin and Fromagex), 5-lb. loaves, smaller sizes for 1-lb. Edam balls, Camembert, ricotta and panela baskets, etc.
- » Stacked fiberglass circulating brine system
- » Two Norlake Scientific NSR1331WSW/8H 33 cubic foot incubators for ripening mold and surface-ripened cheeses; off-site ripening also available upon request
- » Warm room capabilities for eyed cheese storage
- » Various cold storage capabilities with variety of temperature ranges for cheese ripening

EQUIPMENT

Full cream cheese manufacturing line. Cream cheese manufacturing line includes items listed below, as well as equipment listed under other categories. Processing lines include cheese vats, pumping line to collect whey and cream cheese, holding vessel, through packaging.

- » Sharples Penwalt Model DS2 cream cheese separator
- » APV Gaulin homogenizer Model M3, 2-stage minimum, 2 gal. of product
- » Scherping Systems PT 30G 30-gal. capacity swept-surface tank with heating/cooling capability

Cold pack and process cheese manufacturing line. Cold pack and process cheese manufacturing line includes items listed below, as well as equipment listed under other categories. Processing lines include mixing/cooking vessels, homogenization and blending. All direct steam comes from culinary steam source.

- » Biro cheese grinder, Model 922, includes various plate sizes
- » Stephan UM/SK5 high shear (bowl-chopper style) Processed Cheese cooker
- » Blendtech twin-screw process cheese cooker, Model CC 0025, 20-lb. capacity, direct and indirect steam with vacuum
- » Stephan cold pack cheese blender, 10-lb. capacity
- » Stephan vertical cutter/mixer, Model 17 91, 50-lb. capacity, indirect steam only
- » Pick Heater for jet cooking sauces
- » Loos 10 lb. Low shear, twin screw process cheese cooker
- » Koss ST Low shear, twin screw process cheese cooker (25 - 45 lbs finished batch size)

Other various equipment used in the processing, converting and packaging of cheese:

- » Urschel cheese shredder, Model CC-D
- » Vemag V 500 robot cheese grinder and vacuum machine with guillotine cutoff
- » Dairy product aerator, 10 lb minimum batch size
- » Lincoln Impinger oven, Model 1130, for baking of Juustoleipä
- » Multivac vacuum sealer with gas flush capabilities, Model C400
- » Variety of portable holding tanks
- » Large and small volume scales from 600 lb scales in 0.2 lb increments down to analytical balances with 0.0001 gram accuracy
- » Sprinkman batch butter churn

***PLEASE NOTE:** Additional equipment may be obtained by the CDR on a project-specific basis.

EQUIPMENT

Dairy Ingredient Processing Equipment

- » Four spiral-wound UF- or MF-compatible systems that contain multiple vessels
- » One system using one or two 3.8 in. elements
- » One system using up to six 3.8-in.-dia. vessels holding two elements each
- » One system using up to three 4.3-in.-dia. vessels holding two elements each
- » One system using one or two 8.0-in.-dia. vessels holding one element each
- » NF or RO operated with one or two 3.8-in.-dia. vessel, one or two elements each
- » Membrane filter system (UF/MF)
- » Pilot-scale plate evaporator capable of 200 to 400 lbs. of water evaporation/hr.
- » Pilot-scale spray dryer capable of 40 lbs. of water evaporation/hr. utilizing a pressure nozzle
- » Stephan mixer with 40-L capability
- » Homogenizer (two-stage)
- » Two pilot-scale milkfat separators
- » Small HTST research pasteurizer
- » Tanks ranging from 5 to 500 gal.
- » Swept-surface jacketed tank with heating and cooling (100 gal.)
- » APV Gaulin homogenizer Model M3, 2-stage, minimum, 2 gal. of product

Dairy Ingredient Processing Equipment

- » Ice cream: Emery Thompson, Taylor and Coldelite batch
- » Taylor soft serve
- » Ice cream: Tetra Pak continuous

SUPPORTING ANALYTICAL EQUIPMENT

Moisture analyzers

Total solids, moisture

Forced-air ovens

Total solids, moisture, total solids (nonfat)

pH/mV meters

pH

General Analysis

Fat, nitrogen, lactose, galactose, lactates, protein composition, acid degree value, titratable acidity, whey (undenatured) protein number, coliforms, yeast and mold, starter organisms, Lactococcus starter, nonstarter lactic acid bacteria, Lactobacillus (hetero), standard plate count, ash, mineral analysis, triglycerides

High Performance Ion Chromatograph

Sugar profile (glucose, galactose, lactose); D/L lactic acid

Spectrophotometer

Lactose, galactose, D/L lactic acid

Water Activity Meter

Water activity

Acid Degree Value Testing equipment

Fourier Transform Infrared Spectrometer (FTIR)

Fat, total solids, total protein, nonprotein nitrogen, casein lactose

Near Infrared Analyzer

Fat, moisture, total protein, salt

Free Fatty Acid testing equipment

Immersion sonicators

Solutions, suspensions, degasification

Centrifuges (various sizes to 25,000 rpm)

Soluble nitrogen, milkfat separation, fat

Paar Physica and Malvern Rheometers

Gelation, small deformation technology

Zeiss Epi-Fluorescence Microscope

Light and fluorescent microscopy

Centrifuge rotors (fixed-angle and swing bucket)

Soluble nitrogen, milkfat separation

Microcentrifuges

Protein composition

Microwave mineralization oven

Mineral analysis

Viscometer

Viscosity

Electrophoresis

Protein composition (10 to 250 kD), protein composition (casein variants)

Capillary electrophoresis

Protein composition (10 to 250 kD)

Block digesters (6 and 20 Place)

Nitrogen content

Automated nitrogen analyzer with autosampler

Nitrogen content

Furnaces

Ashing

Cryoscope

Freezing point depression

ALP analyzer

Alkaline phosphatase

-80 C freezers

Sample preservation, starter culture storage

Low-temperature incubators

Various microbiological tests

Rotary evaporators (1 L)

Solvent evaporation

Soxhlet extractors (100 mL)

Fat extractions

Sample homogenizers

Sample preparation

Particle size analyzer (20 to 2,000 um) with autosampler

Particle size determination for liquids and solids

Microfluidizer

Preparation of liposomes

Multi-angle laser light scattering detector (MALLS)

Determination of molecular weight of polymers

Inductively coupled plasma-axial optical emission spectroscope with autosampler

Mineral analysis

Gas chromatograph-flame ionization detectors with autosampler

Fatty acid composition, triglycerides, fatty acid sn-triglyceride positional analysis

High-performance liquid chromatograph with autosampler

Phospholipids, carbohydrates, protein, composition (casein variants)

Evaporative light-scattering detector

Phospholipids, carbohydrates, triglycerides

Drop point analyzer

Melt point

Walk-in coolers (4 C)

Sample preservation

Commercial deli-style slicers

Melt test

Vacuum sealers

Sample preservation

Oxidative stability instrument

Accelerated oxidative stability

Chloride analyzers

Salt determination



COURSES, SYMPOSIA AND EVENTS

- Applied Dairy Chemistry Short Course
- Cleaning and Sanitation Workshop
- Cheese Grading and Evaluation Short Course (2 times per year)
- Cheese Technology Short Course (2 times per year)
- Cultured Dairy Products Short Course (odd-numbered years)
- Batch Freezer Workshop
- Dairy HACCP Workshop
- Dairy Ingredients Utilization Short Course (odd-numbered years)
- Ice Cream Makers Short Course
- Dairy Ingredient Manufacturing Short Course (even-numbered years)
- Master Cheese Maker Short Course (Focus on specific trends and technologies in the manufacture of various cheeses)
- Milk Pasteurization and Process Control School (2 times per year)
- Process Cheese Short Course
- World of Cheese – Pasture to Plate Short Course
- Buttermakers Short Course
- Various courses related to sustainability
- Custom company training programs for industry
- CDR Industry Team Research Forum
- International Cheese Technology Exposition
- Wisconsin Cheese Industry Conference
- Certificate in Dairy Processing (3 times per year)



COMMUNICATIONS AND OTHER RESOURCES

- *The Dairy Pipeline*
quarterly technical newsletter
- Technical reviews
 - » Dried Dairy Ingredients
 - » Dairy Proteins
 - » Whey Processing – Bleaching
 - » Fact sheets
 - » Whey Processing - Annatto and Color Removal
 - » Cracker and Cheese Pairing Guide
 - » Distribution of Milk Components Between Cheese & Whey
 - » Membranes 101
 - » Membrane Configurations
 - » Quick Guide to Choosing the Best Type of Whey
 - » Relative Milk Component Sizes in Comparison with Membrane Pore Size Ranges
 - » Use of Membranes for Standardizing Milk for Cheese Production
 - » Guide to Smoked Cheeses
 - » Brining Cheese, A Comprehensive Guide
 - » Dust Fires and Explosions Associated with Dairy Powders
 - » Better Butter book





RESEARCHERS AND STAFF

ROBERT BRADLEY, JR., PH.D.

