



NATIONAL DAIRY FOODS RESEARCH CENTERS

RESEARCH AND INNOVATION RESOURCES



**DAIRY INNOVATION
LABS**



**FACILITIES AND
EQUIPMENT**



**TECHNICAL TRAINING
AND SHORT COURSES**



**TECHNICAL
ASSISTANCE**



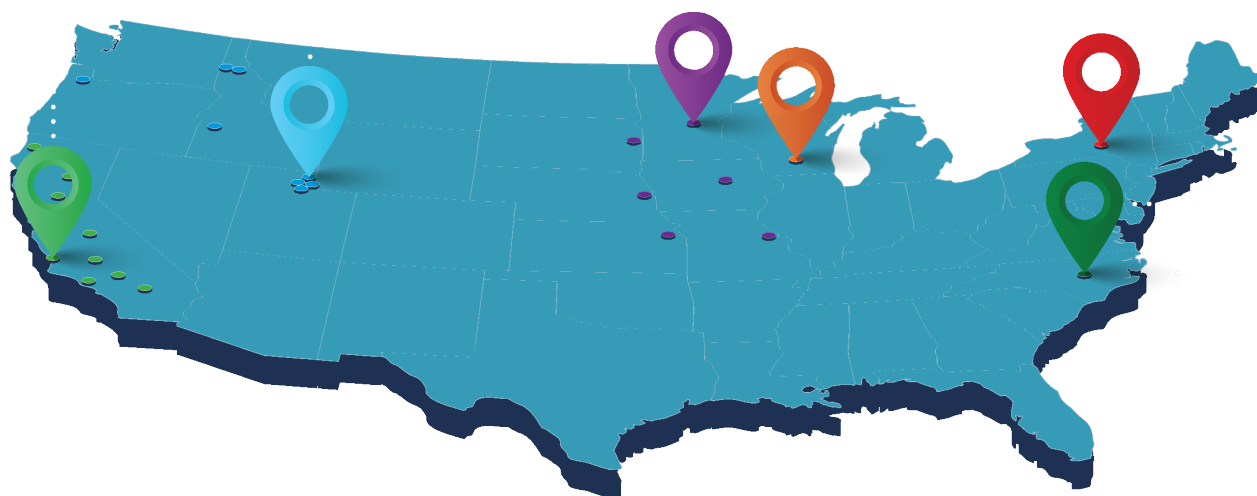
**FUTURE
PROOFING**

NATIONAL DAIRY FOODS RESEARCH CENTERS

National Dairy Foods Research Centers, supported by Dairy Management Inc. (DMI), ensures the U.S. dairy industry stays relevant to consumer needs and preferences, drives innovation, contributes to a healthier planet and creates a profitable and agile U.S. dairy value chain.

Established in 1987, the network is made up of six dairy centers encompassing over 20 universities across the U.S. The Centers' mission is to ensure that the U.S. dairy industry continues to nourish the world by offering safe, quality and innovative dairy products. The mission is enabled by providing the dairy industry access to research leaders who provide innovative solutions through their world-renowned research programs. The Centers are also instrumental in developing talent who are the industry's future. The dairy innovation labs at the Centers assist the industry in concept creation, prototype development, troubleshooting, scale-up and sensory services. The Centers also offer technical training and short courses that ensure that the industry talent is continuously updated on technological advancements in product innovation, quality and safety.

For over 30 years, the Centers have contributed to building a vibrant U.S. dairy industry that continues to innovate and nourish the world.



**CALIFORNIA
DAIRY
INNOVATION
CENTER**

**WESTERN
DAIRY
CENTER**

**MIDWEST
DAIRY
CENTER**

**CENTER
FOR DAIRY
RESEARCH**

**NORTHEAST
DAIRY FOODS
RESEARCH
CENTER**

**SOUTHEAST
DAIRY FOODS
RESEARCH
CENTER**



Dairy Management Inc.™ (DMI) is funded by America's nearly 28,000 dairy farm families, 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.

TABLE OF CONTENTS

DMI DAIRY PRODUCTS RESEARCH AND DEVELOPMENT 4

CALIFORNIA DAIRY FOODS RESEARCH CENTER 5

Overview.....	5
Facilities and Equipment.....	6
Dairy Products Technology Center	6
Overview	6
Research Focus	6
Application Program and Prototyping	6
Equipment.....	7
Supporting Analytical Equipment	8
Education and Training.....	8
Staff and Researchers	9
Department of Food Science and Technology,	
Milk Processing Lab.....	10
Overview	10
Milk Processing Lab	10
Research Focus	10
Equipment.....	11
Supporting Analytical Equipment	11
Education and Training.....	12
Staff and Researchers	12
Dairy Science Academics & Research.....	14
Overview	14
Research Focus	14
Facilities.....	15
Equipment.....	16
Supporting Analytical Equipment	16
Sensory Evaluation.....	16
Courses, Symposia and Events	16
Staff and Researchers	17

THE CENTER FOR DAIRY RESEARCH 21

Overview.....	21
Research Focus	21
Cheese.....	22
Dairy Protein/Ingredients and Processing	22
Aseptic/UHT Beverage Innovation Facility.....	22
Analytical Services	22
Safety/Quality Applications	23
Entrepreneurship.....	23
Sensory Analysis	23
Facilities and Equipment.....	24
The Center for Dairy Research	24
Overview	24
Equipment.....	24
Cheese Manufacturing	24
Full Cream Cheese Manufacturing Line.....	25
Cold Pack and Process Cheese Manufacturing Line.....	25
Other Various Equipment Used in the Processing,	
Converting and Packaging of Cheese.....	25
Aseptic Beverage Line.....	26
Dairy Ingredient Processing Equipment	26
Ice Cream Equipment.....	26
Supporting Analytical Equipment	26
Courses, Symposia and Events	29
Communications and Other Resources	29
Staff and Researchers	30

MIDWEST DAIRY FOODS RESEARCH CENTER 34

Overview.....	34
Research Focus	34
Facilities and Equipment.....	35
University of Minnesota.....	35
Facilities	35
Equipment.....	35
South Dakota State University	36
Equipment.....	36
Analytical Capabilities.....	36
Iowa State University	38
Facilities	38
Equipment.....	38
Courses, Symposia and Events	38
Staff and Researchers	39

NORTHEAST DAIRY FOODS RESEARCH CENTER 42

Overview.....	42
Research Focus	42
Facilities and Equipment.....	43
Food Processing and Development Laboratory	43
Overview	43
Equipment.....	44
Cornell Dairy Processing Plant	45
Overview	45
Cornell Sensory Evaluation Center.....	45
Overview	45
Seneca Foods Food Venture Center and	
Pilot Plant at Cornell AgriTech.....	46
High Pressure Processing Validation Center.....	46
Cornell Institute For Food Systems Industry	
Partnership Program	46
Overview	46
Courses, Symposia and Events	47
Staff and Researchers	47

SOUTHEAST DAIRY FOODS RESEARCH CENTER 50

Overview.....	50
Research Focus	50
Sensory Applications Laboratory.....	51
Food Rheology Laboratory	51
Facilities and Equipment.....	51
North Carolina State University.....	51
Equipment.....	51
Sensory Service Center.....	52
Analytical Technology & Equipment	52
Courses, Symposia and Events	53
Staff and Researchers	54

WESTERN DAIRY CENTER..... 55

Overview.....	55
Research Focus	55
Facilities and Equipment.....	56
Equipment.....	57
Boise State University.....	57
Brigham Young University	58
Brigham Young University-Idaho	60
Oregon State University	61
Utah State University.....	62
Washington State University.....	63
Weber State University.....	65
Courses and Events	66
Staff And Researchers.....	66

DMI DAIRY PRODUCTS RESEARCH AND DEVELOPMENT



DAIRY MANAGEMENT INC.

Rosemont, IL

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OVERVIEW

Among the priorities of DMI is to deliver breakthrough science and innovations to redefine U.S. dairy wellness and product leadership. It also aims to renew U.S. dairy's image and relevance to build trust and grow incremental and sustainable sales. The Dairy Products Research team strives to advance these priorities through targeted research and development activities that address consumer needs and expand dairy choices in domestic and international markets. The group develops and executes a strategic plan for the product research program. This includes funding research projects at various dairy research centers and universities in the U.S. These programs lead to cutting-edge research findings, platform technologies, and quality and food safety solutions that enable the U.S. dairy industry to generate high-quality, innovative products and ingredients.

Furthermore, the group directs strategic resources to offer expert product/process development, technical support, and food safety and quality resources to the U.S. dairy industry. Developing current and future workforce through education and development through the National Dairy Foods Research Centers is also one of our primary goals. The team also ensures that the industry adopts platform technologies from our research partners to ensure a sustainable and innovative U.S. dairy value chain. We strive to future-proof the U.S. dairy industry by sponsoring and supporting transformative technologies and tapping the collective expertise of our 138+ experts across our dairy centers to drive innovation and address current and future challenges.

CALIFORNIA DAIRY INNOVATION CENTER



DAIRY PRODUCTS TECHNOLOGY CENTER (DPTC)

California Polytechnic State University
San Luis Obispo, CA

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY MILK PROCESSING LAB

University of California - Davis, CA

DAIRY SCIENCE ACADEMICS & RESEARCH

Jordan College of Agricultural Sciences
and Technology (JCAST)
California State University - Fresno, CA

RANNEY FOOD PROCESSING LAB

Chapman University - Orange, CA

STUDENT INNOVATION IDEA LABS

CalPoly Pomona - Pomona, CA

OTHER UNIVERSITY PARTNERS

San Diego State University
California State University, Chico
California State University, Long Beach
CalPoly Humboldt



CENTER DIRECTOR

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OVERVIEW

The CDIC is a collaboration of California dairy producers, processors and universities focused on one primary objective: driving dairy innovation. The CDIC operates across major universities in California, in collaboration with the California Dairy Research Foundation (CDRF), as well as the other dairy research centers funded by Dairy Management Inc. across the country and industry representatives. The CDIC also partners, as needed, with leading international research organizations, experts and key solution providers throughout the supply chain. The major academic collaborators of the CDIC are California Polytechnic State University, San Luis Obispo, the University of California, Davis, Fresno State University, Fresno, Chapman University, Orange and CalPoly Pomona, Pomona.

The CDIC's program of work is guided by a Steering Committee which helps develop the Center's Strategic Plan and provides guidance for the execution of research programs as well as educational activities. The focus of the Center is on product, packaging innovation as well as training and education of the current and future California dairy's workforce. CDIC also support the CMAB's product innovation competitions, brand managers and entrepreneurs, and California dairy processors of all sizes through services ranging from technical support to training programs. In addition to the major academic institutions listed in this brochure, the CDIC works with other research institutions, private labs, consultants and experts in their field, domestically and internationally, to deliver best-of-class expertise to the industry throughout the supply chain.



FACILITIES AND EQUIPMENT

DAIRY PRODUCTS TECHNOLOGY CENTER

California Polytechnic State University
San Luis Obispo, CA

OVERVIEW

The Dairy Products Technology Center (DPTC) conducts applied and strategic dairy research and development in the areas of product technology and utilization, ingredient 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. A diverse, highly experienced staff offers a broad set of expertise, and is called upon by dairy foods processors of all sizes for a range of services, as well as extensive research projects.

Facilities at the DPTC are state-of-the-art, equipped with advanced and routine analytical equipment, dairy foods pilot plant, and a commercially licensed dairy processing facility. The DII 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 DPTC is the Cal Poly dairy farm, where fresh milk is available for research and development activities, as well as raw material for the creamery's operations. Faculty from both the Animal Science and Food Science & Nutrition Departments of the College of Agriculture, Food & Environmental Sciences provide expertise and support programs.

RESEARCH FOCUS

The Dairy Products Technology 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. Areas of research and expertise include:

- 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)
- Dairy nutrition and health (probiotics, bioactive ingredients and components)
- Dairy quality assurance (food safety, environmental stewardship, testing methods development)

APPLICATION PROGRAM AND PROTOTYPING

This program provides technical support to innovators, start-ups, manufacturers, users and marketers of milk and dairy ingredients. It involves transfer of existing research information, technical training, 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. Services are available on a fee-for-service basis. The pilot plant is widely used by industry for the development of prototypes, testing of processes, and to support entrepreneurs as well as large-scale processors. 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.



CONTACT:

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Director

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Applications support and specialized analytical capabilities are also available on campus in the extensive Boswell Ag Tech Center opened in 2022. Functions include an experience innovation lab, teaching and research instrumentation laboratory, a nutrition and food and beverage laboratory. The new Center features a culinary teaching lab, sensory analysis teaching and research lab, and food safety laboratories.

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.



EQUIPMENT

COMMERCIAL CREAMERY 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)
- » Scholle filler for 3- to 6-gallon bags
- » 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)
- » Open, water-jacketed cheese vats (Stoelting 500 gallons, Kusel 2-100 gallons)
- » 150-gallon Damrow Double-O enclosed cheese vat
- » Koch vacuum packaging system (1- to 40-lb. block)
- » Miscellaneous tanks and pumps – Highshear Silverson mixer
- » Cold storage (-15 to -40 F) (approx. 200 sq. ft.)

PILOT PLANT EQUIPMENT (RESEARCH USE ONLY)

- » Microthermics UHT (direct and indirect heating) with clean-fill hood and aseptic homo (25 L/hr)
- » 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)
- » Two Universal 50-gal specialty cheese vats
- » 4 Groen process steam kettles (40-60 gallon capacity)
- » Spiral-wound DDS UF and RO system (50 to 100 L/hr)
- » 2-50 L Cheese Vats
- » 2-50 L electric batch butter churn
- » Egli continuous pilot-scale butter churn (1 to 2 lbs/min)
- » Niro Filterlab spray dryer FLG-60 (60 lb./hr. water evaporation rate, capable of drying milk, whey and agglomeration)
- » Yogurt/ Batch Pasteurizer 50 L
- » DA 7250 NIR Analyzer
- » Thermomix TM6
- » Fromaggio Cheese Maker



SUPPORTING ANALYTICAL EQUIPMENT

In addition to the specialized equipment listed below, the DPTC 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.

Furthermore, the DPTC works with several departments on campus (Materials Engineering, Biological Science, and Food Science & Nutrition) for more specialized expertise, instrumentation, and processing equipment.

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

Texture analyzer

- » Texture profile analysis, firmness, etc.

Hunter colorimeter

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

Block digestion and distillation system

- » Nitrogen/protein analysis

Autotitration system

- » Determination of buffering capacity

Water activity meter

- » Water activity measurement

Countertop food dehydrator

- » Food dehydration



EDUCATION AND TRAINING

In addition to the dairy processing and product development classes offered as part of the University's curriculum, the DPTC offers focused short courses throughout the year which are designed to meet the needs of the current workforce, as well as other educational events, lectures, conferences and symposia.



STAFF AND RESEARCHERS

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Dairy products development, cheese and sensory evaluation.

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Cheese technology research focusing on texture and functional properties, laboratory analysis of industry products.

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Center and programs administration.

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Organization of short courses, training. Specialty cheese production expert, food safety.

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Dairy foods and health: prebiotics, probiotics, and bioavailability of minerals; clean-label ice-cream processing; MPC functionalities.

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Food and labeling regulations, food safety.

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Sensory evaluation of dairy foods and ingredients, product development.

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Applied economics, entrepreneurship innovation and consumer research

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Food marketing, economics of obesity, nutrition labeling consumer demand analysis

ADDITIONAL EXPERTISE:

Product Packaging Research and Testing is also available at Cal Poly through the Cal Pack Lab. Contact staff for more information.





FACILITIES AND EQUIPMENT

DEPARTMENT OF FOOD SCIENCE AND TECHNOLOGY MILK PROCESSING LAB

University of California
Davis, CA



CONTACT:

BRUNA PAVIANI

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OVERVIEW

The Department of Food Science and Technology features the Milk Processing Lab, which offers services to the industry, as well as numerous specialized laboratories focused on specific areas of milk processing and nutritional attributes, staffed by experts in their respective fields.

UC-Davis features extensive research capacity in state-of-the-art laboratories and faculty engages in collaborative research with dairy industry processors domestically and internationally.



MILK PROCESSING LAB

The state-of-the-art 800 square foot Milk Processing Laboratory was designed and built to enable collaborative and multi-disciplinary food science research to bring exciting innovations to the food industry, particularly in the realm of novel methods for the fractionation and recovery of bioactive milk components. The Milk Processing Lab provides an excellent resource for scholarly research as well as collaborations with dairy industry partners.

The facility features 110/208/480 V (single & three-phase) power supplied by eight utility stations, steam, chilled and RD water, an isolated drainage system, and HEPA filtration to ensure air quality. Additionally, the Milk Processing Lab complies with all specifications required to produce materials for animal trials with an approved Institutional Review Board protocol. Outside the Milk Processing Lab, is a facility of 300 square feet featuring ambient equipment storage to pretreat larger volumes of raw materials as well as a walk-in fridge and walk-in freezer to store processing samples.

RESEARCH FOCUS

The Milk Processing Laboratory enables the scale-up of bench-top research to the transitional pilot plant stage before it can be implemented commercially. The Milk Processing Lab boasts a highly flexible design with all equipment mounted on wheels. This flexibility and the variety of equipment enables the exploration of a wide range of research concepts. Research in the milk lab aims to increase our understanding of the chemical and biological properties of milk components; specifically, this involves separation, characterization and then incorporation into foods.

The Milk Processing Lab is frequently utilized to isolate and characterize bioactive milk components, as well as to develop and prepare samples for studies on packaging, stability, and novel ingredient formulation. To date, the lab has played a pivotal role in advancing research efforts, including isolating and testing bioactive milk compounds through safe and environmentally friendly methods prior to their application as functional food ingredients. Additional work has focused on dairy fluid processing, the fermentation of lactose and monosaccharides, stability testing, preparing samples for clinical studies, and the development of innovative dairy ingredients and products.