Professor Emeritus of Food Science

UW-Madison
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Processing and utilization of dairy foods, analytical methods of analysis; food product development; ultrafiltration and reverse osmosis, frozen dessert technology, analytical methods of food analysis and dairy foods technology; stabilization and emulsification of food systems, environmental toxicants in food products; independent third-party, 3A-mandated equipment cleanliness evaluations

KIMBERLEE (K.J.) BURRINGTON

Coordinator, Dairy Ingredient, Cultured Products and Beverages Applications Program

The Center for Dairy Research
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Coordinates dairy ingredients program targeting industry needs in the areas of whey processing/ component separation and utilization of these components in a variety of food and beverage products

SRINIVASAN DAMODARAN, PH.D.

Owen Fennema Professor, Food Chemistry

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Enzyme chemistry and technology; food chemistry; protein chemistry and technology

MARK ETZEL, PH.D.

Professor, Food Science (joint with Chemical Engineering)

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Food and bioprocess engineering; mass transfer and bioseparation processes; membrane bioseparations; protein purification; drying of foods and microorganisms

KATHY GLASS, PH.D.

Distinguished Scientist, Microbial Sciences Food Research Institute

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Process cheese safety; shelf-life studies with foodborne pathogens; evaluation of product safety for new formulations

RANI GOVINDASAMY-LUCEY, PH.D.

Senior Scientist

The Center for Dairy Research
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Coordinates research projects within CDR. Areas of expertise include: evaluation of texture and rheological properties of cheese; standardization approaches for cheese making, including cheese yield determination; design of cheese projects/ trials; determination of the coagulation properties of cheese milk; membrane processing for cheese making; cream cheese properties; buttermilk as an ingredient; low-fat cheese

VIC GRASSMAN, CEcD

Technology & Commercialization Manager

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TURBO program manager, lead coordinator and partner contact for all commercialization and economic development initiatives. Brings research and technology to the private sector.

SUNDARAM GUNASEKARAN, PH.D.

Professor, Biological Systems Engineering (joint with Food Science)

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Determining physical properties and quality factors of food materials and design of sensors and instrumentation for quality evaluation of food materials nondestructively; rheological and transport properties, structure-function relationships; value-added food and nonfood processes of biomaterials

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Food engineering/processing, separations, crystallization/ particulate processes, structure-function relations

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Analytical methods for food analysis; microbial quality and safety of foods; HACCP, food quality and food safety

JOHN JAEGGI

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Coordinates cheese making trials; serves as an industry information resource, provides technical support for specialty cheese makers

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Assists the Dairy Ingredient and Beverage group as well as the Cultured Products group with basic research to product formulation, with particular interest in protein.

ANDY JOHNSON

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Coordinates cheese making trials involving a wide variety of natural and specialty cheeses; provides information and technical support for brokers, end users, ingredients suppliers, manufacturers and others in the industry

MARK JOHNSON, PH.D.

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Coordinates CDR's strategic and applied cheese research program; cheese technology; manufacturing procedures and effects on quality; technology and microbiology of reduced-fat cheeses; enhanced ripening of cheese using lactobacilli; and cheese defects

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Research Specialist

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Dairy ingredient applications and responsible for the InnovateWithDairy.com website and dairy technical-support line

YANJIE LU, PH.D.

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Supports research projects on cheese and dairy ingredients. Lab manager for Dr. Lucey lab

JOHN LUCEY, PH.D.

Director, CDR; Professor, Food Science

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Dairy chemistry/technology; physicochemical properties of dairy products; cheese technology; rheological properties of dairy products; milk proteins; yogurt science and technology

SARAH MINASIAN

Applications Lab Coordinator

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With a culinary background, supports research and development application projects for the CDR

GINA MODE

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Coordinates cheese making trials involving a wide variety of natural and process cheeses; provides information and technical support for brokers, end users, ingredients suppliers, manufacturers and others in the industry

MIKE MOLITOR

Pilot Plant Manager

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Coordinates the center's pilot plant use for filtration, evaporation and spray-drying projects; serves as department resource for equipment design and maintenance; supports processing of dairy products, including yield and mass balance

DON OTTER, PH.D.

Coordinator Certificate in Dairy Processing Program

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Coordinates the Certificate in Dairy Processing program at the Center. Collaborates in work related to processing, especially related to whey proteins.

KIRK PARKIN, PH.D.

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Food chemistry and biochemistry, particularly enzymology and bioactive phytochemicals and nutraceuticals; identification, characterization and enrichment of health promoting, bioactive compounds in foods; characterization of enzymes in foods and as processing aides

SCOTT RANKIN, PH.D.

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Characterization primarily of dairy food flavor with sensory and instrumental techniques; programs and short courses in support of the dairy foods processing industry

JUAN ROMERO

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Supports analytical activities for the CDR, including comprehensive chemical, microbiological, sensory and rheological testing services

PAMELA L. RUEGG, DVM, MPVM, DABVP (Dairy Practice)

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Milk quality specialist; on-farm implementation of best management practices to improve milk quality and safety; research interests focused on the application of epidemiologic techniques to critical issues related to milk quality and safety; influence of cow and farm hygiene on milk safety and quality

STEVE RYDZEWSKI

Process Research Specialist

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Assists with trials, SOPs, dairy plant equipment decisions and other aspects involving the processing pilot plant.

KAREN SMITH, PH.D.

Researcher

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Specializes in process development, scale-up and troubleshooting; conducts research in milk/whey separation, concentration and drying; develops materials for industry education

MARIANNE SMUKOWSKI

Safety and Quality Coordinator

The Center for Dairy Research
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Serves as technical adviser to the dairy industry for safety/ quality programs, HACCP implementation and dairy facility audits; facilitates industry/ regulatory interactions; and is technical coordinator for the Wisconsin Master Cheesemaker® Program

DEAN SOMMER

Cheese and Food Technologist

The Center for Dairy Research
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Serves as a resource for cheese manufacturers and end users interested in expanding the use of cheese, particularly as an ingredient

JAMES STEELE, PH.D.

Professor, Food Science

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Dairy microbiology; genetics and physiology of lactic acid bacteria; cheese flavor; probiotics

BECKY SURLS, PH.D.

Associate Researcher

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Responsible for analytical work, particularly for the Cheese Applications and Research group. Also involved in general research and student training at CDR.

TOM SZALKUCKI

Assistant to the Director

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Serves as assistant to the director with specific additional duties related to projects, contracts, reports, technical information and CDR physical facilities

DEBRA WENDORF BOYKE

Communications Coordinator

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Manages all internal and external communication and short course/training activities of the center

WILLIAM WENDORFF, PH.D.

Emeritus Professor, Food Science

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Quality and environmental concerns of the dairy industry; sheep milk processing



MIDWEST DAIRY FOODS RESEARCH CENTER

www.midwestdairy.umn.edu



University of Minnesota
(St. Paul)

South Dakota State University
(Brookings)

Iowa State University
(Ames)

Affiliate universities:
University of Nebraska
Kansas State University
and University of Missouri



CENTER DIRECTOR

LLOYD METZGER, PH.D.

Center Director

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OVERVIEW

The Midwest Dairy Foods Research Center has resources within the University of Minnesota (St. Paul), South Dakota State University (Brookings) and Iowa State University (Ames). The dairy center was formed to conduct research and provide support needed to increase the viability of the United States dairy industry and ensure its future competitiveness. The center offers expertise in dairy foods research for both traditional dairy products and dairy products used as an ingredient.

RESEARCH FOCUS

- Develop analytical tools and testing methods for on-farm and dairy plant processing, and for understanding the functionality and structure-building properties of dairy products and ingredients
- Investigate the safety, flavor, consumer perception, and nutritional profiles of dairy products
- Develop manufacturing technology for customized products and ingredients, increase sustainability, and extend the shelf life of products
- Develop value-added products and ingredients from dairy components to improve consumer health, provide clean labels, and reduce waste streams.



FACILITIES AND EQUIPMENT

University of Minnesota



CONTACT:

RAY MILLER, Plant Manager
612-624-7776
rmiller@umn.edu



FACILITIES

Sensory Center – ZATA VICKERS, Director

The sensory center has two tasting suites, and each suite contains eight booths and a food preparation area. Both suites have computerized data collection systems. Sensory center staff routinely train and administer descriptive analysis panels, and recruit and administer consumer taste panels.

Joseph J. Warthesen Food Processing Center

– TONYA SCHOENFUSS, Director

The food processing center has a large variety of dairy and food processing equipment. We are state certified as a Grade B dairy and have a certified HTST milk pasteurizer and vat pasteurizer. We welcome industry clients to conduct R&D trials in our facility, and cheese and ice cream start-ups to manufacture in our facility as they develop their own plants.