Partners span companies of all sizes, from start-ups to multinational corporations and cover nearly every facet of the food and beverage industry including all types of dairy products, infant formula, breast milk, water treatment and processing co-products or by-products. Simultaneously, the facility enables the training of students on the latest separation and analytical technologies.



EQUIPMENT

The Milk Processing Lab is designed to be highly flexible by having all of the equipment on wheels and the Microthermics equipment at the MPL is certified by Nationally Recognized Testing Laboratory (NRTL).

PROCESSING SYSTEMS

- » Pasteurizer/UHT Unit (Microthermics)
 - › Can perform HTST and UHT pasteurization on milk, skim, or cream
 - › Pilot plant scale, typically operated at 2 L per min, CIP cleanable
- » Homogenizer (GEA)
 - › 2 stages to maximize homogenization
 - › In-line with Microthermics HTST/UHT unit
 - › Pilot plant scale and CIP cleanable
- » Filler with automatic fill control
 - › Capable of aseptic filling in a ultra-clean filling environment
 - › In-line with Microthermics HTST/UHT unit
 - › Pilot plant scale and CIP cleanable
- » Membrane filtration (GEA)
 - › Capable of micro, ultra and nano-filtration and reverse osmosis to isolate milk bioactive components
- › Operates with flat sheet or spiral (up to 3 membranes in series)
- » Cream Separator (GEA)
 - › Separates raw milk into skim and cream fractions
 - › Typically operated at 3.3 L/min
 - › Connects to heat exchanger and milk receiving tanks
- » Fermenters
 - › Custom-designed stainless-steel fermenters
 - › Frequently used for lactose and monosaccharide fermentation

OTHER EQUIPMENT

- » Receiving tanks (up to 100 gallons capacity, Sprinkman Corp)
- » Water Circulating Temperature Heat Transfer System
- » Heat Exchanger
- » High-Performance Desalination unit



SUPPORTING ANALYTICAL EQUIPMENT

With extensive research over many years, we have developed specialized protocols to isolate and analyze glycans, peptide, proteins and MFG from dairy samples. The Barile lab maintains an array of advanced analytical equipment that is used to guide the separation of bioactive milk components in near real-time.

Triple Quad LC-MS (Agilent Technologies)

- » 6470 Triple Quadrupole Liquid Chromatography Mass Spectrometer

Dionex HPAE-PAD (2 units - Thermo Scientific)

- » High Performance Anion-Exchange Chromatography with Pulsed Amperometric Detection

Nano LC Chip QToF (Agilent Technologies)

- » Nano Liquid Chromatography chip Quadrupole Time-of Flight mass spectrometer

MALDI ToF (Bulker Daltonics)

- » Microflex LRF Matrix-Assisted Laser Desorption/Ionization Time-of-Flight mass spectrometer





EDUCATION AND TRAINING

Contact Dr. Moshe Rosenberg, Professor and Specialist, Dairy Engineering and Technology, for more information on UC Davis Extension Services mrosenberg@ucdavis.edu



STAFF AND RESEARCHERS

DANIELA BARILE, Ph.D.

Professor

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Discovery of novel milk bioactive components and their functions. Characterization and quantification of compounds such as glycoproteins, peptides, glycans, and glycolipids in milk and dairy streams. With Dr. Juliana De Moura Bell and Dr. David Mills, Dr. Barile manages the Milk Processing Lab.

JULIANA DE MOURA BELL, Ph.D.

Associate Professor

Departments of Food Science & Technology and Biological & Agricultural Engineering
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Development of sustainable processing techniques (i.e., membrane fractionation, enzymatic reactions, fermentation, enzyme- and microwave-assisted extractions) to extract, modify, and isolate food compounds (using bovine colostrum as a model system) with desired functional and biological properties. Processing scale-up and conversation of food processing byproducts into added value compounds.

GAIL BORNHORST, Ph.D.

Professor and Engineer

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The Bornhorst lab specializes in food processing and food digestion, with a focus on food structural breakdown during digestion and relationship with physical property changes and macronutrient release and hydrolysis; food processing and structuring techniques to modulate food gastric behavior; development of physiologically-relevant in vitro digestion models.

J. BRUCE GERMAN, Ph.D.

Professor

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Research in the German lab is designed to understand how the components of foods in the diet can affect the various biological processes in humans that we consider health.

DANIELLE LEMAY, Ph.D.

Research Molecular Biologist, USDA ARS
Adjunct Professor, Department of Nutrition
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Studies on dietary components, including milk compounds, and fermentable carbohydrates, and how they affect host response and whether that response is modulated by the functional capabilities of resident microbiota. Approaches employ big data techniques, such as sequencing technologies and machine learning, to understand the effects of diet on human health.

MARIA MARCO, Ph.D.

Professor

Department of Food Science & Technology
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The Marco lab specializes in food microbiology with an emphasis on dairy food microbiomes, fermented dairy foods, probiotics, and spoilage and product defects.

RUIHONG ZHANG, Ph.D.

Professor

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Bioenvironmental engineering. Study of biological, physical, and chemical processing techniques for organic waste conversion and nutrient management; control of gaseous and particulate emissions from animal feedlots and food processing facilities.

DAVID A. MILLS, Ph.D.

Professor

Peter J. Shields Chair in Dairy Food Science
Departments of Food Science & Technology and
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Research on the influence of milk components on gut health. Exploration on interactions among milk-borne prebiotics, probiotics, antimicrobials and other bioactive molecules on the host gut microbiota with links to overall host health.

NITIN NITIN, Ph.D.

Professor

Departments of Food Science & Technology
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Research on development and evaluation of bio-based materials including dairy-derived components for the delivery of micronutrients and probiotics; design of novel materials and processes, including synergistic and non-thermal processes and biosensors to improve safety of food products; development and deployment of mechanistic and machine learning models to predict and optimize process efficiencies, product design and sustainability.

MOSHE ROSENBERG, D.Sc.

Professor and Specialist

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Dairy chemistry and microbiology; milk processing technology and engineering. Cheese making science and technology. Milk processibility. Evolution of cheese quality attributes during aging; Technological and quality aspects of ESL and UHT milk products. Structural properties of dairy products. Quality attributes of milk and dairy products. Authentication of milk and dairy products; Regional origin of milk and dairy products; Milk proteins and lipids as microencapsulating agents in food and pharma applications; Advanced milk processing technologies.

CAROLYN SLUPSKY, Ph.D.

Professor

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Impact of food (including dairy) and nutrition on health; using small molecular chemical profiling to support integration of diet and nutrition in a complex biosystems approach; relationship between diet and gut microbiota; impact of microbial derived metabolites on host health.

AMEER TAHA, Ph.D.

Associate Professor

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Focus on characterizing lipid bioactives in milk and understanding their role in brain development. The lab uses quantitative mass-spectrometry methods to quantify lipid bioactives in various milk lipid fractions (e.g. cream, procream), and to probe their bioavailability and brain uptake.





FACILITIES AND EQUIPMENT

DAIRY SCIENCE ACADEMICS & RESEARCH

Jordan College of Agricultural Sciences and Technology (JCAST)

California State University
Fresno, CA



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OVERVIEW

Two of the six departments within JCAST are specifically devoted to dairy science academics and research. Faculty from the other four departments (Agribusiness, Plant Science, Industrial Technology, and Viticulture) regularly collaborate on dairy related research and outreach endeavors. The Institute for Food and Agriculture is one of the three centers within JCAST that supports faculty-led research and outreach in partnership with students, community, and/or industry members.

Food Science and Nutrition Department inspires students with the academic rigor and experiential learning to pursue two bachelor of science majors: Food and Nutritional Sciences including Culinology® and Food Technology options and Human Nutritional Sciences. The Department also offers a Master's in Food and Nutritional Sciences for students who want to gain further experience in the Food and Dairy Industries.

Animal Science and Agriculture Education Department creates a multi-faceted approach for students to pursue BS and Masters degrees in Animal Science, some featuring a Dairy Science emphasis.

Institute for Food and Agriculture (IFA) emerged from recommendations by the President's Commission on Agriculture which was charged to link Fresno State's agricultural programs with science, mathematics, engineering, business, and other disciplines to best serve the dynamic food and agriculture industry. IFA facilitates applied research and outreach opportunities through disciplinary and interdisciplinary research and innovation in food science, dairy science, food safety, nutrition, agribusiness, animal science, agriculture education, industrial technology, plant science, and entomology. IFA works hand-in-hand with faculty and industry leaders to disseminate research findings via workshops, trainings, conferences, publications, and receiving visiting food and agriculture scholars (community, industry, academic).

RESEARCH FOCUS

Fresno State enthusiastically provides direct technical assistance to dairy businesses through hands-on value-added product development consultancies, workshops, and workforce training. Specific areas of expertise include milk production, milk processing, development of new and current dairy products, and sensory evaluation. Current research emphasizes

- New product development (specialty and ethnically rich cheeses)
- Quality attributes of dairy products (yield, composition, sensory evaluation, consumer perceptions)
- Dairy food safety and quality assurance



FACILITIES

DAIRY PROCESSING PLANT

The Dairy Processing Plant facility (The Creamery) provides students from multiple disciplines across campus with hands-on experiential learning in managing a facility and operating equipment to produce a multitude of dairy products including thirty-five ice cream flavors, butter, spreadable butter, cheese, and fluid milk (including chocolate milk). Under the supervision of a general manager, a staff of about 10 students runs the facility and operates equipment such as the pasteurizer, homogenizer, cheese vat, ice cream maker, and filling machine along with other minor specialty equipment. The students also engage in multiple faculty-supervised research projects related to dairy products. The facility is commercially certified and products are sold on campus via Fresno State's Rue and Gwen Gibson Farm Market as well as at select local and regional markets.

DAIRY DIAGNOSTICS LABORATORY

Created to simultaneously enhance student laboratory practice skills and real time data upon which to base nutrition, cow health, and cow productivity decisions, the Dairy Diagnostic Lab is the location for compositional and microbiological diagnostic analyses of animal feeds, blood, and milk. It is specifically designed to give students new opportunities to work with the latest technology to ensure herd health, nutrition and milk standards as well as encourage higher milk production. The lab can easily be utilized by undergraduate and graduate students, students in dairy classes, as well as students working at the dairy unit to conduct milk quality analysis and also assessment of blood samples from cows with mastitis to determine the most effective antibiotic treatments.

MANUAL MANCEBO, JR. AND KATYE MANCEBO DAIRY UNIT

The Fresno State Dairy is one of the few collegiate dairies run entirely by students. A staff of approximately 20 students maintains two different breeds of dairy cattle (the Holstein and the Jersey) 24 hours per day, 7 days per week, and 52 weeks per year. There are 275-300 cows within the dairy herd. Fresno State uses about 1/7th of the milk for production activities at its Dairy Processing Plant and the remainder is sold to a local dairy processing company for commercial usage.

FOOD SAFETY & MICROBIOLOGY LABORATORY

Specific to this laboratory, student and industry research projects are able to test microorganisms and chemicals used by the food industry, including pathogenic microorganisms such as *Salmonella spp.* or *Staphylococcus aureus*.

JORDAN AGRICULTURAL RESEARCH CENTER (JARC)

This 30,000 square foot world-class research center focuses on investigating advanced concepts and practices of agriculture, food, and the natural resources. It was specifically designed to foster multidisciplinary and interdisciplinary collaborations between bright minds within the three colleges addressing food and agricultural sciences, engineering, and science and mathematics.

- **Olam Sensory Laboratory** is a dedicated space in which researchers investigate how agricultural practices and post-harvest processing affect consumers' perception of agricultural products such as wine, cheese, and desserts. It features seven sensory cubicle stations. Food and beverage products tested to date include wine (including smoke-tainted), fresh fruit grown on the campus farm, dessert products in development by students for commercial purposes, and targeted consumer products developed by faculty. The sensory lab aids researchers in gathering data for their trials and provides students with the hands-on experience they need in preparation to work in the industry.
(note: video available at <https://fresnostate.edu/jcast/jarc/jarc-consumer-sensory-research.html>) (fresnostate.edu))
- **Wonderful Training Room** adjoins the Olam Sensory Laboratory. This space is a multipurpose room in which panelists can receive training prior to engaging in sensory evaluation activities. It also serves as a great space to host small-group workshops, short-courses, conferences, and symposia.
- **Food Preparation Area** is also located next to the Olam Sensory Laboratory and is equipped with an industrial kitchen. This space is useful for preparation purposes for sensory evaluation experiments.

RUE AND GWEN GIBSON FARM MARKET

In many aspects, the Gibson Farm Market represents the culminating student supply chain experience as every product offered for sale therein has been grown, harvested, processed, packaged, and/or marketed by students. Dairy products include Fresno State's famous ice cream, milkshakes created on demand, milk (including chocolate), and cheese. While an on-campus location, the market is open to both the campus community and the general public. Key celebration events include Opening Corn Weekend and the Fall Festival and Plant Sale - both which feature student-led activities for youth/families along with the sale of food and agricultural products.



EQUIPMENT

- » Refrigerated delivery van
- » Tanker (600 gallon)
- » HTST System (pasteurizer and homogenizer) for Milk and Ice Cream Mix (300 gallon/hour; HTST is a legally sealed unit by the state of California)
- » Rotary Filler (½ - 1 gallon)
- » Cold Milk Separator - DeLaval (250 gallon/hour)
- » Holding Tank (600 gallon)
- » Round Open Cheese Vat (32 gallon)
- » Rectangular Open Cheese Vat (215 gallon)
- » Cheese Press (vertical)
- » Ice Cream Batch Freezer (1, 40 and 44 quart)
- » Ice Cream Piston Depositor (8-32 & 20-80 oz)
- » Butter Churn (25 gallon)
- » Processing Vat (300 gallon)
- » High Shear Mixer
- » Powder Induction Mixer
- » Ultrafiltration Unit (research use only)
- » Yogurt cup filler
- » Cheese curd draining bag cart
- » Cheese aging cabinet
- » Small homogenizer (2900 PSI)
- » Glycol chilling unit



SUPPORTING ANALYTICAL EQUIPMENT

- » MilkoScan FT1 - Foss
- » BacSomatic - Foss
- » VetScan VS2-1200 Abaxis
- » Near Infrared Spectrometer DS2500FSR - Foss
- » Fiber Analyzer A200 Ankom Technologies
- » RT-PCR Detection System Acumen
- » Laminar Flow Hood
- » Elemental Analysis for CHNS Elementar
- » Thermo Scientific Gallery for food and beverage automatic photometric analyzer
- » Texture Analyzer
- » Water Activity Meter
- » Halogen-Moisture Analyzer



SENSORY EVALUATION

- » 7-Booth Sensory Evaluation Area with food preparation industrial kitchen equipped with portable devices and Compusense software and adjoining training room as well as indoor open space
- » BIOPAC MP160 system equipped with bionomadix wireless system to measure skin conductance, heart rate, respiration and facial electromyography



COURSES, SYMPOSIA AND EVENTS

- Cows to Neurons: Dairy Economic Development and Innovation
- USDA Cochran International Study Tours focused on Dairy
- Agriculture Kids' Camp for 7-11 year old youth
- Dairy Lab Skills Enrichment Workshop
- Cheesemaking 101 Workshop in collaboration with the California Artisan Cheese Guild
- International Restaurateurs Study Tour
- Livestock Artificial Insemination
- Dairy Calf Health



STAFF AND RESEARCHERS

DANIEL AVILA

Manager

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Mr. Avila draws upon over 30 years of experience in dairy products manufacturing to guide the student employee team operating the dairy processing center. He is the certified person to pick up and receive milk, to assess quality of the received milk and to pasteurize milk. Mr. Avila is a proud Fresno State bulldog alum.

AMY THAO

Technician

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Creamery Agricultural Operations

KELLI WILLIAMSON

Lecturer

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Dairy processing

PAULINA FREIRE-VACONEZ, Ph.D.

Lecturer

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Innovative production in the dairy industry, focusing on machine learning, sensory analysis, and rapid detection methods, HPP processing



STEVEN PAO, Ph.D.

Professor

Department of Food Science and Nutrition
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Dr. Pao is a Full Professor with far-reaching research in the areas of food protection and farm hygiene. He has consulted in numerous countries to address food safety and quality management, including dairy products, and regularly draws upon those experiences to enrich his academic teaching with students.

SUSAN PHEASANT, Ph.D.

Director

Institute for Food and Agriculture
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Dr. Pheasant has a passion for organizing people and projects as well as conducting utilization-focused evaluations. She embraces fully her role to support faculty, students, and the food and ag sector through applied research, grant development and management, and educational outreach. Her most recent degree integrates agricultural economics, marketing, education, and rural sociology in addressing how producers adopt new ideas and technologies. Dr. Pheasant also serves as the JCAST representative to Fresno State's United Nations Global Compact steering committee; Fresno State is the first (and only) CSU/UC institution to become a member of the United Nations Global Compact.

KYLE THOMPSON, Ph.D.

Assistant Professor

Department of Animal Science and Agriculture
Education Manager
Dairy Science Unit
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Dr. Thompson oversees the student-run 300+ dairy cow enterprise on campus, advises numerous dairy related student clubs and judging teams, teaches both undergraduate and graduate dairy science courses, and conducts research addressing dairy nutrition and lactating cow probiotics. He is a proud Fresno State bulldog alum.



FACILITIES AND EQUIPMENT

CHAPMAN FOOD INNOVATION

Ranney Food Processing Laboratory
Chapman University
Orange, CA



EQUIPMENT

- » Blast freezer - Bravo B-S 5
- » Cabinet dehydrator - Harvest Saver R - 5A
- » Carver press - Carver 3851-0
- » Combination oven - Rational SCCWE61
- » Dough Sheeter - Somerset CDR-2000S
- » Freeze dryer - Harvest Right HR7000-L
- » Homogenizer - Gaulin 15MR-8TA
- » Ice-cream maker - Taylor 104-27
- » Proofer Cabinet - Avantco 177HPI1836
- » Spray dryer, bench top - Buchi B-290
- » Steam-jacketed kettle - Groen TDB-40
- » Tray sealer - ILPRA KOCH STAMPO
- » Microthermics UHT/HTST Pasteurizer with inline GEA
- » Homogenizer and SPO Microthermics LAB-25EHVH & GEA NS2006H
- » UltraVac Commercial Chamber Sealer Ultrasource
- » Universal Food Processing Machine - Stephan UM 12
- » Cream separator - Janschitz FJ 130 ERR



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Sensory evaluation and consumer research



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- » Meat Grinder - Kitchener 337989
- » Dicer (1) Dyna Cube, Dynamic 06140
- » Handheld Homogenizer (1) PRO Scientific PRO250
- » Air Mixer with 80L Pot Lightning Air Drive
- » High Shear Laboratory Mixer/Homogenizer (2) Silverson L5M-A
- » Planetary Mixer Hobart HL 120
- » Pressure Sterilizers (2) ALLAMERICAN 25X & 50X
- » Ribbon Blender (1) Mainca RM 20
- » Thermomix TM5-4
- » Vacuum Sealer
- » Vacuum Marinade Flavor Maker Tumbler
- » Vitamix Blender
- » Confectionery Coating Pan
- » Chocolate Melanger
- » Chocolate Tempering
- » Oktober Can Seamer (sleek) Model 7
- » Foodini 3D Printer
- » KitchenAid Stand Mixers

LILIAN SENER, Ph.D.

Professor and Program Director, Food Science
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Determining preservative and sensory properties of phenolic and melanoidin compounds, with the overall goal of enhancing the quality and chemical shelf life of food.



STUDENT INNOVATION IDEA LAB

STUDENT INNOVATION IDEA LAB CALPOLY POMONA

Pomona, CA



EQUIPMENT

- » Twin screw extruder, Processor 11 mm (Thermo fisher), Gravimetric feeder, low and high moisture extrusion. 100 g - 2.5 kg per hour
- » Buchi Mini Spray Dryer S-300 220C (1-3 gph)
- » GEA Homogenizer Twin Panda 400 (15 gph)
- » CT-1 Sous Vide Cook & Chill Tank (DC Norris), (120 lbs per batch)
- » Bench-top Bioreactor (3.6 L), Labfors 5. Solid and liquid fermentation
- » Hammer miller ZM200



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STAFF AND RESEARCHERS

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Novel food ingredient delivery technologies for applications in fortified and functional foods.

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Food proteins and extrusion processing

JULIE LEE, Ph.D.

Assistant Professor,
Department of Agribusiness and Food Industry
Management/Agricultural Science
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Modeling and simulation the market and welfare effects of food policy (e.g., sugar-sweetened beverage tax, Trans-fat ban policy) and agricultural technology (e.g., CRISPR-edited soybean, beef) by integrating heterogeneous agents' preferences with the multi-market framework and comparative statistics

HARMIT SINGH, Ph.D.

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Food chemistry, Shelf-life/processing solutions for food industries



STAFF AND RESEARCHERS - Other University Partners

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DARBY HEFFNER

Dairy Manager, Organic Dairy Unit at University Farm
California State University, Chico
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Darby oversees day-to-day management of the unit as well as the teaching and training of the dairy management team.

CYNTHIA A. DALEY, Ph.D.

Professor & Director of the Regenerative Agriculture Initiative and Organic Dairy Program
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Dr. Daley supervises and directs the Organic Dairy Program (ODP), providing education and training in organic pasture management and livestock production practices to students and farmers through courses, workshops, field days and conferences.

CHERYL ROCK, Ph.D.

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Food Product Development, Novel Processing Technologies, Sustainable aspects of Food Science and Technology, Functional Foods

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CENTER FOR DAIRY RESEARCH

www.cdr.wisc.edu



UNIVERSITY OF WISCONSIN-MADISON

www.cdr.wisc.edu

OVERVIEW

The Center for Dairy Research (CDR) is a state-of-the-art research center with a licensed, operating dairy plant located 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 and product development. Collectively, the CDR staff has over 280 years of food industry experience, which creates a unique mix of academic and industry perspectives to help address 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.



CENTER DIRECTOR

JOHN LUCEY, Ph.D.

Director

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RESEARCH FOCUS

- Functional properties of cheese, cheese products and cultured dairy products
- Functional dairy proteins (casein, 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
- Dairy coproduct valorization

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.

CDR's cheese making pilot plant is a licensed dairy plant located at the University of Wisconsin-Madison. 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. Its new facilities include 9 unique cheese ripening caves that are individually temperature and humidity controlled.

CDR cheese applications staff works confidentially with all sectors of the dairy industry, providing consultation, pilot plant trials, application development, sensory and analytical laboratory evaluation, as well as on-site trials and visits. From dairy producers and manufacturers to ingredients suppliers and equipment manufacturers, application 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. Staff work collaboratively with campus researchers to explore and demonstrate the health benefits derived from cheese consumption.

DAIRY PROTEIN/INGREDIENTS AND PROCESSING

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, whey protein phospholipid concentrate (WPPC) 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. CDR's new facility also offers an expanded range of services including a Siccadania 3-stage pilot dryer capable of 130 lbs. of water evaporation/hour in addition to its APV single stage spray dryer (40 lbs. water evaporation/hr.) Coproduct valorization, including through bio-fermentation, uses a 400-liter Eppendorf bioreactor and the extensive fractionation and concentration resources in our pilot plants. Fermentation resources allow for the manufacture and packaging of various types of cultured products.

ASEPTIC/UHT BEVERAGE INNOVATION FACILITY

CDR's beverage innovation center offers a flexible, modular system for processing and aseptic packaging of beverages including aseptic homogenizer, indirect and direct heating unit, bag-in-box and bottle packaging and other small-scale processing equipment for dairy beverage innovation.

ANALYTICAL SERVICES

Analytical services are offered to support projects carried out at the Center. CDR provides comprehensive chemical and microbiological testing services. 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 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. The center has recently added molecular biology resources that allow for microbial and Microbiome analysis via modern DNA sequencing techniques.

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 work 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.

ENTREPRENEURSHIP

CDR has an active entrepreneurship program that is focused on the commercialization of novel dairy technologies & products, driving resilience among dairy processors with innovation programs and bringing new technologies to address pressing dairy industry issues such as the conversion of dairy by-products into more valuable revenue streams.

Whether your company is interested in licensing a CDR technology or working with CDR to develop a novel technology or product, the entrepreneurship 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. CDR also supports entrepreneurs and small companies in developing new, innovative dairy products by working with them to develop their product ideas, assisting them with scale up and then helping them find co-packers or licensed space to produce their products on a commercial basis. Services include business development assistance such as business plan templates, formulation and scale-up expertise, regulatory guidance etc.,

CDR is a licensed facility, and our plant and commercial kitchen can be used to produce products for commercial use.

SENSORY ANALYSIS

CDR is a trusted sensory partner from start to finish. CDR staff begin by pinpointing the exact purpose and end goal for a requested sensory analysis, and then proceed to design sensory tests and ballots with the right questions to optimize value and insight for the client. CDR utilizes industry best practices and modern Compusense software for this analysis. CDR employs a standing trained descriptive panel to analyze flavor, texture, and appearance profiles, as well as functionality such as shredding, slicing, or cooking applications. CDR also has sensory experts with collective decades of industry experience to screen products and offer technical advice and troubleshooting. CDR also has an extensive database of diverse consumer panelists from the Madison area, that can evaluate products in brand new sensory booths or be interviewed in focus groups on site. Our trained panel can also be utilized for discrimination testing such as triangle or tetrad methodologies. CDR also has extensive capabilities for testing the quality shelf life of refrigerated or shelf stable products including climate chambers that can simulate abuse of lights, humidity, or temperature. After the data is collected, CDR can provide exceptional analysis and insights, including data visualizations, statistical analysis, and interactive business intelligence style interactive reports.

Sensory testing capabilities:

- Descriptive Analysis
- Descriptive Analysis Functionality
- Expert Screening
- Consumer Liking / Hedonics / Preference
- Consumer Focus Group
- Difference/Similarity Testing (Triangle, Tetrad, etc.)
- Shelf-Life Evaluation
- Accelerated Shelf-Life Evaluation



FACILITIES AND EQUIPMENT

THE CENTER FOR DAIRY RESEARCH

UW-Madison
Pilot Plant Equipment



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OVERVIEW

CDR's new state-of-the-art 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.



EQUIPMENT

CHEESE MANUFACTURING

Processing lines include tanks/vats/vessels and packaging equipment.

CDR offers state-of-the-art pilot plant facilities for making any style or variety of cheese. The facility is licensed and inspected by the FDA and state of Wisconsin and staffed by Certified Pasteurizer Operators and Wisconsin licensed Cheesemakers, Cheese Graders, Buttermakers, and Butter Graders. Included is raw milk receiving and processing that can accommodate specialty loads and has a variety of storage tanks for cooling and/or heating. Milk can be standardized utilizing the GEA Westfalia Ecocream Separator, incorporation of powders or other ingredients, or membrane filtration (diafiltration, microfiltration, nanofiltration, ultrafiltration, or reverse osmosis). Pasteurization/heat treatment can be completed with the Darlington Dairy Supply Vat Pasteurizer or the MP&C HTST Pasteurizer with optional two stage GEA Ariete homogenization and standard or extended holding tube. CDR has an extensive selection of cheese manufacturing equipment (listed below) and ten affinage/ripening rooms utilizing an automated Air Quality Process system that controls temperature, humidity, and air flow to set specific environmental conditions.

- » 4 Relco 1000-lb capacity open vats with networked control panels, Optiset coagulation sensors, 1/4, 3/8, 1/2, 3/4, and 1" knives and 4 Kusel jacketed drain/finishing tables - these vats and tables include load cells making them ideal for yield study work
- » 6 Stoelting 600-lb capacity open vats with 1/4, 3/8, 1/2, 3/4, and 1" knives - these vats are ideal for artisan and specialty cheeses
- » 4 custom 45-lb capacity mini cheese vats with independent controls and agitation - ideal for acidification studies
- » Kusel 450-lb capacity portable cheese vat that can utilize either electricity or steam for heating
- » 2 APT 2500-lb capacity automated horizontal enclosed cheese vats with Kusel jacketed drain/finishing table
- » 9 independent ripening and drying rooms, each with its own hygienic air conditioner (USDA approved), temperature, humidity and air flow controls; includes Swiss cheese warm room
- » Kalt 1000-lb capacity automated open copper-lined cheese vat for Alpine and hard Italian style cheeses with Kalt pre-press that features independently controlled air rams and a variety of cheese forms
- » Alpma tipping vat, split into 2 450-lb capacity sections, including knives, chutes, drain table and a variety of cheese forms - ideal for high solids milk, Brie, Camembert, and Feta style cheeses
- » Tetra Pak waterless pasta filata cooker/stretcher/mixer molder with two independently controlled stages and direct and/or indirect steam injection
- » Supreme 640 pasta filata cooker/stretcher/mixer molder

- » Supreme 940 pasta filata molder/extruder
- » Stoelting pre-press with 4 separate chambers for pressing cheeses under whey
- » Vacuum chamber cheese press for pressing cheese under vacuum
- » Ullmer's A-frame vertical cheese press with 6 individually controlled air rams and drawers designed to collect press whey
- » Ullmer's horizontal cheese press with 2 individually controlled air rams
- » EBR 7MF curd mill
- » Kusel block mold turner
- » MilkyLab LAB 22 fresh mozzarella cheese molding machine
- » Extensive selection of microperforated, plastic, and stainless-steel cheese forms - from 2 lb balls to 40 lb blocks and almost everything in between
- » Stacked fiberglass brine system plus the ability to make custom brines in a variety of sizes

FULL CREAM CHEESE MANUFACTURING LINE:

Also includes equipment listed under other categories. Processing lines include cheese vats, pumping line to collect whey and cream cheese, holding vessel, as well as packaging equipment.

- » Sharples Penwalt DS2 cream cheese separator
- » APV Gaulin M3 two-stage homogenizer
- » Scherping Systems 30 gallon capacity swept surface tank

COLD PACK AND PROCESS CHEESE MANUFACTURING LINE:

Also includes equipment listed under other categories. Processing lines include mixing/cooking vessels, homogenization and blending. All direct steam comes from culinary steam source.

- » Hobart 10-lb capacity commercial food preparing machine cold pack cheese unit
- » Stephan UM/SK5 5-lb capacity high shear bowl chopper-style process cheese cooker with direct and/or indirect steam and vacuum
- » Blentech CC 0025 20-lb capacity low shear twin screw process cheese cooker with direct and/or indirect steam and vacuum
- » Stephan VCM12 10-lb capacity vertical cutter/mixer cold pack cheese unit
- » Loos 10-lb capacity low shear twin screw process cheese cooker with direct and/or indirect steam and vacuum
- » SM Beier low shear single screw process cheese cooker
- » Stephan vertical cutter/mixer, Model 17 91, 50-lb. capacity, indirect steam only

OTHER VARIOUS EQUIPMENT USED IN THE PROCESSING, CONVERTING AND PACKAGING OF CHEESE:

- › Urschel CC-D cheese shredder with feather and V-cut heads
- › Vemag V 500 robot cheese grinder and vacuum machine with guillotine cutoff
- › Haas-MondoMix A-05 dairy product aerator
- › Lincoln portable impinger oven - ideal for baking Juustoleipä cheese
- › Multivac C-400 vacuum sealer with gas flush capabilities
- › 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
- › CVP Systems FreshVac vertical vacuum sealer

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

ASEPTIC BEVERAGE LINE:

- » OMVE Continuous flow UHT pilot line
 - › System capacity: 200 L/hr (53 gal/h)
 - › Formulation tank
 - › Direct and Indirect Heating
 - › Various Holding Times
 - › Cooling (tubular heat exchangers)
 - › Homogenizer (upstream or downstream)
 - › Aseptic Holding Tank
- » Filling station 1: Pre-sterilized PET screw cap bottles (Gosselin/Nalgene)
- » Filling station 2: Bag-in-Box (pre-sterilized Scholler bags, 3 L)
- » Armfield HTST/UHT Processing System FT-94X
 - › System capacity: 30-100 L/hr (6-26 gal/h)
 - › Indirect heating (15, 30 and 120 s hold tubes)
 - › Armfield Sterile Filling System)
- » Retort - Standard, static canning

DAIRY INGREDIENT PROCESSING EQUIPMENT:

- » Filtration
 - › Various Spiral-wound cross-flow filtration systems each containing multiple vessels
 - › 3.8., 4.3 & 8 inch diameter vessels available
 - › MF, UF, NF and RO available
- » Evaporator
 - › Pilot-scale plate evaporator capable of 200-400 lbs. of water evaporation/hr. Batch, recirculating, high solids evaporater
- » Spray Dryer:
 - › Siccadania 3-stage pilot dryer capable of 130 lbs. of water evaporation/hr.
 - › APV Pilot-scale spray dryer capable of 40 lbs. of water evaporation/hr. utilizing a pressure nozzle
- » Fermentation
 - › 40 gal fermentation tanks, x4 (each independently heated)
 - › 150 gal fermentation tanks, x4 (each independently heated)
 - › Treko 21KS Yogurt cup filler - 8 oz & 16 oz cups
 - › 400 L bio-reactor (Eppendorf)
- » Two Yamato IN804 Programmable Incubators
- » Other Processing Equipment
 - › Homogenizer - Pilot Scale (two-stage)
 - › Homogenizer - Lab scale (two-stage)
 - › Two pilot-scale mechanical separators - Cream Cheese & Greek Yogurt / Quarq
 - › Small HTST research pasteurizer
 - › Various Tanks ranging from 5 to 1200 gal.
 - › Various Pumps e.g. centrifugal, PD, Twin-screw, etc.
 - › Swept-surface jacketed tank with heating and cooling (30 gal.)
 - › Tubular Heat Exchanger
 - › Stephan mixer with 40-L capability
- » APPLICATIONS LAB:
 - › Benchtop milk fat separator
 - › Rotor stator mixer (multiple heads for different volumes)
 - › 3-D printer for liquid feed
 - › Overhead Agitators
 - › Various scales, mixers etc.

ICE CREAM EQUIPMENT:

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



SUPPORTING ANALYTICAL EQUIPMENT

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

Moisture analyzers

Total solids, moisture

Water Activity Meter

Water activity

Forced-air ovens

Total solids, moisture, total solids (nonfat)

pH/mV meters

pH

High Performance Ion Chromatography

Sugar Profile (glucose, galactose, lactose); D/L lactic acid and other organic acids (propionic, acetic, butyric, succinic, citric, etc.)

Spectrophotometer

Lactose, galactose, D/L lactic acid

Acid Degree Value Testing equipment**Fourier Transform Infrared Spectrometer (FTIR)**

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

Near, Mid-Infrared Analyzer

Fat, moisture, total protein

Immersion sonicators

Solutions, suspensions, degasification

Centrifuges (various sizes to 25,000 rpm)

Soluble nitrogen, milkfat separation, fat

Rheometry, Texture analysis

Cheese, Yogurt, Beverage Texture Characterization e.g. gelation, deformation, viscosity, heat profiles, melting properties etc.

Powder Characterization e.g. flow, compaction, cohesion etc.