EQUIPMENT

PASTEURIZERS/PROCESSORS

- » Microthermics UHT System: includes homogenizer and HEPA filtered filling hood, 1 to 3 L/min.
- » Vat pasteurizer, homogenizer and plate cooler: 50 to 100 gal.
- » Pasteurizer: Cherry-Burrell, 4,000 lbs./hr.
- » Process cheese cooker: Blentech, 10 lbs.
- » Process cheese cooker: Damrow, 40 lb
- » Tetra All-mix vacuum blender

DRYERS/AGGLOMERATORS

- » Fluid bed: Glatt GPCG-1, Wurster spray process, 3-lb. cap.
- » Drum dryer: Buflovac 6-in. drums
- » Spray dryer: Coulter, 90 lbs./hr.
- » Spray dryer: APV, 20 lbs./hr.
- » Freeze dryer
- » Tray dryer

CHEESE PROCESSING

- » Blue cheese needler
- » Cheddaring belt: Tetra-Scherping, 200 to 300 lbs./hr.
- » Cheese presses: vertical and horizontal with various hoop styles
- » Cheese vat: Damrow, 5,000 lbs.
- » Cheese vat: Tetra-Scherping, automated, 2,500-lb. cap.
- » Dewheying and salting belt
- » Cheese vats: Kusel, 2,000 lbs.
- » Cheese vats: Nu-Vat, 800 lbs. (2)
- » Curdmill: Damrow

FROZEN DAIRY PROCESSING

- » Tetra-Hoyer Frigus SF600 continuous ice cream freezer: 120 gal./hr.
- » fruit/nut feeder

HOMOGENIZATION AND BLENDING

- » Colloid Mills
- » Homogenizers: Gaulin 30 and 125 gal./hr.
- » Microfluidizer

FILTRATION/SEPARATION/CONCENTRATION

- » Decanter centrifuge: Sharples, 1 gal./min.
- » Desludging centrifuge: Westfalia, 3 to 5 L/min.
- » PTI RO/UF system multitube
- » UF system: DDS-20, Plate and Frame, 10-L
- » Evaporator: CE Rogers, 200 lbs./hr.

MIXERS/CHOPPERS

- » Hammermill: Fitzpatrick, 5-lb. hopper
- » Ribbon blenders
- » Urshel

OTHER

- » Twin-screw extruder: Buhler 44 mm twin-screw with loss-in weight powder feed and flow metered liquid injection
- » Coating drum: Spray Dynamics
- » Temperature- and humidity-controlled environmental chamber
- » Rack oven & proofer
- » Horiba L-960A Laser Diffraction Particle Size Analyzer
- » Malvern ZetaSizer Nano ZS



FACILITIES AND EQUIPMENT

South Dakota State University Dairy Plant



CONTACT:

JOHN HABERKORN, Dairy Plant Research Manager
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South Dakota State University Institute for Dairy Ingredient Processing



CONTACT:

STEVE BECKMAN, Manager
605-688-4184
DairyIngredientProcessing.com



EQUIPMENT

- » Batch freezer: 40-qt. Emery Thompson
- » Butter churns: 15 to 450 lbs.
- » Centrifugal pumps
- » Cheddar mill
- » Cheese block cutter (pneumatic)
- » Cheese press (pneumatic)
- » Cheese sealer: Sipromac
- » Cheese shredder: Hobart
- » Cheese vat: 2,500 lb. HCV
- » Cheese vat: 2x Kusel Double-O, 500 lbs.
- » Cheese vat: 1,000 lbs. fully enclosed, double-O on load cells with pre-draw and final drain
- » Cold bowl cream separator: DeLaval, 5,000 lbs./hr. and 7,500 lbs./hr. cold bowl
- » Crystallization tank: 3,000 lbs.
- » Drain table for HCV and 100 lbs. Double-O
- » Evaporator: multi-pass, falling film with high concentration finisher and single-stage flesh cooler, 1,500 lbs./hr., custom built, Dahmes Equipment
- » Filler: Bag-n-Box, Scholle
- » Filtration systems: multi-stage, low, and high pressure
- » Fruit feeder
- » Homogenizer: Gaulin, 5,000 lbs./hr., 4,000 psi
- » Homogenizer: 7,500 lbs./hr., 3,500 psi
- » HTST systems: 5,000 lbs./hr. and 7,500 lbs./hr.
- » Ice cream freezer: APV K110, 150 gal./hr.
- » Likwifier: 100 gal.
- » Microfiltration system: 1.7 m², ceramic membranes
- » Nano/reverse osmosis filtration, pilot lab, spiral wound with 3.8-in. elements
- » Niro spray dryer: rotary atomizer
- » Platform scales: 75 lbs. and 400 lbs.
- » Positive pump for revel in ice cream
- » Process cheese cooker: single-screw, 30-lb. culinary steam generator
- » Process vats: 20, 50, 200, 300, 500 and 600 gal.; steam and cool
- » Raw milk storage: 2 x 8,500 gal. silos
- » Refrigerated and frozen storage facilities, includes -40 F blast freezer
- » Spray dryer: two-stage with vibrating fluid bed and agglomeration capacity, custom built, Dahmes Equipment, 300 lbs./hr.
- » Steam culture chest
- » Ultrafiltration pilot lab, spiral-wound with 3.8-in. elements
- » Ultra/microfiltration system, 4-stage w/mag flow meters and pressure transducers, process 1,000 to 1,500 lbs./hr



FACILITIES AND EQUIPMENT

Iowa State University



CONTACT:

HUI WANG, Pilot Plant Manager
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FACILITIES

- Dry processing pilot plant
- Fermentation facility
- Food microbiology lab
- High hydrostatic pressure processing facility
- Nutrition and Wellness Research Center
- Fitness and metabolism unit
- Meeting rooms
- Sensory evaluation unit

- Process development lab
- Product development capabilities
- Technology transfer pilot plant and theater
- Test kitchen and sensory lab
- Wet processing pilot plant

A fee for use may be associated with some of the listed equipment. Please contact Stephanie Clark or Hui Wang if you are interested in more information about equipment or services provided at Iowa State University.



EQUIPMENT:

- » Acid digester: Labconco
- » Aroma scan
- » Autoclave
- » Brookfields HBYR1
- » CEM Microwave Ashing System 300
- » Centrifuge: Autocrit Ultra 3
- » Centrifuge: Beckman J2-21
- » Centrifuge: Beckman J2-2M/E, refrigerated
- » Centrifuge: Beckman J2-HC, high-speed
- » Centrifuge: Cepa Z41, continuous
- » Centrifuge: Clinical
- » Centrifuge: Damon/IEC, tabletop
- » Centrifuge: IEC, explosion-proof, low-speed
- » Centrifuge: International Model HN
- » Centrifuge: Sorvall RC3B Plus
- » Centrifuge: Swing Bucket, 4-L
- » Centrivap concentrator: Labconco
- » Cheese press
- » Cheese vats: jacketed stainless steel w/agitation
- » Cold and dry storage lockers
- » Compression and injection molding machines
- » Consistometer: Adams
- » Consistometer: Bostwick
- » Extrusion systems for grain processing
- » Fermentors: Benchtop, 1-, 2-, 5-, 10-L
- » Fermentors: sterilizable-in-place, 15-, 50-, 100-L
- » Filters
- » Filtration unit: Amicaon hollow-fiber
- » Flow cytometer: Accuri C6
- » Food extrusion
- » Freeze drying
- » Freezer: ultralow (-70C)
- » Refrigerator/Freezer: explosion-proof, isotherm
- » Gamma counter
- » Gas chromatography: Varian
- » Gas chromatography-mass spectrometry: Agilent
- » Gel imaging cabinet - Glue depositing
- » High-performance liquid chromatograph
- » High-temperature short-time pasteurizer (Microthermics)
- » Homogenizer: Avestin
- » Hunter Labscan XE
- » Incubator shaker: New Brunswick Sci
- » Instron 1122

- » Kettle: electric-heated with agitation, 10 gal.
- » Kjeldahl: Labconco
- » Membrane filter system
- » Microbiological incubators: regular, refrigerated
- » Microplate reader
- » Microscopes, light and fluorescence with digital-imaging capability
- » Milestone M/S Meba Micro Digest Units
- » Oven: Fisher Isotemp
- » Oven: Lindberg Blue M
- » PCR Cycler: Applied Biosystems, Biorad, Finnzymes
- » Penetrometers
- » Photochem (oxidation potential system)
- » Plastic film and sheet extruder
- » Rapid Visco Analyzer
- » Refractometer
- » Retorts
- » Rotary evaporator and vacuum pump
- » Screens and mixing tanks
- » SLM French Pressure Cell Press
- » Spectronics XL-1500 UV Crosslinker
- » Spectrophotometer: Beckman DU 640
- » Spectrophotometer: Genesys 20
- » Spectrophotometer: HP PDA 8452
- » Spectrophotometer: Spectronic 21D
- » Spinning disc colorimeters
- » Spiral filter/pump
- » Stomachers
- » Texture analyzer (TAXT2)
- » Toxic diet prep room and pelletor and mixer
- » Ultracentrifuge: Beckman L8M
- » UV illuminator: Fisher Biotech
- » Vacuum oven: food-grade
- » Viscometers: Digital Brookfield (YR-1; HDB, RV)
- » Volary evaporator: food-grade
- » Water activity meter: AquaLab
- » Wet grinders
- » Wire cheese block cutter



COURSES, SYMPOSIA AND EVENTS

UNIVERSITY OF MINNESOTA

- Artisan Cheese Making Workshop
- Extrusion Workshop
- Food Chemistry Workshops
- ServSafe
- Milk Pasteurization and Dairy Plant Sanitation Workshops
- Identifying, controlling and labeling food allergens for the food industry
- Food Establishment Sanitation Workshop
- Microbrewery Food Safety and HACCP
- Listeria Monitoring and Validation of Food Safety Plans for Retail Establishments
- Dry Sanitation for Food Plants
- Food Allergen Training
- Hazard Analysis Critical Control Points (HACCP): Intro and advanced training
- Food Plant Environmental Monitoring
- Food Plant Sanitation
- Acidified Foods Training for Entrepreneurs and Food Processors
- Juice HACCP Workshop
- Food Safety Roundtable Meetings

SOUTH DAKOTA STATE UNIVERSITY

- Cheese Judging Workshops
- Micro and Ultra Filtration Workshops
- Cheese Manufacture Workshops

IOWA STATE UNIVERSITY

- Hazard Analysis Critical Control Points (HACCP) 101
- ServSafe



RESEARCHERS AND STAFF

Researchers and nutritionists work within the dairy research program and are closely aligned with the University of Minnesota Food Science Department, the South Dakota State University Dairy Science Department, the Iowa State University Food Science and Human Nutrition Department, the Kansas State University Animal Sciences and Industry Department, the University of Nebraska-Lincoln Food Science and Technology Department, and the University of Missouri Food Science Department addressing new product development and processes for dairy products and ingredients.