Food Texture Analyzers

Brookfield Viscometer

Zeiss Epi-Fluorescence Microscope

Light and fluorescent microscopy
Confocal & SEM

Centrifuges (fixed-angle and swing bucket & micro)

Soluble nitrogen, milkfat separation

Pellet & Supernatant analysis e.g. Protein composition

Microwave mineralization oven

Mineral analysis

Electrophoresis

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

Protein Hydrolysis e.g. in Caseins during Cheese ripening

Capillary electrophoresis

Protein composition (caseins and whey proteins) and major peptides produced during cheese manufacture/ripening

Block digesters (6 and 20 Place)

Nitrogen content

Nitrogen analysis - Kjedahl and Dumas units with autosampler

Nitrogen content of various matrices and determining proteolysis in cheese during ripening.

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 (0.01 to 1,000 μ m) with autosampler

Particle size determination for liquids and solids

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 chromatography-flame ionization detectors with autosampler

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

Gas Chromatography-mass selective detector (GC-MSD):

Volatile Organic Compounds (aromatics) using headspace solid-phase microextraction (HS-SPME).

Olfactory Detection Port for key aromatic compounds is also available.

High-performance liquid chromatography with diode array detector (DAD), refractive index detector (RID) and autosampler

Carbohydrates and organic acids found in milk and dairy products, milk proteins, peptide profile.

Ultraperformance liquid chromatography with diode array detector (DAD), fluorescence (FLR) detector and autosampler:

Analysis of Amino Acids

Walk-in coolers (4 C)

Sample preservation

Commercial deli-style slicers

Melt test

Machinability Testing

Vacuum sealers

Sample preservation

Chloride analyzers

Salt determination

Automated Titrators

Buffering properties, insoluble/soluble calcium analyses

Molecular Analysis - DNA sequencing and Microbiome Analysis

Nucleic acid purification robot: For high throughput nucleic acid purification.

NanoDrop spectrophotometer: For nucleic acid purity analysis

Qubit 4 fluorometer: For nucleic acid and protein quantification

Nucleic acid analyzer: Electrophoresis based nucleic acid fragment analysis.

Thermocycler: For PCR amplification of nucleic acids.

E-gel electrophoresis system: for DNA fragment analysis.

GridION nucleic acid sequencer: DNA and RNA long read sequencing

Magnetic particle handler: Nucleic acid sequencing library preparation.

Biosafety cabinet: For microbiology work under sterile and contained conditions.

Sensory and Shelf Life Equipment / Facilities

Six (6) segregated sensory booths with sinks in each booth

20 tablets with Compusense software for data collection

Attached sensory prep area including mini fridge and 2 Nemco food warmers

Three (3) Climate Chambers (749L interior volume, temperatures 5-70C and humidity control)

Incubators with light for abuse studies

Incubators for superchilling for extended shelf life

Walk in coolers and freezers for sample storage

Commercial Kitchen

Alto Shaam combination oven for convection baking and smoking

Two (2) Lincoln impinger ovens for pizza and other applications

Two (2) Stone Piza Ovens

Two (2) Turbo Chef Ovens

Two (2) Flat top and grate grills

Microwaves

Deep fryers

Commercial sized gas ovens

Commercial Gas Stovetop Burners

Home style electric ovens

Home style gas ovens

1 5 gal Hobart Mixer

3 Kitchen Aids Mixers

Deli Slicer

4 Traulsen roll-in cooler units

Walk in Cooler and Freezer

Sundry Utensils, scales, blenders etc.



COURSES, SYMPOSIA AND EVENTS

All are in-person courses, unless otherwise noted.

CENTER FOR DAIRY RESEARCH – short courses and training sessions (<https://www.cdr.wisc.edu/education>)

- **CHEESE**

- » Cheesemaking Fundamentals
- » Cheesemaking Fundamentals, online, self-study
- » Cheesemaking Fundamentals, in Spanish, online, self-study
- » Advanced Cheesemaking, American Varieties
- » Advanced Cheesemaking, Italian Varieties
- » Advanced Cheesemaking, Artisan Varieties
- » Process Cheese & Cold Pack Cheese
- » World of Cheese: Pasture to Plate
- » Cheese Grading & Evaluation
- » Cheese Judging
- » WI Cheesemaker License Prep, online, self-study (new in 2026)

- **DAIRY INGREDIENTS**

- » Dairy Ingredient Fundamentals

UW-MADISON FOOD SCIENCE – short courses and training sessions (<https://dairyfoods.wisc.edu/>)

- » Milk Pasteurization and Process Control
- » Milk Pasteurization and Process Control, online, self-study
- » Cleaning and Sanitation Workshop, online, self-study

- » Dairy Ingredient Fundamentals, online, self-study
- » Dairy Protein Beverage Applications
- » Cultured Dairy Products
- » Dairy Processing (new in 2026)

- **BUTTER**

- » Buttermaking Fundamentals, online, self-study
- » Buttermaking Comprehensive
- » Buttermaking Apprenticeship

- **FOOD SAFETY/QUALITY**

- » HACCP Certificate
- » PCQI Training
- » Advanced Sanitation
- » Environmental Monitoring
- » Food Fraud, online, self-study (new in 2026)

- **CERTIFICATE IN DAIRY PROCEESSING**, online, live + self-study

- **DAIRY WASTEWATER FUNDAMENTALS**

- » Applied Dairy Chemistry, online, self-study
- » Emergency Seal Applicator Training, online, self-study
- » Successful Ice Cream Retailing
- » Batch Freezer Workshop



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



STAFF AND RESEARCHERS

BRADLEY W. BOLLING, Ph.D.

Associate Professor, Food Science
UW-Madison
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Food chemistry and analysis, dietary phytochemicals, functional foods and prevention of chronic disease.

MAGGIE BECHER, Ph.D.

Assistant Coordinator, Cheese Industry and Applications
The Center for Dairy Research, UW-Madison
mbecher@cdr.wisc.edu

Expertise in extending the performance shelf-life of cheese. Additional experience with quality assurance, research and development, coordinating cheesemaking trials with industry clients.

RANI GOVINDASAMY-LUCEY, Ph.D.

Distinguished Scientist
The Center for Dairy Research, UW-Madison
rani@cdr.wisc.edu

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.

JIM CROPP

Instrumentation Technologist, Dairy Products and Processing
The Center for Dairy Research, UW-Madison
jcropp@cdr.wisc.edu

Provides technical assistance to clients as they develop their concepts/products in the CDR facility as well as on-site support with troubleshooting and scale-up assistance.

MICHAEL GAY, CE&D.

Development Specialist
The Center for Dairy Research, UW-Madison
mgay@cdr.wisc.edu

Engages with business partners, start-ups and other entities to support the CDR's mission in bringing value to the dairy industry through additional funding efforts and innovative technologies applicable to the circular bioeconomy and the dairy industry.

AUDREY GIRARD, Ph.D.

Assistant Professor, Food Science
UW-Madison
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Protein chemistry to improve food quality, sustainability and nutrition; protein-polyphenol interactions.

TOM GUERIN, Ph.D.

Assistant Center Director
The Center for Dairy Research, UW-Madison
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More than 20 years of experience in research and product development in dairy and food ingredients. Responsible for client interaction, project management and ensuring alignment with changing demands and trends of the food industry.

SUNDARAM GUNASEKARAN, Ph.D.

Professor, Biological Systems Engineering and Food Science
UW-Madison
guna@wisc.edu

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.

RICHARD HARTEL, Ph.D.

Professor, Food Science (joint with Biological Systems Engineering)
UW-Madison
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Food engineering/processing, separations, crystallization/ particulate processes, structure-function relations.

KATIE HILTY

Assistant Coordinator, Cheese Industry & Applications
The Center for Dairy Research
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With professional experience in corporate quality assurance with a wide array of dairy foods, Katie coordinates trials for industry partners to help develop and manufacture new dairy products.

KRISTEN HOUCK

Research Specialist, Microbiology
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Coordinator of microbiological services at CDR, responsible for microbial testing, analysis and safety of dairy products. Brings 20+ years of lab experience to the position.

MELLISA HOUFFE

Research Cheesemaker and Instrumentation Technologist, Dairy Products and Processing
The Center for Dairy Research
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A licensed buttermaker, cheesemaker, butter grader. Assists with the operations of the pilot plant, guiding research and helping with special projects.

TU ANH HUYNH, Ph.D.

Assistant Professor, Food Science
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Thuynh6@wisc.edu

Molecular mechanisms of bacterial pathogenesis and stress response, bacterial signaling, bacterial pathogen – host interactions, small molecule-protein interactions, food safety.

RODRIGO IBÁÑEZ, Ph.D.

Associate Scientist
The Center for Dairy Research
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Knowledge and expertise conducting research in cheese science and technology with a focus on microbiological topics related to cheese and dairy products.

BARBARA INGHAM, Ph.D.

Professor, Food Science, Food Safety Extension Specialist
UW-Madison
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Analytical methods for food analysis; microbial quality and safety of foods; HACCP, food quality and food safety.

JOHN JAEGLI

Coordinator, Cheese Research and Wisconsin Master Cheesemaker Program
The Center for Dairy Research, UW-Madison
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Third generation cheesemaker. Coordinates cheese making trials; serves as an industry information resource, provides technical support for specialty cheesemakers, administers the Wisconsin Cheesemaker Program.

LUIS JIMÉNEZ-MAROTO, Ph.D.

Assistant Coordinator, Cheese Industry & Applications
The Center for Dairy Research, UW-Madison
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Expertise in research, data analysis, sensory, judging and training. Research on the effects of high-pressure processing and low temperature storage on the long-term performance and shelf life of various cheeses.

JEREMY LINDLOFF

Pilot Plant Manager
The Center for Dairy Research, UW-Madison
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Manages operations of CDR's licensed pilot plant, executing research and industry trials and ensuring equipment and processes are operating efficiently.

YANJIE LU, Ph.D.

Researcher, Lab Manager
The Center for Dairy Research, UW-Madison
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Provides technical support and conducts analysis for research and industry projects. Develops and adapts methods involved in dairy products and dairy processing. Serves as lab manager for Dr. Lucey lab.

JOHN LUCEY, Ph.D.

Director, CDR; Professor, Food Science
The Center for Dairy Research, UW-Madison
jlucey@cdr.wisc.edu

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

ANDREA LUKE, MBA

Administrative Director
The Center for Dairy Research, UW-Madison
aluke@cdr.wisc.edu

Responsible for center operations including financial and human capital oversight and infrastructure, grant management, and external agreement administration.

ANDREA MILLER, RD

Communications and Training Manager
The Center for Dairy Research, UW-Madison
amiller@cdr.wisc.edu

Manages internal and external communications, stakeholder relations and short course/training program for the Center.

GINA MODE, MBA

Coordinator, Cheese Industry Applications Program
The Center for Dairy Research, UW-Madison
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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

Process Advisor/Innovation
The Center for Dairy Research, UW-Madison
molitor@cdr.wisc.edu

Advises CDR process laboratory activities, especially projects utilizing pasteurization, MF, UF, NF, RO filtration, evaporation and/or spray drying equipment. Expertise in process engineering with over 18 years of experience. Serves as technical resource for domestic dairy manufacturers.

ALEX O'BRIEN

Coordinator, Dairy Food Safety/Quality
The Center for Dairy Research, UW-Madison
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Assists dairy plants with food safety plans, quality issues, and performs third party audits.

GULUSTAN OZTURK, Ph.D.

Assistant Professor, Food Science
UW-Madison
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Expertise includes developing advanced separation processes for milk and dairy streams to extract compounds for personalized nutrition and precision treatments aimed at enhancing human health.

JOSE MIGUEL PEREZ, Ph.D.

Cheese Scientist
The Center for Dairy Research, UW-Madison
jperez@cdr.edu

Expertise in using modern molecular techniques to investigate microbes in cheese. Miguel researches the role of different members of dairy microbiomes in the production of safe, nutritious, and tasty cheeses.

BRANDON PROCHASKA, M.S.

Coordinator, Sensory Program
The Center for Dairy Research, UW-Madison
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Experience in sensory science including different sensory techniques such as consumer testing, triangle testing, shelf life testing, trained and maintained panelists as well as dairy technical services and data visualization/process improvement.

VICTOR UJOR, Ph.D.

Assistant Professor, Food Science
UW-Madison
ujor@wisc.edu

Fermentation, renewable fuels and biochemicals, metabolic engineering/synthetic biology, bioprocess design, bioconversion of food wastes and agricultural residues to value-added products.

SCOTT RANKIN, Ph.D.

Professor, Food Science
UW-Madison
sarankin@wisc.edu

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

EMILY SLATTER, MBA

Grand Administration Manager
The Center for Dairy Research, UW-Madison
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Manages grant application, programming, and reporting activities. Provides business development training and support for dairy entrepreneurs in the Midwest.

SRIRUPA SEN

Researcher
The Center for Dairy Research, UW-Madison
sen22@wisc.edu

Research focused on modifications to milk powder processing and manufacturing, Srirupa works closely with scientists and industry coordinators to conduct analytical testing.

DEAN SOMMER, M.S.

Cheese and Food Technologist
The Center for Dairy Research, UW-Madison
dsommer@cdr.wisc.edu

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

YECTLI TAHUILAN

Dairy Ingredients & Applications Specialist
The Center for Dairy Research, UW-Madison
tahuilanolgu@wisc.edu

Coordinates industry trials for clients developing new application areas for milk ingredients. Expertise in food engineering and quality assurance processes for various dairy products.

NICK TEREBAYZA

Analytical Lab Supervisor
The Center for Dairy Research, UW-Madison
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Leads the analytical lab team to provide accurate and timely data for all CDR industry and research projects.

BEN ULLERUP MATHERS

Assistant Coordinator, Cheese Industry and Applications
The Center for Dairy Research, UW-Madison
bmathers@cdr.wisc.edu

A licensed cheesemaker, with experience in all parts of the cheesemaking process, from vat to packaging. Ben coordinates cheese trials and troubleshooting for specialty cheeses.

DANIEL WILBANKS, Ph.D.

Coordinator, Dairy Products & Processing Team
The Center for Dairy Research, UW-Madison
dwilbanks@cdr.wisc.edu

Coordinates industry trials involving the development and processing of dairy products utilizing various fermentation, fractionation & concentration processes; provides technical information and support to the industry stakeholders including ingredient suppliers, manufacturers and others.

PRATISHTHA VERMA, M.S.

Dairy Ingredients & Applications Specialist
The Center for Dairy Research, UW-Madison
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Coordinates industry trials for clients developing new application areas for milk ingredients. Expertise in chemical and microbiological testing techniques of various dairy products.



MIDWEST DAIRY FOODS RESEARCH CENTER



UNIVERSITY OF MINNESOTA

St. Paul, MN
www.midwestdairy.umn.edu

SOUTH DAKOTA STATE UNIVERSITY

Brookings, SD

IOWA STATE UNIVERSITY

Ames, IA

AFFILIATE UNIVERSITIES:

University of Nebraska
Kansas State University
University of Missouri

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) as core universities and University of Nebraska (Lincoln), Kansas State University (Manhattan), and University of Missouri (Columbus) as affiliate universities. The dairy center was formed to conduct research and provide support needed to increase the viability of the U.S. dairy industry and ensure its future competitiveness. The center offers expertise in dairy foods research for both traditional dairy products and dairy derived ingredients.



CENTER DIRECTOR

JAYENDRA AMAMCHARLA, Ph.D.

Center Director
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RESEARCH FOCUS

- **Consumer Solutions:** Modern wellness (immunity, calming, energy and digestive health) through dairy derived components for targeted consumer sections (Youth/Schools/Gen Z); Foundational research on milk components to improve consumer experience to include higher protein, high fat, clean label, and sugar reduction; E-commerce (packaging, food safety, sensors); Educate consumers on sustainability and dairy benefits; Nutrition strategies to understand & enhance bioavailability of nutrients in dairy products.
- **Industry Solutions:** Enable cheese and dairy ingredients exports (produce and process interventions, shelf life, quality and functionality); Improve dairy ingredients and permeates powder quality, safety, and functionality; New platforms and an untapped market for dairy; Upcycling dairy co-products; Analytical tools and testing methods to measure and predict the quality and safety of products/ingredients; Novel and scalable technologies to improve microbial quality and safety of dairy products and ingredients; Optimize water and energy usage and wastewater management.



FACILITIES AND EQUIPMENT

UNIVERSITY OF MINNESOTA



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.



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: with heat and swept surface, 10 to 25 gal.

DRYERS/AGGLOMERATORS

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

MIXERS/CHOPPERS

- » Hammermill: Fitzpatrick, 5-lb. hopper
- » Ribbon blenders: 40 and 80 lbs
- » Colloid Mill Fryma Toothed



CONTACT:

MITCHELL MAHER

Plant Manager
612-624-7776
maher069@umn.edu

JOSEPH J. WARTHESEN FOOD PROCESSING CENTER

Dr. Jayendra Amamcharla, 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.

CHEESE PROCESSING

- » Blue cheese Punch
- » Cheese presses: vertical and horizontal with various hoop styles
- » Cheese vat: Damrow, 5,000 lbs.
- » Cheese vats: Kusel, 2,000 lbs. (2)
- » Cheese vat: Nu-Vat, 800 lbs. (1)
- » Curdmill: Damrow

FROZEN DAIRY PROCESSING

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

HOMOGENIZATION AND BLENDING

- » Colloid Mills
- » Homogenizers: Gaulin 60 and 125 gal./hr.
- » Microfluidizer

FILTRATION/SEPARATION/ CONCENTRATION

- » Decanter centrifuge: stp, Westfalia, 1-2 gal./min.
- » Desludging centrifuge: Westfalia, 2-3 L/min.
- » PTI RO/MF system Spiral wound
- » Miniature Filtration RO/MF: DDS-20, Plate and Frame, 10-L
- » Evaporator: Forced Circulation, 75-100 lbs./hr.