JAYENDRA AMAMCHARLA, PH.D.

Assistant Professor of Food Science

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Advanced sensing technologies for dairy and food process monitoring; rapid and alternative methods for dairy and food analysis (functional, chemical, and microbial)

SANJEEV ANAND, PH.D.

Professor of Dairy Microbiology, Food Safety

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Public health microbiology of milk and food products, predictive microbiology, quality systems implementation, biofilms, nutraceuticals and molecular methods in microbiology. Bioluminescent markers and signal molecules

LANCE BAUMGARD, PH.D.

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Environmental and nutritional physiology; post-absorptive carbohydrate and lipid metabolism; bioenergetics; dairy science and nutrition

DAVID BAUMLER, PH.D.

Assistant Professor of Food Safety Microbiology

University of Minnesota

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Experimental and computational systems biology methods to study pathogenic and commensal microorganisms during interactions with hosts and in environments such as foods

DONALD BEITZ, PH.D.

Distinguished Professor in Agriculture and Professor of Animal Science and Biochemistry

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Lipid metabolism; cholesterol; nutritional and genetic control of animal food

ANDREIA BIANCHINI, PH.D.

Research Associate Professor of Food Science

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Evaluate ingredients, assess processes, and develop strategies to reduce/prevent contamination of final products with mycotoxins and bacterial pathogens; develop quality control mechanisms; and HACCP assistance focusing on food, dairy and feed products

TERRY BOYLSTON, PH.D.

Associate Professor of Food Science and Human Nutrition

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Lipid and flavor composition of foods; conjugated linoleic acid formation in dairy products

MARIN BOZIC, PH.D.

Assistant Professor of Dairy Foods Marketing Economics

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U.S. dairy policy analysis; dairy risk analysis; demand analysis and elicitation of consumers' willingness to pay for new dairy foods products; and feasibility assessments of new dairy technologies, processing investments and new products

BYRON BREHM-STECHER, PH.D.

Associate Professor of Food Science
and Human Nutrition

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Food safety and biosecurity; rapid molecular detection of foodborne pathogens and spoilage organisms; flow cytometry; biomimetics; multicomponent antimicrobial systems

REBECCA CADEMARTIRI, PH.D.

Adjunct Assistant Professor
of Materials Science and Engineering

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Interactions of biological entities, especially bacteriophages, with materials for detecting bacteria, protecting plants, animals and humans from bacterial infections; and treating bacterial infections in animals and humans

STEPHANIE CLARK, PH.D.

Professor of Food Science and Human Nutrition;
Associate Director of the Midwest Dairy Foods
Research Center

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Applies food microbiology and chemistry approaches to bridge the gap between dairy product sensory quality and human health

CARRIE EARTHMAN, PH.D.

Professor of Nutrition

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Clinical nutrition, medical nutrition therapy, body cell mass, nutrition support and assessment for patients at risk for wasting and gastric bypass surgery

BARAEM ISMAIL, PH.D.

Associate Professor of Food Science

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Phytochemicals, protein and enzyme chemistry; improving the functionality and bioactivity of food constituents; soy isoflavones (chemical structure, protein association, extractability, stability and bioavailability)

STEPHANIE JUNG, PH.D.

Associate Professor of Food Science
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Iowa State University
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High-pressure treatment of foods; effects of processing on food components (proteins and enzymes); use of enzymes to modify protein characteristics (extractability and functional properties)

THEODORE LABUZA, PH.D.

Morse Alumni Distinguished Teaching Professor
of Food Science

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Water activity, food stability and safety, food law, shelf-life testing, glass transition phenomena, bioterrorism, contaminants in food, time-temperature integrator tags

BUDDHI LAMSAL, PH.D.

Associate Professor of Food Science
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Iowa State University
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Food processing and engineering; crops utilization and industrial value-addition through enzyme application, fermentations and bio-based products; engineering properties of food; structure-functional properties of proteins, polysaccharides and food rheology

PEGGY LEHTOLA

Assistant Director of Midwest Dairy Foods
Research Center

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Assistant to the director

RUTH MACDONALD, PH.D.

Professor of Food Science and Human Nutrition
Department Head

Iowa State University
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Identifying factors in foods that reduce the incidence of progression of cancer

SERGIO MARTINEZ-MONTEAGUDO**Assistant Professor in Dairy Manufacturing**

South Dakota State University
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Engineering aspects of innovative processing technologies; reaction kinetics within pressure-temperature landscape; process characterization and optimization

AUBREY MENDONCA, PH.D.**Associate Professor of Food Science and Human Nutrition**

Iowa State University
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Rapid detection of human pathogens in dairy foods; development and application of natural antimicrobials to enhance the safety and quality of dairy foods

LLOYD METZGER, PH.D.**Professor and Alfred Chair in Dairy Education, Director of Dairy Center**

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Structure and functional roles of cheese components and modification of manufacturing parameters; cheese technology; dairy products processing

VIKRAM MISTRY, PH.D.**Professor and Department Head of Dairy Science**

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Reduced-fat dairy products; membrane processing; process cheese manufacture; salt whey in cheese making; cheese making characteristics of milks from Holstein and Brown Swiss cows

KASIVISWANATH MUTHUKUMARAPPAN, PH.D.**Professor of Agricultural and Biosystems Engineering**

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Dairy rheology and microstructure; physical and functional properties of dairy products

DANIEL O'SULLIVAN, PH.D.**Professor of Food Science**

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Bacteriophage resistance and bacteriocin production in lactococci, genetic regulatory circuits, genetic fingerprinting, probiotic cultures

GARY REINECCIUS, PH.D.**Professor of Food Science**

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Flavor chemistry, off-flavors and flavor processing

R. ROGER RUAN, PH.D.**Professor of Biosystems and Agricultural Engineering**

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Imaging and spectroscopy technology, shelf-life testing, structure-function relationships of biological materials

TONYA SCHOENFUSS, PH.D.**Associate Professor of Food Science**

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How formula and manufacturing processes affect natural and process cheeses, fermented milks and other dairy ingredients

KAREN SCHMIDT, PH.D.**Professor of Food Science**

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Dairy foods chemistry; dairy foods quality; dairy foods technology, and dairy protein chemistry

BONGKOSH VARDHANABHUTI, PH.D.**Assistant Professor of Food Science**

University of Missouri
vardhanabhutib@missouri.edu

Improve functional properties of dairy proteins; understand relationships between structure, physical properties, stability, and functionality of proteins and mixed protein-polysaccharide systems; develop protein and polysaccharide complexes having enhanced functional properties

ZATA VICKERS, PH.D.

Professor of Food Science

University of Minnesota
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Food aromas and acceptability; sensory evaluation of food; improved sensory and flavor techniques for fermented dairy products



TONG WANG, PH.D.

Professor of Food Science and Human Nutrition

Iowa State University
tongwang@iastate.edu

Lipid chemistry and analysis; value-added processing and utilization of soybeans and other oilseeds; vegetable oil refining



NORTHEAST DAIRY FOODS RESEARCH CENTER



Cornell University

[http://foodscience.cornell.edu/
cals/foodsci/research/
dairy-center/overview.cfm](http://foodscience.cornell.edu/cals/foodsci/research/dairy-center/overview.cfm)



CENTER DIRECTORS

DAVID M. BARBANO, PH.D.

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OVERVIEW

The Northeast Dairy Foods Research Center located at Cornell University, Ithaca, N.Y., was formed to conduct fluid milk and dairy ingredient research, provide applications and technical support for the improvements in milk powder quality and help establish the next generation of dairy ingredients.

The Northeast Dairy Foods Research Center also provides new learning opportunities for the industry with short-course training in dairy food safety and Hazard Analysis and Critical Control Points (HACCP) and dairy processing with a particular focus on fluid milk processing, cheese making and artisan dairy production.

RESEARCH FOCUS

VALUE ADDED DAIRY

- Physical and engineering properties of dairy ingredients
- Supercritical Fluid Extrusion processing of dairy foods
- Functionalization of whey protein
- Technological approaches to produce longer shelf-life-concentrated micellar casein from skim milk for ingredient use in dairy and nondairy food products

DAIRY MICROBIOLOGY AND SAFETY/FLUID MILK QUALITY

- Investigate farm management practices associated with high sporeformers levels in raw milk
- Influence of processing parameters on bacterial outgrowth in pasteurized fluid milk
- Develop molecular-based raw milk testing methods

DAIRY MICROBIOLOGY AND SAFETY/FLUID MILK QUALITY (CONT.)

- Dairy foods safety: intervention strategies for microbial inactivation
- Tracking and characterization of sporeformers in dairy processing systems
- Evaluation of raw milk tests for predicting pasteurized milk quality
- Extension of chocolate milk shelf life
- Extension of dairy foods' shelf life by supercritical carbon dioxide treatments
- Determine the impact of annatto and bleaching on flavor and functionality of WPC 80 and SPC 80
- Mechanisms for control of spoilage organisms
- Applications of bacteriophage to improve health
- Novel applications for co-products of dairy fermentations

DAIRY PROCESSING

- Milk protein rheology and functional properties
- Novel processing methods for the dairy industry



FACILITIES AND EQUIPMENT

Food Processing and Development Laboratory (FPDL)



CONTACT:

ROBERT RALYEA, General Manager, Cornell University
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<http://www.cals.cornell.edu/cals/foodsci/research/FPDL/index.cfm>

The goal of the Cornell University Food Processing and Development Laboratory (FPDL) is to create a professional environment in which teaching, research and extension activities can be conducted in support of the mission of the Cornell Institute for Food Systems and College of Agriculture and Life Sciences program at Cornell. As such, FPDL priorities are as follows:

- Teaching: Provide hands-on learning experiences for students enrolled in Food Science and related curricula.
- Research: Provide a state-of-the-art facility and technical assistance for conducting food and dairy-related research and development using Cornell's pilot plant facilities.
 - » Assist in the transfer of new technology from the research program to the industry.
 - » Provide facilities and staff support on a fee-for-use basis to assist companies and individuals with production and testing of product formulations provided by the client.
- Extension: Provide facilities for use in applied extension research and continuing education programs.

The facility has experienced full-time staff professionals who are able to assist in all aspects of food product development and processing. Companies/individuals can visit our facilities and work collaboratively with personnel, or the staff of the FPDL can process products to your specifications and ship it to you overnight. Customized small product development runs can be conducted with our established access to ingredients and raw materials.

The 10,000-square-foot main processing area is adjacent to our fully licensed operating dairy plant. It houses a NYS permitted, small scale HTST system capable of continuous pasteurization of batches as small as 100 gallons and multiple permitted cheese bats (with associated cheddar milling equipment, cheese press, etc.). This combination allows for scaling up of production in order to provide a variety of products for consumer demonstrations, food shows and exhibitions.

EQUIPMENT

DRYING CAPABILITIES

- » Model 1 Niro Atomizer Versatile Utility Spray Dryer – 22-kg/hr. evaporative capacity
- » 100SRC Virtis Freeze Dryer – 45.5 kg condenser ice capacity
- » Buflovak Laboratory Atmospheric Double Drum Dryer – 8-in. drying width

EVAPORATOR

- » Model Type E – Anhydro Laboratory Vacuum Evaporator (rising film)

ICE CREAM FREEZERS

- » Emory Thompson – 20-qt. batch freezer
- » Emory Thompson – 6-qt. batch freezer
- » Technogel 80 – continuous freezer
- » Plate Heat Exchangers – 1 pt./min. to 15 gal./min.

HTST/UHT PASTEURIZING EQUIPMENT

- » APV HTST Pasteurizer (400 gal/hr) Homogenization optional
- » Extended hold tube (to 4 min hold time)
- » Microthermics 25DH – 1 to 2 L/min. (HTST/UHT indirect steam application)

VAT PASTEURIZING EQUIPMENT

- » Walker Cone Bottom Processor – 40 min./100 gal. max capacity
- » 5 can vat pasteurizer (15 min/50 gal max capacity)
- » Additional Jacketed Vats – 400-gal. vats (2)

EXTRUSION TECHNOLOGY

- Wenger TX 52

CHEESE MAKING EQUIPMENT

- » Kusel A-Frame cheese press
- » Supreme Mini Mixer Mozzarella cheese stretcher
- » 2,250-gal. cheese vats
- » 300-gal. Cheddar cheese vat – 4 Damrow 5-can open vats
- » 2 Kusel “Double-O” 5-can automatic vats
- » 50 can Qualtech automatic cheese vat

GAULIN TWO STAGE HOMOGENIZERS

- » 42 to 1,000 gal./hr.

SEPARATORS/CLARIFIERS

- (1,750 lbs./hr. to 13,000 lbs./hr.)
- » Equipment Engineering Model 590
- » DeLaval Model 340
- » DeLaval Model 366
- » GEA KNA-3 Greek Yogurt Separator
- » CO₂ incorporation system
- » Various Membrane Systems

PACKAGING SYSTEMS

- » Koch Multivac vacuum sealer
- » Filler Specialties 1/2-gallon and gallon plastic jug filler

UTILITIES

- » Electrical, chilled water, steam (culinary and regular), reverse osmosis water and pressurized air

COOLERS

- » Various walk-in coolers and wind tunnels, temp range from -35 F to 105 F



FACILITIES AND EQUIPMENT

Dairy Processing Plant



CONTACT:

TIMOTHY BARNARD, Dairy Plant Manager,
Cornell University
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The Cornell Dairy Processing Plant (permitted by New York State Agriculture & Markets) supports the primary teaching, research and outreach missions of the Department of Food Science, the Cornell Institute of Food Science and the College of Agriculture and Life Sciences. Specifically, the Dairy contributes to undergraduate and graduate instruction in food science; to basic and applied dairy foods research; to public service through extension programs; and as a designated training facility for New York State Certified Milk Inspectors and New York State Department of Agriculture and Market Inspectors. As a by-product of its mission-based functions, the Cornell Dairy also produces fluid milk, juices, yogurt, pudding and ice cream products to be sold on the Cornell University, Ithaca campus, to offset the total costs incurred in the equipping and operations of the dairy plant.

DAIRY PROCESSING LABORATORY

The Dairy Processing Laboratory research focus areas include Food Safety Engineering and Food Quality. Research in the area of Food Safety Engineering focuses on the development of new and improved processing methods able to reduce the microbial load in food systems, of current interest being membrane separation and Pulsed Light treatment. The Food Quality component of research aims at elucidating the intermolecular interactions and structural transformations that occur during processing of dairy and complex foods, and using this understanding to improve their quality and functionality.

EQUIPMENT

- » Strain-controlled Advanced Rheometric Expansion System (ARES) (TA Instruments)
- » Zeta potential and particle size analysis instrumentation (Brookhaven Inc.)
- » Thermal analysis system (DSC and TGA, Seiko Instruments)
- » Pulsed Light treatment unit (Xenon Corp.)
- » Incubators
- » Colorimeter
- » Basic equipment for physical, chemical and microbiological analyses
- » Pilot scale, automated microfiltration unit equipped with ceramic membranes

MILK QUALITY IMPROVEMENT PROGRAM

The laboratories and staff of the MQIP are involved in a variety of applied research projects related to the quality and safety of milk and dairy products. A number of research projects are conducted in collaboration with the Cornell Food Science Department Food Safety Laboratory. Results from these research projects are rapidly communicated to the dairy industry, resulting in immediate improvements for the industry.

EQUIPMENT

Autoplate 4000- Q-Count

FOOD SAFETY LABORATORY AND LABORATORY FOR MOLECULAR TYPING

Research in Food Safety Laboratory focuses on the pathogenesis of foodborne diseases, pre- and postharvest food safety and on improving our understanding of the transmission of foodborne bacterial pathogens and spoilage from farm animals and from foods to humans. A better understanding of the transmission pathways of foodborne pathogens is necessary to design better strategies to prevent and control human disease. Both basic and applied research in the laboratory is targeted toward developing the scientific knowledge necessary to improve our ability to prevent foodborne diseases.

Current research in the Food Safety laboratory focuses on a number of dairy relevant pathogens including *Listeria monocytogenes*, *Salmonella*, and *Bacillus cereus* as well as detection identification, and tracking of different spoilage organisms (e.g., sporeformers, Gram-negative spoilage organisms [*Pseudomonas*, coliforms], as well as yeast and molds).



EQUIPMENT

- » RiboPrinter – Microbial Characterization System
- » Pulsed Field Gel Electrophoresis (PFGE)
– Genetic Fingerprinting
- » PCR and Sequence Based Characterization
(16S, rpoB, etc.)
- » Agilent 2100 Bioanalyzer, REP-PCR Based
Microbial Characterization
- » Illumina – Full Genome Sequencing
(Life Sciences Core Laboratory)
- » ABI Prism – Real Time PCR Detection System
- » Applied Biosystems Quant Studio 6Flex system for
quantitative PCR

FOOD SAFETY ENGINEERING AND FOOD QUALITY LAB

Moraru's group research program is dedicated to developing technical solutions for improving food safety and quality and to advancing the knowledge in the area of microbial, physical and engineering properties of foods, particularly dairy foods. Our efforts are channeled in two distinct research areas: Food Safety Engineering and Food Quality.