FACILITIES AND EQUIPMENT

SOUTH DAKOTA STATE UNIVERSITY

Institute for Dairy Ingredient Processing
(IDIP)

PRAFULLA SALUNKE, Ph.D.

605-688-4118

prafulla.salunke@sdstate.edu



EQUIPMENT

- » ALPMA Curd Coagulator Vat with Drainage Belt
- » Batch freezer: 24-qt. Emery Thompson
- » Butter churn: 500 lbs cream and 1-lb printer
- » SPX Hydrodynamic Cavitator Processor (8")
- » Centrifugal pumps (Fristam FPX/R and Ampco)
- » Cheddar Curd Mill
- » GenMac Cheese block cutter (pneumatic)
- » Kusel Vertical Cheese press (pneumatic)
- » Cheese sealer: Sipromac
- » Cheese shredder: Hobart
- » Cheese vat: 2,500 lb. HCV Tetra Pak
- » Cheese vats 2x: 500 lb. Kusel Double-O
- » Cheese vat: 1,000 lb. Double-O
- » Cold bowl cream separators: DeLaval 392, 5,000 lb/hr.; and GEA MSE-140 13,000 lb/hr.
- » Waukesha SPX Colloid Mill

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
- » CEM microwave moisture analyzer
- » Cheese chloride analyzer



CONTACT:

STEVEN BECKMAN

Dairy Plant Research Manager
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<https://www.sdstate.edu/dairy-and-food-science>

KAYLEE SARTELL

Pilot Plant Research Technician
kaylee.sartell@sdstate.edu

- » Crystallization tank: 2,000 lbs.
- » Drain table for HCV and Double-O Cheese Vats
- » Evaporator: multi-pass, falling film, 1,500 lb/hr evap rate, Dahmes Equipment
- » Liquid Filler: Bag-in-Box, General Films Model 34
- » Polymeric Membrane Filtration systems: multi-stage, low, and high pressure, MF to RO
- » Ceramic Membrane Filtration system: Pall Membralox 7-stick [$1.6m^2$], 0.1 and 1.4 μm
- » Fruit feeder: Tetra Pak Addus
- » Ice Cream Filler: Rotary Cup Auto (Sawvel); Manual 3-gal (Sawvel)
- » Benchtop Crystallization equipment
- » Benchtop filter (flat sheet) tester, low pressure
- » Homogenizer: Gaulin, 5,000 lbs./hr., 4,000 psi
- » Homogenizer: Gaulin, 7,500 lbs./hr., 3,500 psi
- » HTST systems: 5,000 lbs./hr. and 7,500 lbs./hr. AGC ProFlow Plates

- » Continuous ice cream freezer: Tetra Pak Frigus 600 L/hr
- » Breddo Likwifier: 100 gal.
- » Mixing vessel: Armfield FT140x, 50L, jacketed, high shear emulsifier
- » Niro spray dryer: Gas fired; Two-fluid atomization, counter-flow, 20 lb/hr water evap
- » Plate heat exchangers 3x: 1,500 lb/hr
- » Platform scales: 75 lbs. and 400 lbs.
- » Positive displacement pumps 3x, Various sizes: Waukesha U11 and Fristm FKL
- » Process cheese cooker: single-screw, 30-lb. culinary steam generator
- » Process vats/tanks: 20, 50, 200, 300, 500 and 600 gal.; Steam and cool
- » Raw milk storage: 2 x 6,000 gal. silos
- » Refrigerated and frozen storage facilities, includes -40 F blast freezer
- » Spray dryer: Electric heated, tall-form, two-stage with vibrating fluid bed and agglomeration capacity, Dahmes Equipment, 300 lb/hr water evap
- » Steam culture chests
- » Ultrasonic Processor: 1 kW, with flow-cell (Hielscher 1000hd)
- » Silverson High-shear Batch mixer
- » 3D Printer (FDM) for prototyping
- » IBC totes: 250 and 300-gal
- » Dry product storage
- » COP Tanks 2x: 100-gal, water agitation



ANALYTICAL CAPABILITIES

HPLC, Capillary Electrophoresis, ashing oven, vacuum oven

Microbiological analyses

Water analyses (BOD, COD, TSS, TOC)

Turbidity, colorimetric

Viscometry (Brookfield) and Rheology (Anton-Paar)

Particle Size (Anton-Paar Litesizer 500 DLS)

Texture Analyzer (Stable Micro Systems TA.XTplus)

Wet chemistry analyses for proximate analysis

Rapid protein (CEM Sprint, FTIR), rapid TS (CEM Smart 5)

Rapid proximate composition (Bentley DairySpec FT)

Digital Handheld Brix Meter (Misco)

Rapid Swab Reader: Hygiena EnsureTouch (ATP, Protein)

Turbidimeter (Lamotte)





FACILITIES AND EQUIPMENT

IOWA STATE UNIVERSITY



FACILITIES

- Food processing pilot plant
- Fermentation facility
- Sensory evaluation units



EQUIPMENT

- » CEM Microwave Ashing System 300
- » Centrifuges: call for options
- » Cheese press (approximately 100-lb capacity Longhorn hoop press)
- » Cheese vats: 2 400-lb capacity jacketed stainless steel
- » Extrusion systems for grain processing
- » Fermentors: Benchtop, 1-, 2-, 5-, 10-L
- » Fermentors: sterilizable-in-place, 15-, 50-, 100-L
- » Filtration unit: hollow-fiber
- » Freeze drying
- » Freezer: ultralow (-70°C)
- » High shear blender (Admix Rotosolver)
- » High-temperature short-time pasteurizer (Microthermics)
- » Refractometers
- » Rotary evaporator and vacuum pump
- » Screens and mixing tanks
- » Spectronics XL-1500 UV Crosslinker
- » Spectrophotometers: call for options



COURSES, SYMPOSIA AND EVENTS

SOUTH DAKOTA STATE UNIVERSITY

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



CONTACT:

CALEB WANDSCHNEIDER

Pilot Plant Manager

phone: 515-294-3690

cwand@iastate.edu

PROCESS DEVELOPMENT LAB

- Product development capabilities
- Test kitchen and sensory lab
- Wet processing pilot plant

A fee for use may be associated with some of the listed equipment. Please contact Dylan Liu (dylanliu@iastate.edu), if you are interested in more information about equipment or services provided at Iowa State University.

- » Homogenizer: Avestin
- » Homogenizer: GEA
- » Ice cream freezer: Taylor
- » Instron Universal Testing Unit 1122
- » Pasteurizer-Cheese Vat: C. vant' riet
- » Pumps: call for options
- » Kettles: electric-heated with agitation, 10 gal.
- » Kjeldahl: Labconco
- » Membrane filter system
- » Microbiological incubators: regular, refrigerated
- » Microplate reader
- » Oven: Fisher Isotemp
- » Penetrometers
- » Photochem (oxidation potential system)
- » Stomachers
- » Texture analyzer (TA.XT Plus)
- » Ultracentrifuge: Beckman L8M
- » UV illuminator: Fisher Biotech
- » Vacuum oven: food-grade

IOWA STATE UNIVERSITY

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



STAFF AND RESEARCHERS

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 and Food 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.

Professor of Dairy Fractionation and Separation Science
University of Minnesota
jayendra@umn.edu

Membrane processing; functional modification of milk proteins; dairy-derived ingredients; physical properties of dairy foods; and micro- and nano-bubbles in dairy processing.

SANJEEV ANAND, Ph.D.

Professor of Dairy Microbiology, Food Safety
South Dakota State University
sanjeev.anand@sdstate.edu

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.

ANDREIA BIANCHINI, Ph.D.

Associate Professor of Food Science
University of Nebraska-Lincoln
abianchini2@unl.edu

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.

STEVEN BOWDEN, Ph.D.

Assistant Professor of Food Science
University of Minnesota
sbowden@umn.edu

Genetic characterization of foodborne pathogens in foods and food environments; biological control of foodborne pathogens using intrinsic microorganisms to exclude pathogens; bacteriophage isolation, characterization and bioengineering as targeted antimicrobials.

TERRY BOYLSTON, Ph.D.

Associate Professor of Food Science and Human Nutrition
Iowa State University
tboylsto@iastate.edu

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

BYRON BREHM-STECHER, Ph.D.

Associate Professor of Food Science and Human Nutrition
Iowa State University
byron@iastate.edu

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

FERNANDA F G DIAS, Ph.D.

Assistant Professor of Food Science
University of Minnesota
ffgdias@umn.edu

Lipid chemistry; green extraction strategies; effects of environmentally friendly strategies on lipidomic markers of oil quality, and extractability, bioactivity and bioaccessibility of phytochemicals

AHMED HAMMAM, Ph.D.

Assistant Professor of Animal Sciences and Industry
Kansas State University
arhammam@ksu.edu

Dairy products processing; dairy ingredients development; membrane filtration technology; cheese technology and production; functional properties of dairy foods.

BARAEM ISMAIL, Ph.D.

Professor of Food Science
University of Minnesota
bismailm@umn.edu

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

SRINIVAS JANASWAMY, Ph.D.

Associate Professor of Dairy and Food Science
South Dakota State University
Srinivas.janaswamy@sdstate.edu

Functional biopolymers; novel carriers of bioactive compounds; agricultural residues; package materials; water purification.

BUDDHI LAMSAL, Ph.D.

Professor of Food Science and Human Nutrition
Iowa State University
lamsal@iastate.edu

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.

DYLAN LIU, Ph.D.

Assistant Professor of Food Science and Human Nutrition; Associate Director of the Midwest Dairy Foods Research Center
Iowa State University
dylanliu@iastate.edu

Sustainable process optimization in dairy manufacturing to improve efficiency; development of novel dairy products to enhance quality, functionality, and sustainability; transforming dairy by-products into high-value products, promoting circular economy principles and minimizing waste.

PEGGY LEHTOLA

Assistant Director of Midwest Dairy Foods Research Center
University of Minnesota
plehtola@umn.edu

Assistant to the Director, MDFRC.

AUBREY MENDONCA, Ph.D.

Associate Professor of Food Science and Human Nutrition
Iowa State University
amendon@iastate.edu

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

KUMAR MALLIKARJUNAN, Ph.D.

Professor of Food Science
University of Minnesota
kumarpm@umn.edu

Food process engineering process modeling, and optimization; non-contact, non-destructive sensing and extraction of phytochemicals; electronic nose, Fourier transform infrared spectroscopy novel processing techniques; dairy processing and characterization; extraction of phytochemicals.

KASIVISWANATH MUTHUKUMARAPPAN, Ph.D.

Professor of Agricultural and Biosystems Engineering
South Dakota State University
muthukum@sdstate.edu

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

DANIEL O'SULLIVAN, Ph.D.

Professor of Food Science
University of Minnesota
dosulliv@umn.edu

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

MANEESHA MOHAN, Ph.D.

Associate Professor and Alfred Chair in Dairy Manufacturing
South Dakota State University
Maneesha.mohan@sdstate.edu

Product structure and rheology; novel food processing technologies—high pressure processing, nanobubble technology, supercritical fluid processing; functional products and ingredients; dairy processing and value addition; delivery systems, release kinetics and biological activity.

R. ROGER RUAN, Ph.D.

Professor of Biosystems and Agricultural Engineering
University of Minnesota
ruanx001@umn.edu

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

PRAFULLA SALUNKE, Ph.D.

Assistant Professor of Dairy and Food Science;
Associate Director of the Midwest Dairy Foods Research Center
South Dakota State University
prafulla.salunke@sdstate.edu

Processing and product manufacturing impacts on dairy product quality and functionality attributes. Focus on cheese, dairy ingredients, and enzymes used in dairy processing.

JOHAN UBBINK, Ph.D.

Professor and Department Head of Food Science and Nutrition
University of Minnesota
jubbink@umn.edu

Science and technology of high-solids foods, processing and characterization of starch-based foods; processing and characterization of plant protein-based foods; technology and application of food powders; encapsulation and delivery of bioactive compounds.

BONGKOSH VARDHANABHUTI, Ph.D.

Associate 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
zvickers@umn.edu

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





NORTHEAST DAIRY FOODS RESEARCH CENTER



CORNELL UNIVERSITY

<https://cals.cornell.edu/northeast-dairy-foods-research-center>

OVERVIEW

The Northeast Dairy Foods Research Center, located at Cornell University, Ithaca, NY, pursues a wide spectrum of dairy foods research with a specific focus on fluid milk, dairy ingredients, yogurt, cheese, dairy powders, food safety, sustainability, and novel dairy processing technologies. The program also works on the impact of primary dairy production and animal health on milk quality.

The Northeast Dairy Foods Research Center also provides learning opportunities for the industry with short-course training in dairy food safety and dairy processing with separate certificate programs in fluid milk processing, cheese, yogurt, and dairy powders (see <https://www.flipsnack.com/ifscornell/2025-course-catalog-dairy-foods-extension/full-view.html>).



CENTER DIRECTORS

CARMEN I. MORARU, Ph.D.

Interim Center Director
607-255-8121
cim24@cornell.edu

NICOLE MARTIN, Ph.D.

Director, Milk Quality Improvement Program (MQIP)
607-254-5544
nicole.martin@cornell.edu

RESEARCH FOCUS

Value Added Dairy and Dairy Processing

- Physical, engineering and functional properties of milk proteins and dairy ingredients
- Functionalization and value added utilization of milk proteins
- Novel processing (High Pressure Processing, High Pressure Homogenization, Supercritical Fluid Extrusion, Microwave Vacuum Drying, membrane filtration) of dairy products and ingredients
- Technological approaches to increase the shelf-life of fluid milk and other dairy foods.
- Upcycling of dairy byproducts by fermentation, processing and use of enzymes
- Technological approaches for producing new dairy beverages and ingredients from milk with sensory and nutritional attributes that consumers desire
- Processing based intervention strategies for microbial inactivation

Dairy Food Microbiology, Quality, and Safety

- Dairy foods safety
- Source tracking of microbial contaminants from farm through finished product
- Predictive modeling of dairy product spoilage and assessment of intervention strategies
- Environmental monitoring for pathogens in dairy processing environments
- Impact of raw milk quality on processed product quality
- Molecular and microbiological method development for detection, identification and subtyping dairy associated microbial contaminants
- Mechanisms for controlling spoilage organisms
- Applications of bacteriophages to improve milk safety and shelf life
- Novel applications for co-products of dairy fermentations
- Investigate farm management practices associated with high sporeformer levels in raw milk
- Development of modeling and digital tools for the dairy industry
- Development of molecular-based raw milk testing methods

Analytical Methods for Dairy and Sensory

- Development of analytical tools for managing milk quality, composition and sustainability of milk produced for dairy product manufacture
- Chemical analysis of milk and dairy products
- Sensory evaluation of milk and dairy foods and consumer research



FACILITIES AND EQUIPMENT

FOOD PROCESSING AND DEVELOPMENT LABORATORY (FPDL)

<https://cals.cornell.edu/food-science/outreach-extension/food-processing-and-development-laboratory>

OVERVIEW

The Cornell University Food Processing and Development Laboratory (FPDL) is a highly flexible pilot plant that allows industry access to equipment and expertise to facilitate the development of new dairy products and/or to produce new dairy products on a small scale. Our 'plug and play' design means we can emulate your plant processing parameters for accurate product development projects while the company can get product trials completed without stopping actual production. Since the facility is a licensed dairy plant permitted by NY State, our products can be used for sensory or consumer acceptance studies. Main utilizations include:

Research and development:

- 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.

This 6,000-square-foot main processing area is directly adjacent to our fully licensed dairy plant. FPDL also houses a small scale HTST system capable of continuous pasteurization of batches as small as 100 gallons with up to a 12-minute extended hold. The facility has multiple cheese vats of 50-500-gallon capacities, with associated equipment such as cheddar milling equipment, cheese presses, a variety of moulds, etc. For yogurt and cultured products production, the facility has a Greek yogurt separator, fermentation vats from 50-500 gallons, several filling capabilities as well as fermentation rooms to 110°F. We have continuous and batch ice cream freezing capability as well as a walk-in hardening freezer (-40°F).



CONTACT:

REBECCA PHILIPS
rlp96@cornell.edu

We also have access to very high-quality milk from our Veterinary School farm located less than a mile away. This combination allows for scaling up of production to provide a variety of products for consumer demonstrations, food shows and exhibitions.

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 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 suppliers of ingredients, cultures and raw materials or if a company prefers, they can ship their preferred ingredients to us.



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

- » Emery Thompson – 20-qt. batch freezer
- » Emery 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 (up to 12 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
- » 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
- » Qualtech 8 foot, 4 tiered horizontal cheese press, 2 shelves per tier (8 shelves total)

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
- » ILPRA glass jar rotary filler
- » Modern 4/6 oz cup 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 110 °F



FACILITIES AND EQUIPMENT

CORNELL DAIRY PROCESSING PLANT



CONTACT:

MACKENZIE BROWN

Cornell Dairy Plant Manager
607-254-6512
mb2269@cornell.edu

OVERVIEW

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, and the College of Agriculture and Life Sciences. Specifically, the Cornell Dairy Plant 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 byproduct of its mission-based functions, the Cornell Dairy also produces fluid milk, juices, yogurt, cheese and ice cream products to be sold on the Cornell University, Ithaca campus, as well as Ithaca College, SUNY Cortland, and Tompkins Cortland Community College, to offset the total costs incurred in the equipping and operations of the dairy plant.

This facility is available for hands-on workshops as well as demonstrations and test runs of new technologies.