EQUIPMENT

- » Strain-controlled Advanced Rheometric Expansion
System (ARES) (TA Instruments)
- » Zeta potential and particle size analysis
instrumentation (Brookhaven Inc.)
- » Thermal analysis system (DSC and TGA, Seiko
Instruments)
- » Pulsed Light treatment unit (Xenon Corp.)
- » Colorimeter (Konica Minolta CR-400)

DAIRY FOODS ENGINEERING LABORATORY

The Dairy Foods Engineering Laboratory is engaged in research on experimental and theoretical aspects of bioseparation processes, high-pressure extrusion with supercritical fluids, cryogenic freezing, physical and engineering properties of biomaterials and novel food processing technologies. A major long-term goal is to develop new and improved unit operations for value-added processing of food and biomaterials. Derivative goals include new techniques for measurement and control of processes and properties for industrial applications.



EQUIPMENT

- » Supercritical fluid extraction, drying, sterilization
and nanoencapsulation systems for liquid and
solid foods
- » Supercritical fluid extrusion system
- » Texture Analyzer
- » Dynamic Mechanical Analyzer
and Brookfield viscometers
- » Differential scanning colorimeter
- » Dense gas freezing system



COURSES, SYMPOSIA AND EVENTS

- HTST Pasteurizer Workshop (3 times per year)
- Vat Pasteurizer/Cheese Grading Workshop (2 times per year)
- Yogurt and Fermented Dairy Products Workshop
- Certified Milk Inspectors School
- Dairy Laboratory Seminar
- New York State Cheese Manufacturers Annual Conference
- New York State Association for Food Protection Annual Conference
- Processing Plant Superintendent Schools (in cooperation with New York State Department of Agriculture and Markets Department of Dairy Services)
- The Science of Cheese (Cheese making) Workshop
- Fluid Milk Quality and Safety Workshop
- FSMA Preventative Controls Qualified Individual Training
- Membrane Filtration and Separation Workshop
- Pathogen Environmental Monitoring Workshop
- Food Safety Plan (HACCP) Training (2 times per year)

<http://dairyextension.foodscience.cornell.edu/extension-calendar>



HIGH PRESSURE PROCESSING

Coming Fall 2016 to Cornell's New York State Agricultural Experiment Station

HIPERBARIC 55

- A 55 L volume vessel, 200 mm diameter
- 22 m² surface requirement
- Automatic loading/unloading system
- Ergonomics and speed



FACILITIES AND EQUIPMENT

Cornell Sensory Evaluation Center



CONTACT:

ALINA STELICK Manager, Cornell University
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The mission of the center is two-fold: to provide training and hands-on learning opportunities to students that are interested in the fields of sensory and consumer research, and to help businesses develop and improve their product offering through consumer and sensory testing.

We conduct Sensory Evaluation and Consumer Product Research. Among the standard services that are offered to commercial clients are Consumer Acceptability, Preference and Discrimination Testing. The fees collected from our commercial clients go directly back to the Department of Food Science to support student programs and research (such as student product development teams, travel to conferences and competitions, scholarships, etc.)



FACILITIES AND EQUIPMENT

Cornell Institute for Food Systems Industry Partnership Program

CONTACT:



JULIE STAFFORD Industry Liaison Officer,
Cornell University
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The Cornell Institute for Food Systems Industry Partnership Program (CIFS-IPP) is an exciting public-private partnership that expands and enhances engagement of Cornell University faculty and staff with industry scientists, engineers, and business leaders throughout the food system. With expertise in business and industry, CIFS-IPP finds solutions to today's food system challenges while shaping tomorrow's discoveries. Together, we inform and advance industry practice with cutting-edge science that pushes our food industry partners to the forefront of research, development, and technology.



RESEARCHERS AND STAFF

DAVID M. BARBANO, PH.D.

Professor

Cornell University
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Membrane filtration of milk, improvement of chemical analysis methods for milk and dairy products, Fourier transform mid-infrared milk analysis – development of models to measure the fatty acid composition of milk, impact of milk somatic cell count on dairy product quality and yield. Methods for production of robust calibration samples for milk analysis. Microfiltration for bacteria and spore removal. Strategies to improve the safety of farmstead raw milk cheese.

KATHRYN J. BOOR, PH.D.

Dean/Professor

Cornell University
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Bacterial response and adaptation to environmental stresses; bacterial virulence; physiology and genetic characteristics of pathogenic bacteria; and dairy microbiology. Dr. Boor collaborates with the department's Food Safety Laboratory (FSL) and the Milk Quality Improvement Program (MQIP). Scientists in the FSL conduct basic and applied research in microbial food safety using the tools of molecular biology and microbiology. Scientists in the MQIP focus on identification and elimination of spoilage microbes in dairy food systems. Work in progress focuses on the genetics and physiology of foodborne bacterial pathogens and spoilage organisms, including *Listeria monocytogenes* and *Bacillus spp.* and related spore-forming bacteria.

NANCY CAREY

Research Support Specialist

Cornell University
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Data management and sensory analysis.

NICOLE HELEN MARTIN, M.S.

Research Support Specialist I

Cornell University
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Dairy microbiology and chemistry.

CARMEN I. MORARU, PH.D.

Associate Professor

Cornell University
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Dairy Foods Engineering, Food Safety Engineering. Specific research projects include: functionality and processing behavior of milk protein preparations obtained by membrane filtration, microfiltration processing for the physical removal of microorganisms from milk, pulsed light treatment for inactivation of microorganisms on food (including dairy) and food contact surfaces, and nanotechnology-based approaches for controlling microbial attachment to food contact surfaces. The broader objective of Carmen Moraru's research is to develop processes capable of delivering safe dairy foods of high quality and nutritional value.

ROBERT D. RALYEA, M.S.**Senior Extension Associate**

Cornell University
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Dairy systems environmental microbiology, product processing and regulations; small-scale dairy production; general food security and risk assessment

SYED S. H. RIZVI, PH.D.**Professor**

Cornell University
srizvi@cornell.edu

Physical and engineering properties of foods; bioseparation and extrusion processes; supercritical fluid-based extraction, sterilization, functionalization and texturization processes

MARTIN WIEDMANN, PH.D., DR. MED. VET.**Professor**

Cornell University
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Food Microbiology. Research focus includes: tracking and characterization of sporeforming bacterial contaminants through farm environments and dairy processing systems; development of molecular-based raw milk tests for the detection of psychrotolerant sporeforming bacteria; full genome sequencing of psychrotolerant sporeformers; influence of processing parameters on bacterial outgrowth in milk; evaluation of pasteurized milk quality using microbiological, sensory and chemical parameters; chocolate milk shelf-life extension and other areas concerning improvement of dairy product quality

ALINA STELICK**Sensory Program Manager**

Cornell University
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Sensory panel training

KIMBERLY BUKOWSKI**Extension Support Specialist**

Cornell University
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Dairy plant auditing, food safety systems; GFSI-Safe Quality Foods; good manufacturing practices; dairy manufacturing; ice cream; FSMA Preventive Controls

LOUISE FELKER**Extension Support Specialist**

Cornell University
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Workshop/short course organization and planning; food safety systems; good manufacturing practices; social media/web development; FSMA Preventive Controls

CARMELA BELICIU**Extension Support Specialist**

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Working with business owners to facilitate their use of FPD facilities; small-scale dairy production; specialty cheese instruction and manufacture; good manufacturing practices

ALIREZA ABBASPOURRAD, PH.D.**Assistant Professor**

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Food chemistry and ingredient technology

SAM ALCALINE, PH.D.**Assistant Professor**

Cornell University
Sda23@cornell.edu

Dairy cultures and fermentation; Dairy microbiology; food fermentations, spoilage organisms, bacteriophage; molecular biology. Dr. Alcaline's research focuses on developing technologies that improve the quality, safety, and potential applications of fermented dairy products and co-products. Current research program includes: mechanisms for control of spoilage organisms, applications of bacteriophage to improve health, dairy safety, and fermentation performance, as well as novel applications for co-products of dairy fermentations

TIMOTHY BARNARD**Dairy Plant Manager**

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DEANNA SIMONS**Quality Manager and Academic Programs Coordinator**

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MACKENZIE BROWN**FPDL Technician**

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SOUTHEAST DAIRY FOODS RESEARCH CENTER

www.sdfrc.ncsu.edu



North Carolina State University
(Raleigh)

Sensory Applications laboratory
(North Carolina State University)
www.ncsu.edu/sensory



CENTER DIRECTOR

MARYANNE DRAKE, PH.D.

Center Director
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OVERVIEW

The Southeast Dairy Foods Research Center, with facilities and support at North Carolina State University (Raleigh) has been operating since 1988 and actively participates in national research planning and execution on behalf of the dairy industry and other entities. The Southeast Dairy Foods Research Center will conduct research, educate scientists, and develop and apply new technologies for processing of milk and its components into dairy products and ingredients with improved health, safety, quality, and expanded functionalities. Areas of research emphasized in this center are notably in whey protein functionality, extended shelf-life processing, probiotics, dairy starter cultures, and the rheology, flavor, chemistry, and sensory quality of cheese and dairy ingredients. The center also hosts a Food Rheology Laboratory, Nutrition Technical Services Laboratory and a Sensory Applications Laboratory, conducting analytical, qualitative and affective sensory tests and flavor chemistry analyses tailored to meet specific needs of the food industry.

RESEARCH FOCUS

- Milk protein and whey ingredient functionality
- Thermal and biological processing
- Extended shelf-life processing
- Sensory properties and flavor chemistry of cheese and dairy ingredients
- Dairy food safety
- Dairy starter cultures and probiotics

SENSORY APPLICATIONS LABORATORY

The Sensory Applications Laboratory at North Carolina State University specializes in dairy sensory and flavor chemistry analysis, including consumer testing (qualitative and quantitative), preference mapping, instrument flavor analysis techniques (gas chromatography mass spectrometry, gas chromatography olfactometry and HPLC) and descriptive analysis. The center maintains three trained descriptive panels. Ongoing flavor research is primarily focused on dairy products (including milk, cheese, milk powders, whey proteins and butter), dairy ingredients applications, and how flavor varies with processing and storage. A specific focus is development of defined sensory languages and the application of these languages to enhanced product understanding, links to volatile compounds (flavor chemistry) and enhanced consumer understanding.

FOOD RHEOLOGY LABORATORY

The research objective of the Food Rheology Laboratory at North Carolina State University is the explanation of the physical chemistry, molecular-level interactions and effect of processing conditions within a food system, through an understanding of rheological behavior, while solving processing and product development problems facing the food industry. Particular emphasis is placed on evaluating rheological contributions to sensory properties of materials during oral processing. The laboratory maintains a full complement of high-precision rheometric, viscometric and compression/extension equipment for complete characterization of food material properties as they relate to material structure and texture. Complementary techniques including tribology and acoustic emission are being developed in the laboratory to expand the scope of research capabilities with respect to food material characterization functionality.



FACILITIES AND EQUIPMENT

North Carolina State University

CONTACT:

MARYANNE DRAKE , PH.D.

Director, Southeast Dairy Foods Research Center
919-513-4598
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EQUIPMENT

- » Cherry-Burrell EQ-3 ESL Gable-top filler
- » LiquiBox Semi-automatic Bag-n-box filler
- » HTST system (700/350 gal./hr.)
- » Feldmeier tubular ultrapasteurization booster
- » DeLaval 590 cold milk separator
- » Multiple batch tanks
- » Admix Rotosolver submersible mixer
- » Tri-clover blender
- » CEM SMART Trac fat/solids analysis system
- » APV Gaulin 2-stage homogenizer
- » Ice cream processing
- » Tetra Hoyer Frigus 600 freezer
- » Tetra Hoyer FF 2000 ingredient feeder
- » Tetra Hoyer variegation system
- » Sweetheart rotary 4-oz. cup filler
- » Sawvel rotary pint cup filler
- » Shrink-wrap oven
- » Cheese vat – 300 gal. (automatic stir, jacketed)
- » Kusel 4MX cheese vat – 65 gal.
- » Manual cheese vat – 50 gal. (jacketed)
- » Cheddar mill
- » Cheese hoops and presses
- » Koch vacuum sealer
- » VRC multicoil processor XXI
- » Feldmeier tubular heat exchanger
- » 75-kw continuous microwave processor
- » Marlen piston pump Model 629
- » ASTEPO low-acid aseptic Bag-n-box filler
- » Radio Frequency Co. Macrowave processor
- » Superspeed and ultracentrifuges

- » Gas chromatography/mass spectrometry (GC/MS)
- » Gas chromatography olfactometry (GCO)
- » Benchtop micro- and ultrafiltration
- » Pilot scale ultrafiltration
- » High-pressure liquid chromatography (HPLC)
- » Microscopy: light, phase and fluorescent
- » Microbiological support laboratory
- » Autoclaves
- » Rheometers
- » Electrophoretic analyses: DNA and protein
- » DNA fingerprinting
- » Kitchen preparation room
- » Consumer testing booths with Compusense
- » Descriptive panel room
- » Sensory panel room
- » Atomic absorption spectrophotometry
- » Visible, UV and fluorescent plate readers
- » Mammalian cell culture
- » Stock retort and can sealer
- » Anhydro pilot scale spray dryer
- » Buchi benchtop spray dryer
- » Retort – approx. 120 1-lb. cans
- » Kemotech smoking room – 4- by 5-ft. firebox
- » CEM microwave moisture analyzer
- » APV homogenizer – 2 stages
- » Gas chromatographs (GC), GC-MS, GC-O
- » HPLC, LC-MS
- » Mass spectrometers (MS)
- » Spectrophotometers

SENSORY SERVICE CENTER

Analytical Technology & Equipment

Perkin Elmer Inductively Coupled Plasma-Optical Emission Spectrometer (ICP-OES)

- » Mineral and element analysis
- » Can be used with liquid, semi-solid, and solid samples

HunterLab Colorimeter

- » Can measure samples in both reflection and transmission of colors, spectral reflectance and transmission of samples
- » Ability to analyze opaque solids, clear liquids, transparent films, powders, and opaque liquids
- » Allows for analysis of color change of samples over time in support of data from other analytical analysis techniques

Agilent Technologies GC/MS/MS

- » Agilent tandem GC/MS System
- » Analysis of volatile compounds in very low concentrations
- » Analysis of degradation products that play a role in flavor
- » Equipped with Gerstel sniffer port

Agilent Technologies GC/MS

- » Three (3) - Agilent GC/MS systems
- » Equipped for Solid Phase MicroExtraction (SPME)
- » Volatile analysis of a variety of sample types

Agilent Technologies GC/MS with Thermal Desorption Unit (TDU)

- » Able to analyze lower volatility compounds by heating the sorption onto a substrate for introduction into the GCMS
- » Suited for liquid, gaseous, and solid samples
- » Equipped with Gerstel Twister technology that allows Stir Bar Sorptive Extraction (SBSE)
- » Equipped with Gerstel sniffer port

Agilent Technologies GC/O

- » Two (2) - Agilent GC Olfactometry Systems
- » Human Nose as the detector for compounds
- » Used in conjunction with GC/MS to determine flavor compound quantification

Waters HPLC

- » Separation of nonvolatile compounds in liquids for qualification with various detectors
- » Equipped with Photo Diode Array (PDA), Refrac- tive Index (RI) detectors
- » Previous work analyzing sugar alcohols, furosine, phospholipids

Waters Aquity UPLC/MS

- » Separation of nonvolatile compounds in liquids for qualification with various detectors
- » Higher pressure allows for shorter run times, and better resolution of compounds over traditional HPLC
- » Equipped with Photo Diode Array (PDA), Evaporative Light Scattering (ELS), Fluorescence, and mass spectrometry detectors
- » Previous work analyzing carotenoids, norbixin, organic acids, lysoalanine

Delta Instruments Lactoscope

- » Ability to measure many different basic components found in the milk (fat, protein, lactose, solids)
- » Able to determine other important components of milk: Casein, Density, True Protein, NPN/Calculated Urea, and pH

Malvern Particle Size Analyzer

- » Rapid and effective wet dispersion for particle analysis in liquids
- » Fast particle size measurement of fragile and cohesive dry powders

Formulation Turbiscan

- » Analysis of particles in liquid suspensions in very complex mixtures with multiple dispersed components
- » Used to measure the mean particle size on concentrated media, as no dilution nor sample stress are required
- » Analysis of agglomerates or flocs without altering the particle size of the liquid sample



COURSES, SYMPOSIA AND EVENTS

- HTST Pasteurizer Operator shortcourse (2 times per year)
- Dairy Supplier Sensory on/offsite (4 times per year)
- Antibiotic residuals course (dairy farm)
- FDA Training Dairy and Food Processing
- Sensory and Instrumental Analysis of Dairy Flavors Short Course
- FS 324 Milk and Dairy Products (Internet-based distance education course)
- FS 554 Lactation, Milk and Nutrition
- Cheese Making Short Course



RESEARCHERS AND STAFF

JON ALLEN, PH.D.

Professor of Food, Bioprocessing and Nutrition Sciences

*North Carolina State University
jon_allen@ncsu.edu*

Mammary gland biology and lactation; milk composition, chemistry and functional properties; mineral and vitamin nutrition and metabolism; food allergy; epithelial transport; regulatory biology; nutrition education; diabetes and obesity; glycemic index

GARY CARTWRIGHT

Dairy Enterprise System Director

*North Carolina State University
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Dairy processing, aseptic processing and packaging, continuous-flow microwave processing



CHRISTOPHER R. DAUBERT, PH.D.

Department Head and Professor of Food,
Bioprocessing and Nutrition Sciences
Director of Food Rheology Laboratory

North Carolina State University
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Process cheese structure and texture; functionality of dairy ingredients; protein interactions in gel formation; fracture and texture design of dairy products

MARYANNE DRAKE, PH.D.