CORNELL SENSORY EVALUATION CENTER

ALINA STELICK

Manager
ap262@cornell.edu

OVERVIEW

The mission of the center is three-fold: to provide training and hands-on learning opportunities to students that are interested in the fields of sensory and consumer research, to further research in the areas of sensory science and consumer product testing, 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, Product Sensory Profiling and Custom Employee Sensory and Consumer Research Training Programs. In addition, we provide consultations in all matters related to sensory product testing: appropriateness of particular test method, study sample size, questionnaire design, statistical analyses, sample blinding and serving sizes, to name a few.

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, or scholarships.



**SENECA FOODS FOOD VENTURE
CENTER AND PILOT PLANT at Cornell
AgriTech**

665 W. North Street, Geneva, NY 14456
[https://cals.cornell.edu/cornell-agritech/
partners-institutes/cornell-food-venture-center](https://cals.cornell.edu/cornell-agritech/partners-institutes/cornell-food-venture-center)

ROGER MORSE
Pilot Plant Manager
rtm1@cornell.edu

**HIGH PRESSURE PROCESSING (HPP)
VALIDATION CENTER**

Cornell AgriTech, Geneva, NY
[https://cals.cornell.edu/cornell-agritech/
partners-institutes/hpp-validation-center](https://cals.cornell.edu/cornell-agritech/partners-institutes/hpp-validation-center)

ANN VEGDAHL
Lab Manager
315-787-2258
acv45@cornell.edu

» HIPERBARIC 55 HPP unit (55 L volume vessel, 200 mm diameter)

**CORNELL INSTITUTE FOR FOOD
SYSTEMS INDUSTRY PARTNERSHIP
PROGRAM**

RAJNI ANEJA
Industry Liaison Officer
607-255-0860
ra283@cornell.edu

OVERVIEW

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.





COURSES, SYMPOSIA AND EVENTS

<https://cals.cornell.edu/dairy-extension/course-calendar>

- HTST Pasteurizer Workshop (3 times per year)
- Vat Pasteurizer
- 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)
- Introduction to Ice Cream and Frozen Desserts
- 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
- Dairy Science and Sanitation



STAFF AND RESEARCHERS

CORNELL DAIRY EXTENSION STAFF

The Cornell University Dairy Foods Extension team is a diverse group of faculty and staff from the Department of Food Science with extensive knowledge that spans nearly all aspects of dairy science and technology.

KIMBERLY BUKOWSKI

Extension Support Specialist
krb14@cornell.edu

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

ANA GABRIELA ORTIZ QUEZADA, Ph.D.

Extension Associate
ago4@cornell.edu

Research & Development, Pilot plant equipment (spray dryer, vacuum evaporation); Membrane filtration, Fresh cheese making, Flavor chemistry

LOUISE FELKER

Extension Support Specialist
lmf226@cornell.edu

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

HEATHER SPRAKER

Extension Support Specialist
has248@cornell.edu

Dairy foods systems; Dairy product manufacturing; Food safety systems

REBECCA PHILLIP

Regional Dairy Processing Specialist
rlp96@cornell.edu

Research and development, dairy food systems, dairy food safety

HANNAH MOYAL

Workforce Support Specialist
hb366@cornell.edu

Workforce Development

TAYLOR PELCHER

Workforce Support Specialist
tp393@cornell.edu

Workforce Development

ALEX SOLLA

Executive Administrator
National Dairy Food Safety Coalition
607-255-3459
ahs24@cornell.edu

CORNELL DAIRY RESEARCHERS

<https://cals.cornell.edu/northeast-dairy-foods-research-center/research>

ALIREZA ABBASPOURRAD, Ph. D.

Associate Professor
Cornell University
alireza@cornell.edu

Food chemistry and ingredient technology. Our overarching goal is to stimulate a circular economy through conversion of waste to value and the development of clean label formulation. We developed a comprehensive platform to screen a broad range of dairy byproducts, characterize their physiochemical properties, and sequester high-value compounds. In this vein, we have been working with the dairy industry to identify their waste stream and convert them to milk oligosaccharides, galacto-oligosaccharides, and clean label emulsifiers as well as isolation of lactoferrin from whey. Another active re-search area in our lab is fortifying and adding health promoting functionalities to dairy products through encapsulation platform; examples include encapsulation of amino acids, vitamins, and probiotics.

SAMUEL (SAM) ALCAINE, Ph. D.

Associate Professor
Cornell University
sda23@cornell.edu

Dairy cultures and fermentation; dairy microbiology; food fermentations, spoilage organisms, bacteriophage; molecular biology. Dr. Alcaine'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.

ROBIN DANDO, Ph. D.

Professor
Cornell University
robin.dando@cornell.edu

Sensory and consumer science; taste physiology. The Dando lab studies the signaling events which occur within the taste system. Their research utilizes techniques from physiology, molecular biology, behavioral science and human sensory evaluation to probe the mammalian taste system.

DAVID M. BARBANO, Ph. D.

Professor
Cornell University
barbano1@aol.com

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.

CHANG CHEN, Ph.D.

Assistant Professor
Cornell University
cc2774@cornell.edu

Dr. Chang's program focuses on developing novel postharvest technologies to improve food quality, safety and sustainability of specialty crops and other agricultural/horticultural products, and valorization of their byproducts/side products for value-added applications. I am also interested in developing non-destructive sensing techniques for food quality and safety using optical/spectral approaches.

JULIE GODDARD, Ph. D.

Professor
Cornell University
goddard@cornell.edu

Enzymatic processes; biointerfaces. The Goddard Lab researches polymeric materials and coatings to improve food quality and food safety. Her group has synthesized polymers with specific biological functionality targeting applications in food packaging, bioprocessing materials, and equipment coatings. Specific applications: design of coatings and materials which improve food quality, sustainability, and food safety.

NICOLE MARTIN, Ph.D.

Assistant Research Professor
Cornell University
nicole.martin@cornell.edu

Dairy Microbiology, Dairy Quality and Safety, Dairy Farm Practices, Dairy Farm and Processing Extension, Microbiological Methods. Dr. Martin 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.

CARMEN I. MORARU, Ph. D.

Professor
Cornell University
cim24@cornell.edu

Dairy Foods Processing and Engineering, Food Safety Engineering. One of the objectives of Carmen Moraru's research group is to develop processes capable of delivering safe dairy foods of high quality and nutritional value. Specific research projects include: functionality and processing behavior of milk protein, membrane processing for microbial removal and nonthermal concentration, light treatments for microbial inactivation, novel processing technologies.

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
mw16@cornell.edu

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 and molecular characterization of bacterial pathogens and spoilage organisms; 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.





SOUTHEAST DAIRY FOODS RESEARCH CENTER



NORTH CAROLINA STATE UNIVERSITY

Raleigh, NC
www.sdfrc.ncsu.edu

SENSORY APPLICATIONS LABORATORY

North Carolina State University
www.ncsu.edu/sensory

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.



CENTER DIRECTOR

MARYANNE DRAKE, Ph.D.

Center Director
919-513-4598
mdrake@ncsu.edu

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 highprecision 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
sdfrc@ncsu.edu



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 and S1200 freezers
- » 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, microfiltration and RO
- » 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
- » Microthermics with 2 stage homogenizer and DSI capabilities
- » Differential Scanning Calorimeter (DSC)



SENSORY SERVICE CENTER

ANALYTICAL TECHNOLOGY & EQUIPMENT

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

- » Four (4) - 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), Refractive 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



STAFF AND RESEARCHERS

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.

RODOLPHE BARRANGOU, Ph.D., MBA

Associate Professor, Department of Food,
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.

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.

CARL HOLLIFIELD

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of Food, Bioprocessing and Nutrition Sciences
North Carolina State University
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Directs business operations of the Southeast Dairy
Foods Research Center and the farm to processing
Dairy Enterprise System.

JOSIP SIMUNOVIC, Ph.D.

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Bioprocessing and Nutrition Sciences
North Carolina State University
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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.

CLINT STEVENSON, Ph.D.

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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.

HAOTIAN ZHENG, Ph.D.

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Dairy NTD & NPD, Dairy Ingredients/powder
manufacturing & application; Stabilizer and
texturizer application in dairy products,
Characterization of Physicochemical Properties
of dairy products (liquid, semi-solid, & solid),
Dairy Rheology/Tribology, Dairy Protein & Lipid
(phospholipid) Chemistry, Scale-up (Engineering)





WESTERN DAIRY CENTER



UTAH STATE UNIVERSITY

Logan, UT
builddairy.com,
westerndairycenter.usu.edu

OVERVIEW

The Western Dairy Center, based at Utah State University is a virtual dairy research center with foci on dairy research, driven by the western region dairy industry, and a technically trained, workforce-development pipeline. The center links strongly to the BUILD Dairy program, that was initiated in 2014, with a mission of fostering participation and success of students in dairy research activities that can lead to employment in the dairy industry as well as academia. This is achieved through the BUILD Dairy program designed to BUILD University-Industry Linkages through Learning and Discovery. BUILD Dairy students are supervised by professors from Brigham Young University, University of Utah, Weber State University, Utah State University, University of Idaho, Boise State University, Washington State University and Oregon State 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 importance in innovation, quality, and manufacturing.



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 Dairy West
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RESEARCH FOCUS

- Cheese flavor and functionality
- Cheese technology
- Dairy processing
- Physiological & nutritional impacts of dairy proteins
- Sports nutrition
- Environmental sustainability
- Milk protein chemistry
- Dairy microbiology and safety
- Concentrated dairy products
- Lactic acid bacterial genetics, genomics and metabolomics
- Dairy powders - whey protein, milk protein concentrate, and non-fat dried milk
- Lactose bioconversion
- Dairy sensory (collaboration with SDFRC)



FACILITIES AND EQUIPMENT

UTAH STATE UNIVERSITY



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WEBER STATE UNIVERSITY

MICHELE CULUMBER

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EQUIPMENT

Western Dairy Center Network: University Pilot Plant and Faculty Labs

BOISE STATE UNIVERSITY

Over the past 15 years at Boise State University, PI McDougal has equipped a robust research environment for undergraduate students to work on projects across topics of natural products, food, and analytical chemistry. The equipment available to students in the McDougal lab is complemented by departmental and university instrumentation and facilities. The instrumentation and equipment in the PI's research labs are detailed below.

Computational Chemistry Assets

- » Cluster accounts (Beowulf, R1, R2, Kestrel, Idaho National Lab)
- » Two Linux computational computers (one laptop & one workstation)
- » Four Windows PCs
- » A four-computer workstation graduate student office area
- » A 48 workstation student chemistry computer lab

Laboratory equipment

- » Malvern Zetasizer Ultra Particle Size Analyzer
- » Speedvac
- » VELP SER 158/6 series automatic solvent extractor
- » Two rotary evaporators
- » Fisher Scientific orbital shaker
- » Three fisher brand Isotemp incubators
- » Thermo Scientific™ Thermolyne™ small benchtop muffle furnace
- » Two commercial refrigerators/freezer & chest freezer
- » Elea PEF-Pilot Dual and TC80
- » TetraPak 1812 pilot-scale filtration system
- » Agilent 1260 Infinity GPC system
- » Harvest Saver dehydrator (R-5A)
- » USALab 8-tray freeze dryer
- » USALab 50 L vacuum filtration unit
- » USALab 45 L SS jacketed centrifuge
- » 28 L Robo Coupe blender
- » Aqualab vapor sorption analyzer
- » Waters TA NanoDSC
- » Ultrapure water purification systems (18 MOhm)
- » Two Supelco Visiprep SPE vacuum manifolds
- » Foss Keltec KT-200 digestion and distillation apparatus
- » Seward Stomacher 80 laboratory paddle blender/mixer/stirrer/homogenizer
- » Thermo Fisher Nicolet iS20 FT-MIR spectrometer
- » BioTek Epoch2 microplate reader UV-Vis spectrometer with cuvette holder
- » Agilent AriaMx RT-PCR 96-well plate system
- » Pilotech YC-018 pilot spray dryer
- » USA Labs small-scale spray dryer
- » Teledyne Flodex powder flowability index test instrument
- » Agilent 1260 Infinity II HPLC system with diode array, refractive index, and single quadrupole mass spectrometer detectors
- » Agilent 1290 Infinity II HPLC system with diode array, ELSD detectors
- » Agilent 7000E GCTQ-MS
- » HunterLab Aeros reflectance spectrometer
- » OHAUS MB120 moisture analyzer
- » Aqualab TDL2 water activity meter
- » Eppendorf Centrifuge 5920R (max speed of 14000 rpm)
- » Hanna Instruments HI932 automated titration system
- » LECO FP828P nitrogen/protein analyzer
- » Thermo Scientific Orion Aquafast AQ4500 turbidity meter
- » Thermo Fisher Scientific UPLC-DAD-CAD/MS with Chromeleon software

- » Thermo Scientific UltiMate 3000 HPLC system with DAD and fraction collector with Chromeleon software
- » Bruker FT-NIR Spectrometer MPA with OPUS spectroscopy software
- » CEM MARS 5 chemical microwave
- » Labconco lyophilizer and centrivap refrigeration drying system
- » Confocal raman microscopy (Konrad Meister)
- » Bettersize BeNano Pure - Instrument to measure particle size (DLS/SLS), molecular weight, microrheology, zeta-potential of dispersed particles and molecules (Konrad Meister)



BRIGHAM YOUNG UNIVERSITY

NUTRITION, DIETETICS AND FOOD SCIENCE DEPARTMENT,

BRIGHAM YOUNG UNIVERSITY, Provo, UT

Various Research Laboratories

A variety of equipment is available in our research labs including AACC approved bread mixer, former and oven; Rapid Visco Analyzer; centrifuges; ovens, ranges; spectrophotometers; pH meters; analytical balances; ashing ovens; forced draft and vacuum drying ovens, Rancimat, temperature/humidity control chambers, TATX2 Texture Analyzer, Instron, Viscometers, Malvern particle size analyzer, consistometers, water activity meters, UV/Vis spectrophotometers, refractometers, Soxhlet, Goldfisch, HunterLab Colorflex colorimeter, Differential Scanning Calorimeter and other items.

Pilot Plant

The NDFS pilot plant comprises sixteen utility arrays with steam/air/electrical conduits, high and low temperature and freezing storage walk-ins (5), controlled temperature cabinets (5), steam kettles (4), retort, can sealer, heat penetration evaluation, batch ice cream freezer, soft serve freezers (2), microwave ovens, drying ovens, spray-dryers (2), freeze-dryers (2), ribbon blender, V-blender, mixers, ultrafiltration/RO unit, plate-and-frame HTST heat exchanger, Microthermics UHT/HTST tubular heat exchanger with aseptic fill hood, jacketed and unjacketed mixing vats, homogenizers (2), cream separator, ice machines, pumps (rotary, centrifugal and peristaltic), re-circulating chilled water unit, vacuum sealers, etc.

Metabolomics Center

<https://ndfs.byu.edu/chromatography-facility>

The BYU Metabolomics Center is equipped with a high-resolution mass spectrometer (HRMS) with MSn capabilities that enables high mass accuracy detection

and quantification of molecular features in both global and targeted metabolomics applications. The center also houses HPLC systems with versatile detectors and various GCs (GC-FID and GC-MS), all with high efficiency and high accuracy capabilities. The center is overseen by Dr. Shawn Christensen, an expert in metabolomics and chromatography. Center features include an in-house compound identification library of 600+ authentic standards, access to external libraries with millions of compounds, the ability to perform extractions on diverse sample types, experience in method development, and the capability of performing data analyses on a variety of data sets. Annually, the center processes thousands of samples across a broad spectrum of products and sample types.

Specific capabilities include: LCMS with MS/MS/MSn; HPLC (4 instruments); Detectors (DAD, FLD, RI, FID, ELSD, TCD); Teledyne CombiFlash fractionator; Preparative sample fractionation and isolation via HPLC; GC and GC-MSD (3 instruments); Head space sampler for GC (1 instrument); GERSTEL MPS robotic system for GC SPME and Headspace sampling technology; Thermostat controlled auto sampler; SPE extraction

Sensory Laboratory

<http://sensory.byu.edu/>

The Sensory Laboratory at Brigham Young University is a self-sustaining, commercial test facility. It has seven individual panelist booths, a trained-panel room, controlled lighting/air, separate kitchen/preparation area, computerized data acquisition and analysis, steam tables, heat lamps, commercial ovens (still and convection), grills and fryers.

Food Microbiology Laboratory

The Food Microbiology Laboratory at Brigham Young University is capable of microbiological analysis and testing up to a Biosafety Level 2. It contains equipment such as incubators, laboratory blenders/Stomachers, steam autoclaves, anaerobic chambers/incubators, automated colony counter, microscopes, ultralow -80 C storage freezer, and a Class II Type A HEPA filtered laminar flow biological hood.

Jason Kenealey Lab

Isothermal Titration Calorimetry
Differential scanning Calorimetry
Isothermal calorimetry
Western blotting
Protein purification

Doug Tree Lab

Computational resources - can be used for e.g., simulations or AI applications.

- » A Dell C4140 GPU server with 4 Nvidia V100's and 144 TB of storage space
- » 5 Dell Desktops with dedicated GPUs (3 NVIDIA GeForce RTX 2070s, 1 NVIDIA Quadro RTX 4000, 1 NVIDIA GeForce 4090)
- » In addition, BYU's office research computing offers the following to campus researchers at no charge:
 - › 40-node GPU cluster with 160 GPUs (NVIDIA P100)
 - › 32-node GPU cluster with 64 GPUs (NVIDIA K80)
 - › 136-node cluster with 17408 cores (AMD EPYC)
 - › 256-node cluster with 7168 cores (Intel Broadwell)
 - › 320-node cluster with 7680 cores (Intel Haswell)

BYU Biosafety Level-3 Laboratory and Select Agent Archive (overseen by Dr. Robison)

The Biosafety Level-3 (BSL-3) laboratory is located in rooms 1012, 1014, and 1016 of the Life Science Building (LSB) on the BYU campus in Provo, Utah. The BSL-3 lab is a 2100 ft² facility that has shower-in and shower-out capabilities, a pass-through autoclave, personal protective equipment donning and doffing rooms, 3 research suites (2 for bacteriology and 1 for virology), and an animal BSL-3 (ABSL-3) suite. These facilities are equipped with a total of 4 certified biosafety cabinets and directional air flow controls to maintain continual negative pressure between all

rooms and at all times. In addition, these laboratory suites are furnished with all of the equipment necessary to store, culture, detect, image, and quantify high-risk microbial agents. This includes freezers (-20 and -80°C), refrigerators, incubators (shaking, CO₂ and static), water baths, centrifuges (ambient and refrigerated), microscopes (regular and inverted), anaerobic culture equipment, cell disrupters, a robotic DNA purification system and a UV/Vis spectrophotometer.

The BYU select agent archive began in 1998. Initially, it was funded by the Department of Energy under the Chemical and Biological Non-proliferation Program (CBNP). After the events of 2001, the Department of Homeland Security was created and assumed the support of the archive. Until 2013, the archive was supported by the National Biodefense Analysis and Countermeasures Center (NBACC). The archive was created by collecting select agents through collaborations with international collections, various State health departments, and other agencies. Each isolate was definitively identified, characterized, and annotated. Genomic DNA was extracted and shared with other National research efforts focused on detection and attribution. There are currently almost 1,400 select agents archived in the BYU repository including isolates of: *Bacillus anthracis*, *Brucella species*, *Burkholderia mallei*, *Burkholderia pseudomallei*, *Clostridium botulinum*, *Francisella tularensis* and *Yersinia pestis*. Many of these agents (especially the *F. tularensis* and *Y. pestis*) are unique clinical isolates obtained from the Utah and New Mexico State health departments. Thus, this archive, in its entirety, is unique and is not found at any other location. It is one of the most extensive collections of CDC select agents in the country.

BRIGHAM YOUNG UNIVERSITY - IDAHO

ANIMAL AND FOOD SCIENCE DEPARTMENT SCIENCE AND TECHNOLOGY CENTER BUILDING, REXBUR, ID

Dairy Processing Lab Equipment

- » Milk separator (132gallons/hour)
- » Peristaltic pumps
- » Two-stage homogenizer capable of up to 10,000 PSI
- » State inspected/sealed batch pasteurizers capable of handling from 1.5 to 45 gallons per batch
- » Chill water system (160 gallons)
- » MicroThermics HTST/UHT processor and clean fill hood
- » Manual (Grade A) filler for filling and sealing six ounce yogurt cups and 16 -32 fluid ounce screw cap bottles
- » Small four gallon jacketed tanks that can be used as cheese vats (one gallon minimum batch size)
- » Fifty gallon capacity jacketed cheese vat (10 gallon minimum)
- » Dutch lever cheese press with 3.9 lb capacity cheese molds
- » Vacuum pack sealing machine for cheese
- » Batch ice cream freezer (3.5 to 6 quarts) with a 7-8 minute freeze time per batch
- » Continuous soft serve ice cream freezer with two barrels (dual flavor)
- » Lactoscan Milk Analyzer and pH meter
- » Walk-in cooler
- » Freezer

General Food Processing Lab Equipment

- » UV pasteurizer(juice) and single piston bottle filler
- » Blast chiller
- » Freeze dryer
- » Drying ovens
- » Ro-Tap sieve shaker
- » Controlled temperature/humidity environmental chambers
- » Benchtop electric pasta sheeter/cutter/extruder with ravioli attachment
- » Other assorted mixers, ovens, fryers, choppers, grinders, vegetable abrasion peeler, apple juicer, etc.

- » Walk-in cooler and freezer

Sensory Testing Lab

- » Prep kitchen with adjacent industrial kitchen(access to multiple types of ovens, grills, fryers, cooktops, etc.)
- » Temperature and humidity controlled holding cabinets
- » Separate 6-station sampling lab with adjustable color lighting and I-Pad data entry connected to Compusense

Analytical Testing Equipment

- » Babcock fat test
- » Forced draft and vacuum drying ovens
- » UV/Vis spectrophotometers
- » Halogen rapid moisture analyzer
- » Light microscopes (with camera attachments)
- » Ashing furnace
- » Chloride analyzer
- » Water activity meter
- » HunterLab colorimeter
- » Direct scanning calorimeter
- » HPLC (with diode array, refractive index, and fluorescence detectors)
- » Leco nitrogen combustion analyzer (protein analysis)
- » Texture Technologies texture analyzer
- » Brookfield viscometer
- » Rapid Visco Analyzer
- » Atomic absorption spectrophotometer
- » Inductively coupled plasma atomic emission spectrophotometer (ICP-AES)
- » Access to a microbiology lab of the Biology Department for basic microbiological testing

OREGON STATE UNIVERSITY

Dairy pilot plant (Oregon Department of Agriculture inspected and licensed Dairy processing facility) currently under renovation

- » 20 m2 walk-in cooler
- » 5 x 8 m2 cheese aging rooms with temperature, humidity, and airflow controls
- » 85 m2 Microbiology laboratory
- » 1,500 L milk truck
- » 125 L vat pasteurized and van t'Riet cheese vat with pre-pressing capabilities for gouda production
- » 1,000 L vat pasteurized and van t'Riet cheese vat with pre-pressing capabilities for gouda production
- » Cheese wax unit
- » Cheese press
- » Mozzarella stretcher
- » 5 kg cheese molds appropriate for gouda
- » Lab centrifuge
- » Gerber milkfat
- » Rapid cheese moisture analyzer
- » Lactichek
- » Charm Analyzer for antibiotics
- » Texture analyzer
- » 4 x Servi Doryl coagulation basins (40L each)

David Dallas Lab

- » Peptidomics
- » Proteomics
- » Quantification of peptides
- » Quantification of proteins
- » Glycopeptide analysis (like for glycomacropeptide)
- » Oligosaccharide analysis (glycomics)
- » Digestion analysis (in vitro, ex vivo and in vivo (human subjects))
- » Milk enzyme (protease, lipase, glycosidase) activity analysis
- » Antibacterial and commensal bacteria growth stimulation assays

- » Macrophage activation assays (immunomodulation)
- » Intestinal cell assays
- » Viral inhibition assays
- » ELISA

Si Hong Park Lab

- » Anaerobic chamber to cultivate gut microbiota
- » Absorbance microplate reader (Tecan): Measure a growth curve of bacteria
- » Qubit 4: Measure DNA/RNA concentration
- » PCR, centrifuge etc. Basic molecular work-related equipment.

Juyun Lim Lab

Center for Sensory and Consumer Behavior Research is specialized in conducting basic and applied research, providing customized sensory testing services to food industry, and educating future sensory professionals. Occupying approximately 1,300 sq ft, our center includes two fully equipped wet-lab facilities (one full kitchen and another for chemical stimulus preparation), three independent testing rooms (two testing rooms with a total of ten testing booths and one testing room equipped with a specially designed rinse-sink for psychophysical experiments). Our center also has access to a state-of-the-art focus group room. The center maintains over 3,500 active consumers in the pool.

Chris Curtin Lab

Assistant Prof. Chris Curtin is a yeast biologist with expertise in microbial physiology and application of genomics techniques, including whole-genome sequencing, to better understand microbial response to the environment. The Curtin laboratory is equipped for:

- » high-throughput screening of microbial response to stress conditions.
 - › Screening of potential clean-label mold inhibitors effective on the surface of cheese.
- » preparation of various kinds of genomic sequencing libraries.
 - › Analysis of fungal and bacterial communities associated with dairy products and environments.

UTAH STATE UNIVERSITY

Gary Haight Richardson Dairy Products Laboratory

Faculty Director of Operations: Dr. Taylor Oberg

The Gary Haight Richardson Dairy Products Laboratory at Utah State University is a complete dairy processing facility. It operates daily to produce the dairy products used on campus. It also is used extensively by the researchers at the Western Dairy Center, as well as by researchers from industry for research and product development. Facilities are available on a daily basis for research, product development, formulation, manufacture and scale-up of dairy products. The efficient operation and flexible scheduling ensure a short turnaround time for the customers' products.

Equipment:

- » Scherping horizontal cheese vats (1,500 lbs.) (2)
- » Bench scale cheese vats (30 lbs., 10 lbs.)
- » Open cheese vats (500 lbs.) (3)
- » Homogenizer and pasteurizer
- » Tetra Pak Sterilab ultra-high temperature processor (steam injection and indirect heating)
- » High-pressure, high-temperature extruder
- » Process cheese cooker
- » Ice cream freezer, continuous and batch
- » Mozzarella cooker/stretcher
- » Ultrafiltration, microfiltration, nanofiltration and reverse osmosis separation
- » Grinder
- » Vacuum packager
- » Yogurt system: fermentation tank (100gal.), smoothing valve, cooling/mixing tank (100gal.), packaging into variety of package sizes.

SUPPORTING ANALYTICAL EQUIPMENT:

- » Rheometer
- » Texture profile analyzer
- » High-performance chromatograph
- » High-performance chromatograph/mass spectrometer
- » Gas chromatograph
- » Gas chromatograph/mass spectrometer
- » Capillary electrophoresis
- » Babcock apparatus
- » Microtome
- » Water activity meter

- » Fermenters
- » BSL2+ laboratory with necessary equipment
- » Twin-screw extruder
- » Titrater
- » Freeze dryer
- » Particle analyzer
- » Light microscope
- » Polarized light microscope
- » Turbidity meter
- » Low-intensity ultrasound
- » High-intensity ultrasound
- » Thermo analyzer
- » Moisture analyzer
- » Spectrophotometer UV/Vis
- » Centrifuges
- » Sample homogenizers
- » Freezer (-80 C)

Prateek Sharma Lab

Dr. Sharma's lab is equipped to conduct material testing on dairy foods. The lab is specialized in rheological, textural, and functional characterization of liquids, gels, and solid dairy foods. Equipment available in the lab includes MCR 302 rheometer, TAXT plus texture analyzer, viscometer, rapid protein and moisture analyzer, compound microscope, gel electrophoresis, stomacher etc. It has following research capabilities:

- » Small and large amplitude oscillatory shear rheology on dairy foods for studying gelling, melting and flow behavior
- » Tribology and wear behavior of food materials
- » Interfacial rheology
- » Texture profile analysis of various cheeses
- » Spreadability of butter like products, spreads, etc.
- » Extensibility and Shreddability of cheese samples using texture analyzer
- » Functional properties of cheese including melting, pizza baking performance, etc.
- » Proteolysis in cheese using UREA/SDS PAGE, pH 4.6 soluble nitrogen
- » Water activity measurements
- » Moisture, protein and fat analysis of dairy products

WASHINGTON STATE UNIVERSITY

WSU Pilot Plant

The facilities include access to food processing equipment that would be used for pilot scale testing.

- » EPSI 2 liter HPP process vessel 600 MPa 20-90C
- » Blaw Knox 6x8 double drum dryer
- » Sidam novelty freezer
- » Avure 35 liter HPP process vessel 600 MPa 20-50C
- » Hydrothermal steam injection heater
- » TA/XT2 Texture Analyzer
- » 18-200 liter fermentation tanks with chilled water controlled cooling
- » Armfield FT 40 multiprocess vessel with Silverson mixer
- » Minolta CM-5 Spectrocolorimeter
- » Allfill pneumatic pouch filler
- » Hobart mixers various sizes
- » Koch 250 vacuum pouch sealer
- » Dixie vacuum can closer (various size cans)
- » Hobart bowl chopper
- » Multivac T200 vacuum tray sealer (various size trays)
- » Groen NVA 40 vacuum pan evaporator
- » Small cheese making vats
- » 20-quart steam jacketed mixer
- » 40-, 60- and 80-gallon cooking kettles
- » Milk homogenizer
- » A batch and continuous ice cream freezer
- » Batch and continuous HTST pasteurizer

Dairy Microbiology Laboratory (Lab 240, Food Science & Human Nutrition Building)

This laboratory is a BSL-2 applied food microbiology laboratory with research focus on dairy microbiology and food safety. This laboratory is furnished with all basic applied microbiological equipment including biosafety cabinets, centrifuges, microscope attached to digital camera, smasher, incubators, autoclaves (in a separate room), -80C freezer, refrigerators, water baths, and different types of temperature data loggers. The Dairy Microbiology Laboratory has a good collection of various pathogenic, spoilage and probiotic strains that can be used in various food microbiology studies. The hyperspectral imaging system is used for developing rapid identification technique for food borne microorganisms.

- » Hyperspectral imaging microscope system
- » Microscope attached to digital camera
- » Biosafety cabinets
- » Incubators
- » 80C freezer
- » Refrigerators
- » Centrifuge
- » Smasher
- » Weighing balances
- » Hot- and stirrer-plates
- » Autoclave (in a separate room)
- » Water activity meter
- » pH and ORP meters
- » Kitchen oven
- » Chemical hood
- » Different type of temperature data logger
- » Water baths

Food Processing Laboratory (Lab 373, Food Science & Human Nutrition Building):

This laboratory is dedicated to the non-pathogenic food microbiology and processing research. This laboratory has all the basic equipment needed for basic food science research. The high efficiency nanobubble generator purchased from Japan is a novel technology in food science, and is used to study various applications in food safety, quality and processing.

Equipment:

- » Nanobubble generator
- » Microscope
- » Incubators
- » Refrigerators
- » Centrifuge
- » Smasher
- » Weighing balances
- » Hot- and stirrer-plates
- » Water activity meter
- » Water baths
- » pH and ORP meters
- » Chemical hood
- » Different types of temperature data logger

Carolyn Ross - WSU Sensory Science Center

The Sensory Evaluation Facilities are located on the Washington State University campus in the Food Science and Human Nutrition Building. These facilities include a food-safe kitchen preparation area (500 sq. feet), with ovens, stoves, water baths, warming lights, refrigerators and extensive counter space. Also, part of the facilities is a dedicated sensory training room for descriptive analysis training sessions (230 sq. ft). The Sensory Evaluation Facility includes eight pass-through sensory analysis booths, each equipped with a laptop computer and colored lights (total square footage=210 sq. ft). Each computer is installed with Compusense®Cloud software, which has the capacity and flexibility to present numerous sensory evaluation tests and collect sensory data from panelists. We also have the necessary statistical software for analysis with expertise in each of these software packages. Samsung Galaxy tablets (12) are available for use by trained panelists for sensory profiling, as well as for off-site testing. The Sensory Evaluation Facility also contains the necessary equipment for food preparation, sensory standard preparation and food holding (frozen, cold, warm and hot). Additional equipment such as balances, mixers and other food preparation equipment is available.

The equipment present in the Ross food analysis/food chemistry lab includes: one gas chromatography/olfactometer/mass spectrometer (HP/Agilent 6890N) equipped with auto sampler and DATU data processing and 2012 NIST Library. This system is compatible with SPME (solid-phase microextraction), SPDE (solid phase dynamic extraction) and liquid injection. One gas chromatograph (HP/Agilent 5890N) equipped with stir bar sorptive extraction (SBSE) capabilities. An electronic tongue (ASTREE alpha-MOS, Toulouse, France) equipped with an autosampler and 7 sensors to detect non-volatile compounds is also in the lab. The lab also contains other general food analysis and food chemistry equipment, including a pH meter, autotitrator, rotary evaporator and other general lab supplies.

Meijun Zhu - WSU Food Microbiology and Nutrigenomics Laboratory

Equipment in her BSL2 lab includes: Labconco Class II Purifier® Biosafety hoods, Thermo Scientific General Microbiological incubators, Thermo Precision™ refrigeration incubators, Thermo®, MaxQ4000 incubator shaker, two Seward Stomacher 400 Lab Blenders, Thermo KingFisher 96 immunomagnetic

separation, humidity equilibrium chambers with a humidity control system, AquaLab 4TE benchtop water activity meter, Fisher Isotemp 5150 H11 oil bath, Lab-line aquabath digital water bath, Labconco Freezone 4.5 freeze-dryer, BioTek Synergy H1 Hybrid multi-mode microplate reader, Eppendorf MixMate mixer, Eppendorf 5810R, 5702 and 5424 centrifuge, Thermo® Chromatography refrigerator and -80°C ultra-low freezers, Sharpertek Heated Ultrasonic Cleaner XPS180-6L, Thermo Orin Versa Star Pro™ pH/ISE multiparameter meter with RDO optical dissolved oxygen sensor, Hach DR/900 multiparameter handheld colorimeters.