Director SDFRC, William Neal Reynolds Distinguished Professor, Food, Bioprocessing and Nutrition Sciences, and Director of DMI Sensory Applications Laboratory and NCSU Sensory Services Center

North Carolina State University
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Sensory perception and chemistry of dairy flavors; understanding consumer needs, including market drivers and segmentation

E. ALLEN FOEGEDING, PH.D.

William Neal Reynolds Distinguished Professor
Department of Food, Bioprocessing and Nutrition Sciences

North Carolina State University
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Whey and milk protein ingredient functionality; using dairy proteins to design food structures with desirable properties regarding texture and health; controlling astringent flavor and stability in high-protein/high-acid drinks

TODD KLAENHAMMER, PH.D.

Distinguished University Professor and William Neal Reynolds Distinguished Professor,
Department of Food, Bioprocessing and Nutrition Sciences

North Carolina State University
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Microbiology of starter cultures and probiotics; controlling fermentations and understanding probiotic bacteria through genomics

CLINT STEVENSON, PH.D.

Assistant Professor and Distance Education
Coordinator Department of Food, Bioprocessing and Nutrition Sciences

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Assessing the effectiveness of various teaching methods and instructional design, determining the education, training and workforce needs in dairy food safety and quality assurance, and applied quality control research projects

CARL HOLLIFIELD

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Directs business operations of the Southeast Dairy Foods Research Center and the farm to processing Dairy Enterprise System

RODOLPHE BARRANGOU, PH.D., MBA

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Bioprocessing and Nutrition Sciences

North Carolina State University
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Laboratory focuses on the biology and genetics of CRISPR-Cas immune systems in bacteria, using microbiology, molecular biology and genomics approaches investigate the use of CRISPR-Cas systems

JOSIP SIMUNOVIC, PH.D.

Research Associate Professor, Department of Food,
Bioprocessing and Nutrition Sciences

North Carolina State University
josip_simunovic@ncsu.edu

Conventional and advanced aseptic processing, continuous-flow microwave thermal processing, monitoring and validation of thermal processes for high-acid and low-acid dairy, particulate/multiphase foods and biomaterials

WESTERN DAIRY CENTER



Utah State University
(Logan)

www.usu.edu/westcent



CENTER DIRECTOR

DONALD J. MCMAHON, PH.D.

Center Director

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OVERVIEW

The Western Dairy Center serves as a dairy foods research network in the western United States with a mission of fostering participation and success by students in research activities that can lead to employment in the dairy manufacturing industry as well as academia. This is achieved through its dairy industry funded BUILD Dairy program designed to Build University-Industry Linkages through Learning and Discovery. BUILD Dairy students are supervised by professors from Utah State University, University of Idaho/Washington State University, Oregon State University, Brigham Young University, Weber State University and Texas A & M University. Included in the BUILD Dairy program are opportunities for undergraduate research, as well as Masters and PhD research involving a range of dairy food topics. The BUILD Dairy students participate in leadership and other activities that increase their understanding of dairy food technology and its important in innovation, quality and manufacturing.

RESEARCH FOCUS

- Cheese flavor and functionality
- Cheese technology
- Fermented products, including cheese and yogurt
- Ultra-high-temperature and extended-shelf-life fluid milk beverages
- Milk protein chemistry, including coagulation, denaturation and separation
- Dairy flavor chemistry
- Milk technology and microbiology
- Concentrated milks and product performance
- Anaerobic digestion of dairy processing waste
- Whey protein extrusion
- Application of genetics, genomics and metabolomics to lactic acid bacteria
- Starter cultures for cheese and cultured dairy products.
- Whey and milk utilization
- Microstructure of dairy products
- Sensory analysis
- Butterfat emulsions and crystallization



FACILITIES AND EQUIPMENT

To Arrange Training Courses at
Utah State University



CONTACT:

KIM RASMUSSEN

BUILD Dairy Program Coordinator
435-797-3466
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ALLEN SAYLER

Adjunct Principal Instructor
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asayler@cfsrs.com



FACILITIES AND EQUIPMENT

For Training Courses at
Oregon State University



CONTACT:

LISBETH GODDIK

Extension Specialist in Dairy Technology
541 737 8322
Lisbeth.goddik@oregonstate.edu



COURSES, SYMPOSIA AND EVENTS

Utah State University

- Basic Cheese Making Short Course
- Advanced Cheese Making Short Course
- GMP Workshop
- HACCP Workshop
- Advanced Sanitation Workshop

- Employee Train-the-Trainer Food Safety
- Statistical Process Control Workshop
- Safe Quality Foods Workshop
- FSMA Update Workshop



RESEARCHERS AND STAFF

JEFF BROADBENT, PH.D.

Professor, Dairy Microbiology
Utah State University
jeff.broadbent@usu.edu

Genomics of lactic acid bacteria, nonstarter lactic acid bacteria in cheese; effect of oxidation reduction potential on growth of lactic acid bacteria; use of adjunct cultures

CHUCK CARPENTER, PH.D.

Professor and Department Head, Food Sciences
Utah State University
chuck.carpenter@usu.edu

Muscle biochemistry and physiology, meat processing, microbial pathogens

MICHELE CULUMBER, PH.D.

Professor, Microbiology
Weber State University
mculumer@weber.edu

Immunology, Molecular Biology, Biotechnology

JOY WAITE-CUSIC, PH.D.

Assistant Professor, Food Science and Technology
Oregon State University
joy.waite-cusic@oregonstate.edu

Dairy microbiology

MICHAEL DUNN, PH.D.

Professor, Nutrition, Dietetics & Food Science

Brigham Young University
michael_dunn@byu.edu

Food technology, Micronutrient fortification and stability, folic acid content of foods, and long-term storage stability of staple foods and commodities

LISBETH GODDIK, PH.D.

Professor and Ext. Specialist in Dairy Processing, Food Science and Technology

Oregon State University
Lisbeth.goddik@oregonstate.edu

Dairy processing and technology

HELEN JOYNER, PH.D.

Assistant Professor, Food Sciences

University of Idaho
hjoyner@uidaho.edu

Rheological and tribological properties of foods

SILVANA MARTINI, PH.D.

Professor, Lipids, Sensory Evaluation

Utah State University
silvana.martini@usu.edu

Technologies for designing healthy, high-quality, fat-containing foods for today's consumer; fat crystallization and phase transition theory; encapsulation; relationships between physicochemical properties of fats and emulsions and sensory characteristics

DONALD J. MCMAHON, PH.D.

Director, Western Dairy Center
Director, BUILD Dairy Program
Professor, Dairy Food Processing

Utah State University
donald.mcmahon@usu.edu

Structure and function of casein proteins, milk coagulation, cheese manufacture, cheese texture and functionality

GIULIANA NORATTO, PH.D.

Research Assistant Professor, Food Science and Technology

Texas A&M University
gnoratto@tamu.edu

Bioactive compounds, Gut health

BRIAN NUMMER, PH.D.

Professor, Extension Food Safety Specialist

Utah State University
brian.nummer@usu.edu

Food safety manager education, retail-foodservice food safety, small food entrepreneur food safety, home food storage, HACCP short course

CRAIG J. OBERG, PH.D.

Regents Professor, Microbiology

Weber State University
coberg@weber.edu

Cheese starter cultures, microbiology of lactic acid bacteria, probiotic cultures

MICHAEL QIAN, PH.D.

Professor, Food Science

Oregon State University
michael.qian@oregonstate.edu

Flavor chemistry, food analysis and dairy chemistry; characterization of aroma compounds, and chemical and biological generation in dairy, small fruits and wines; instrumental analysis of food components

KIMBERLY RASMUSSEN

BUILD Dairy Program Coordinator

Utah State University
kimberly.rasmussen@usu.edu

FROST STEELE, PH.D.

Associate Professor

Brigham Young University
frost_steele@byu.edu

Dairy food microbiology and enzyme systems

RANDALL THUNELL, PH.D.

Adjunct Professor

Utah State University
almut.vollmer@usu.edu

Dairy starter cultures

J. ANTONIO TORRES, PH.D.

Distinguished International Professor

Monterrey Institute of Technology
Dr.J.Antonio.Torres@gmail.com

Novel and conventional applications of high-pressure processing with emphasis on bacterial spore inactivation mechanisms, in-line/real-time optical polarization measurements in food systems

ALMUT VOLLMER, PH.D.

Research Assistant Professor

Utah State University
almut.vollmer@usu.edu

Biostructure of dairy foods such as milk, cheese, emulsion, powders using scanning and transmission microscopy

MARIE WALSH, PH.D.

Professor, Dairy Chemistry

Utah State University
marie.walsh@usu.edu

Whey proteins (formulation, extrusion and production) in snack foods and meat extenders; immobilized enzyme reactors



ROBERT WARD, PH.D.

Associate Professor, Bioactive Food Components

Utah State University
robert.ward@usu.edu

Lipid analysis and metabolism, plus novel bioactivities associated with the milkfat globular membrane



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National Dairy Council™
National Dairy Foods Research Centers