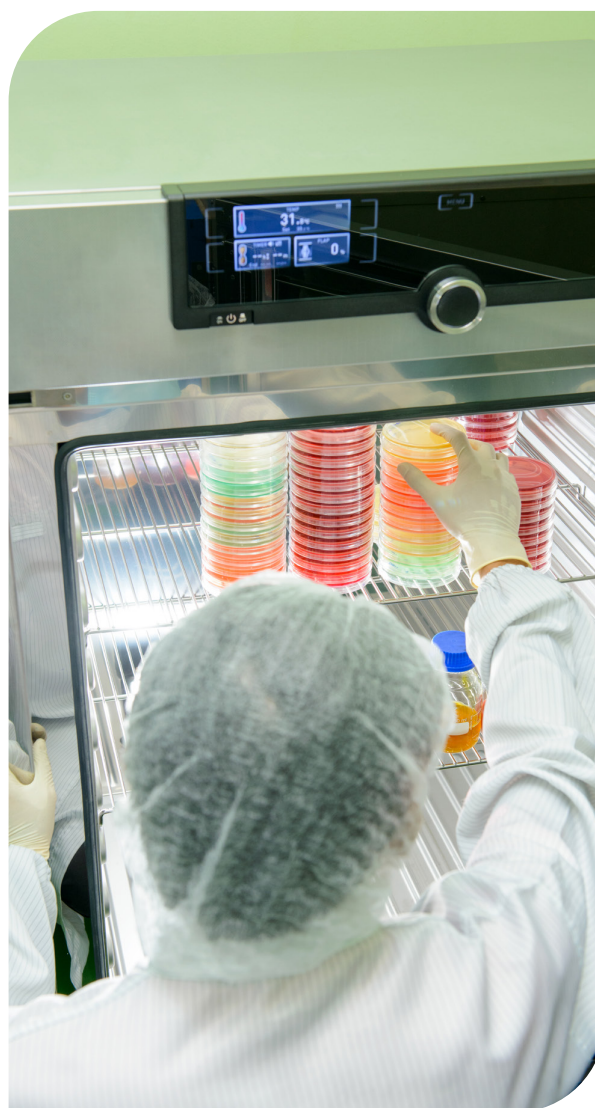
Equipment in her BSL1 lab includes: Labconco Class II Purifier® Biosafety hoods, Thermo 3110 Dual stack CO2 incubators, VWR 1545 incubators, VWR B.O.D. refrigerator incubator, humidity equilibrium chambers, Seward Stomacher 400 Lab Blender, Thermal digital water bath, Mettler Toledo PL3002 balance and XS105DU analytical balance, Thermo HistoStar embedding workstation, Thermo Microm HM325 microtome, Leica 2800E Frigocut Microtome Cryostat, Bio-Rad mini-protean Tetra electrophoresis and blotting transfer units, Thermo Vari-Mix platform rocker, Polytron PT2100 homogenizer generators and Qsonica Q700 sonicator, Termo® NanoDrop 2000, Bio-Rad T-100 Thermal Cycler, Bio-Rad CFX384 real-time PCR system, Thermo EVOS fl fluorescence inverted microscope with time-lapse system, Leica DM2000 LED fluorescence upright microscope, Thermo® Locator 8 Liquid nitrogen tank, Beckman 350 pH meter, VWR® Chromatography refrigerator, -20°C and -40°C freezers, SHIMADZU prominence HPLC M30PDA and Agilent 5977A/7890B GC/MS system.

WEBER STATE UNIVERSITY

The Department of Microbiology at Weber State offers a comprehensive degree in microbiology. We have emphasis areas in medical microbiology, public and environmental health and industrial microbiology and biotechnology. We offer many opportunities for students to conduct mentored undergraduate research projects.

- » Teaching Labs: BS2-designated for 32 students
 - › Fume hoods
 - › Nuaire NU-540-600 Class II Type A2 Biological Safety Cabinets (8)
 - › 20 Leica DM750 Phase contrast compound microscopes--some with integrated cameras
 - › Isotemp water baths
 - › Sorvall ST16 centrifuges (2)
 - › Microcentrifuges
 - › Vortexers
 - › MaxQ4450 benchtop incubator/shakers (2)
 - › Heratherm microbiological incubators
 - › Heracell VIOS 160i CO2 incubators (2).
 - › Anaerobic growth jars
 - › Stomacher
 - › Media preparation station
- » Media prep room with two large-capacity autoclaves, fume hood, chemical cabinet, media refrigerator, hot/stir plates, pH meter, microbalance and dishwasher.
- » Olympus BX43 fluorescence microscope with 130W mercury vapor source, DP22 2.8 Mp CCD camera and filters for DAPI, FITC, and CY3.
- » Olympus FV3000 Confocal Scanning Laser Microscope
- » Research Labs
 - › Environmental microbiology lab
 - › Coy vinyl anaerobic chamber Heraeus
 - › Megafuge 1.0R Centrifuge
 - › Grow light bank and stands
- » Cell culture lab
 - › BioSpec Mini-Beadbeater
 - › NanoDrop Lite Spectrophotometer
 - › Tecan Infinite M200 plate reader (visible, fluorescence and luminescence capable) (2)

- › Barnstead MicroPure water purification system.
- › Inverted microscope
- » Molecular microbiology lab
 - › Applied Biosystems QuantStudio 3 RT-PCR system
 - › Applied Biosystems SimpliAmp Thermal Cycler
 - › Eppendorf Mastercycler Thermocycler
 - › Clean hood
 - › Microcentrifuge
 - › Gel electrophoresis systems





COURSES AND EVENTS

- USU
<https://caas.usu.edu/westerndairycenter/build/short-courses-and-workshops>
- WSU
<https://creamery.wsu.edu/educational-opportunities/cheesemaking-shortcourse/><https://extension.wsu.edu/foodsafety/training-programs/>
- OSU
<https://foodsci.oregonstate.edu/foodsci/extension-outreach/learning-opportunities>
<https://foodsci.oregonstate.edu/foodsci/arbutnot-dairy-center>



STAFF AND RESEARCHERS

ZEYNEP ATAMER, Ph.D.

Assistant Professor, Dairy processing and technology
Department of Food Science and Technology
Oregon State University
zeynep.atamer@oregonstate.edu

Dairy science, dairy microbiology, dairy bacteriophages, spore formers, process and food safety, thermal inactivation, inactivation kinetics, milk proteins, fractionation of casein, membrane separation, heat-stable milk enzymes, cheese technology, ice-cream technology. Teaching Interests include Dairy Processing and Technology, Cheese Science and Technology.

GENE AHLBORN, Ph.D.

Associate Professor, Microbiology and Dairy Technology; Food safety, fermentation Department of Nutrition, Dietetics, and Food Science
Brigham Young University
gene_ahlborn@byu.edu

Flavor chemistry and development (fermentation, reaction and process flavors; Food safety and toxicology; biotechnology)

STEPHANIE CLARK, Ph.D.

Affiliate Professor, Dairy Chemistry, Microbiology, Product Development and Sensory Evaluation
Department of Chemical and Materials Engineering
New Mexico State University
dairy.made.me@gmail.com

Responsibilities have included Associate Director of the Midwest Dairy Foods Research Center, Founder of Iowa State University Creamery, Research in the areas of dairy chemistry, microbiology, processing, and sensory evaluation, as well as undergraduate/graduate Teaching and advising at Iowa State University. Specialties: Dairy foods, Product Development, Sensory Evaluation.

DANIEL CLARK, Ph.D.

Professor, Molecular Biology
Undergraduate student research program
Department of Microbiology
Weber State University
danielclark9@weber.edu

Dr. Daniel Clark studies the pathogenesis, interactions, and treatments of various microbes (MRSA, Salmonella, the brain-eating amoeba *Naegleria fowleri*, malaria, herpes simplex virus) using microbiology and cell culture techniques with bioinformatics. He is an Ogden, Utah native who loves teaching and pondering life's big questions. He teaches microbiology at Weber State University, where he obtained his bachelor's degree. He then received his Ph.D. in molecular biology from BYU studying lupus, and was a postdoctoral fellow at Penn State, focusing on the hepatitis B virus.

MICHAEL QIAN, Ph.D.

Professor, Flavor Chemistry, Lipid Chemistry
Department of Food Science and Technology
Oregon State University
michael.qian@oregonstate.edu

Aroma and flavor compound identification and characterization; flavor compounds chemical and biochemical generation; flavor retention and deterioration during processing and storage. Solventless sample preparation techniques and instrumental analysis with an emphasis on GC, fast GC, HPLC, GC-MS, GC-MS/olfactometry and multi-dimensional GC/GC-MS analysis. Dr. Qian has extensive industrial and academic experience in dairy flavor chemistry and dairy chemistry. His most recent project involved enrichment and isolation of milk membrane lipids and structural elucidation.

SHERI COLE

Director of Sustainable Food Manufacturing
Department of Food Science and Technology
Oregon State University
sheri.cole@oregonstate.edu

Lead OSU's newly established Sustainable Food Manufacturing program. The program's goal is to serve as leaders in enabling changing our food systems to be more sustainable, resilient and equitable through evolution of Food Science and Technology's student education, strategic interdisciplinary research and highly engaged outreach efforts with industry in the Western US and beyond.

MICAH DRUMMOND, Ph.D.

Professor, Muscle Cell Metabolism
Department of Physical Therapy and Athletic Training
University of Utah
micah.drummond@hsc.utah.edu

The research projects within Dr. Drummond's laboratory hold to two general research themes: 1) Understanding the cellular and molecular mechanisms of muscle growth and metabolic function in healthy and mobility impaired older adults. 2) Novel exercise and nutritional strategies to improve muscle, metabolic and physical function deficits in older adults recovery during rehabilitation.

MICHELE CULUMBER, Ph.D.

Professor, Immunology, molecular biology, microbiology, biotechnology
Department Chairperson, Undergraduate student research program
Department of Microbiology
Weber State University
mculumber@weber.edu

Dr. Culumber is interested in studying unique microorganisms in unique environments. She has done research on microbes in contaminated groundwater, Hawaiian soils, Peat Bogs, The Great Salt Lake, and Cheddar cheese. Teaching Interests: Microorganisms impact almost every part of our lives and environments. Dr. Culumber enjoys sharing the many ways that we interact with microorganisms and hope to capture students' interest and motivate them to become scholars of microbiology. She also hopes to encourage students to see how microbiology influences their lives and their careers.

CHRISTOPHER CURTIN, Ph.D.

Associate Professor, Food and Dairy Fermentations
Department of Food Science and Technology
Oregon State University
christopher.curtin@oregonstate.edu

Dr. Curtin's laboratory focuses on fermentation microbiology and food spoilage prevention, spanning a range of fermented foods and beverages. We use next generation sequencing, genomics and molecular biology to understand microbial community function and the properties of fungi and bacteria that affect quality of foods and beverages. Outcomes of research in the Curtin laboratory include development of novel starter cultures, new fermentation system management practices, and identification of strategies to mitigate risk of spoilage.

YOUNAS DADMOHAMMADI, Ph.D.

Assistant Professor, Food-Health Nexus, Dairy Innovation and Sustainability
Department of Food Science and Technology
Oregon State University
younas.dadmo@oregonstate.edu

Younas is a highly trained Chemical Engineer, holding a B.Sc., M.Sc. and Ph.D. His groundbreaking research tackles the pressing agrofood sustainability challenges with a robust multidisciplinary approach. In his lab, Younas leads innovative work on food and feed fortification, the development of novel and health-promoting functional foods and beverages, protein functionalization, precision delivery, co-product valorization, and the extension of shelf life. Younas strongly asserts that DAIRY provides a wealth of benefits beyond just nutrition.

DAVID DALLAS, Ph.D.

Associate Professor, Dairy Nutrition
Department of Nutrition Program, College of Health
Oregon State University
Dave.Dallas@oregonstate.edu

Our laboratory researches the bioactivities of milk proteins and peptides (antimicrobial, pathogen anti-adhesive, immunomodulatory, anti-viral, intestinal cell modulation), their survival and release through the digestive system (using in vivo studies and digestive simulations), the effects of various processing strategies on preservation of milk bioactivities (UV-C, high pressure processing, thermal processing, spray drying, freeze drying) and

the impact of peptides on sensory properties of dairy products (e.g., bitter peptides in cheese). We apply a variety of tools, including clinical trials, mass spectrometry analysis (proteomics, peptidomics, glycopeptidomics, glycomics), protein assays, enzyme assays and cell culture-based bioactivity analysis. benefits beyond just nutrition.

MICHAEL DUNN, Ph.D.

Professor, Food and Dairy Technology
Department of Nutrition, Dietetics, and Food Science
Brigham Young University
michael_dunn@byu.edu

Micronutrient fortification and stability, Shelf-life assessment, Novel food products & processes

COURTNEY M. GARDNER, Ph.D.

Assistant Professor, Environmental microbiology, agricultural waste management, bioprocess engineering
Department of Civil and Environmental Engineering
Washington State University
courtney.gardner@wsu.edu

I am an environmental engineer and applied environmental microbiologist. My research program applies molecular biotechnology to address current challenges at the interface of agriculture, environmental science, and engineering. My overarching goals are to assess microbial adaptation to environmental stressors in both natural and engineered systems as well as to manipulate the dynamics that exist between microbial communities and their environments. My group uses an interdisciplinary approach rooted in applied microbiology, molecular biology, and engineering to accomplish these goals. We employ fundamental biological concepts to study how human activity impacts the adaptation and function of microbiomes and apply this information to develop microbiological interventions for ecological restoration (e.g., nutrient management) as well as diagnostic tools for assessing ecological dysbiosis (e.g., microbiome stress and resilience). My research interests include microbial bioprocess engineering for agricultural waste treatment and nutrient management, microbiome engineering, the environmental fate and behavior of genetic biotechnology used in agriculture, environmental antibiotic resistance, and plant pathogen-host interactions.

TANYA HALLIDAY, Ph.D.

Assistant Professor, Sports Nutrition
Department of Health and Kinesiology
University of Utah
tanya.halliday@utah.edu

My research focuses on how exercise of differing modalities influences appetite regulation, energy intake, non-exercise physical activity, and body weight management. My research training and current work also include an emphasis on development of novel interventions for weight loss maintenance; and examination of mechanisms linking lifestyle habits (diet and exercise) to glycemic-related outcomes.

KORRY HINTZE, Ph.D.

Associate Professor, Nutrition
Department of Nutrition, Dietetics, and Food Sciences
Utah State University
Korry.Hintze@usu.edu

Diet, chronic disease, gut microbiome, dairy bioactives and gut health, Western diet and colon cancer, dietary protein and gut inflammation.

LAURA JEFFERIES, Ph.D.

Associate Professor, Sensory perception, labeling, dairy technology
Department of Nutrition, Dietetics, and Food Science
Brigham Young University
laura_jefferies@byu.edu

Sensory analysis and consumer insights and marketing. Dairy science, packaging design and messaging. Food processing and engineering. Teaching Interests; Food Process Engineering, Techniques for Sensory Evaluation, Food Commodity Processing.

KRISTEN A JOHNSON, Ph.D.

Professor, Sustainability, Ruminant nutrition, manure management, mitigation of GHG
Department of Animal Sciences
Washington State University
johnsoka@wsu.edu

Sustainability is not an obtainable target, rather it is a decision-making framework used over time. Our goal is to provide information to the dairy industry that allows for sound decision-making. Environmental issues are of increasing concern

to livestock industries. We generate scientifically-based information about air quality and ruminant production. Additionally, we work with the industry to create economically-based solutions to current and future challenges. Recent projects include examination of the efficacy of dairy water treatment through the use of vermiculture systems to enhance the use of water, reduce emissions, and create value-added products

MELANIE HANLON

Dairy Initiative Program Manager, Dairy product development, outreach and engagement, and program logistics

Department of Food Science and Technology
Oregon State University
melanie.hanlon@oregonstate.edu

My educational background has been in food science and technology, with a focus of my undergraduate studies on cheesemaking and microbiology of dairy products. During this time I also interned in product development and gained an appreciation for innovation and quality of new products. I am passionate about sustainable food systems, and am eager to learn more about applications of food science.

JUYUN LIM, Ph.D.

Professor, Consumer & Sensory Evaluation
Department of Food Science and Technology
Oregon State University
juyun.lim@oregonstate.edu

Taste perception, flavor perception, ingestive behavior, consumer behavior, sensory and consumer testing methodology.

LESLIE KERBY, Ph.D.

Associate Professor, Machine Learning, Artificial Intelligence

Department of Computer Science
Idaho State University
lesliekerby@isu.edu

Dr. Kerby's research and capabilities center around designing, building, and securing AI systems within science and engineering. Projects are varied and include AI applied to nuclear reactor operation and monitoring, AI applied to Li-ion battery performance and quantum chemistry, the security of AI systems, and building custom AI applications for collaborators (for example, scholarly analysis or qualitative data analysis).

JASON KENEALEY, Ph.D.

Associate Professor, Chemotherapeutics
Department of Nutrition, Dietetics, and Food Science
Brigham Young University
jason_kenealey@byu.edu

Milk protein biochemistry, protein unfolding and protein stability, protein-ligand binding interactions, recombinant protein expression, isothermal titration calorimetry, differential scanning calorimetry, microcalorimetry.

DOUG TREE, Ph.D.

Associate Professor, Chemical engineering
Department of Chemical Engineering
Brigham Young University
tree.doug@byu.edu

Dairy: crystallization, triacylglycerol phase behavior
Equipment: Anton Paar Modular Compact Rheometer with Peltier temperature control

JOVANA KOVACEVIC, Ph.D.

Associate Professor, Food Microbiology
Department of Food Science and Technology
Oregon State University
jovana.kovacevic@oregonstate.edu

Dr. Kovacevic's program focuses on food microbiology and safety, with emphasis on traditional and novel molecular microbiology and genomic approaches to study the mechanisms underlying pathogenesis, stress survival, persistence and antimicrobial resistance of foodborne pathogens. Her research uses molecular methods and whole genome sequencing to trace, better understand and prevent contamination events in the food chain, with particular focus on *Listeria monocytogenes*. Through her work with the Western Regional Center to Enhance Food Safety, she supports the Western U.S. region in Food Safety Modernization Act-related food safety training, education and outreach activities.

GINNY LANE, Ph.D.

Assistant Professor, Human Nutrition
School of Family and Consumer Sciences
University of Idaho
vlane@uidaho.edu

Dr. Lane's research focuses on nutritional health status among children and marginalized populations, with an emphasis on understanding the social environment with a view to the development of culturally appropriate interventions at the community level. Her research uses mixed methods to comprehensively understand and address nutritional health concerns.

Through her work with the University of Idaho Food Security Coalition, she supports efforts to enhance food security on campus.

APRIL LEYTEM, Ph.D.

Research Soil Scientist
University of Idaho
USDA-ARS
april.leytem@usda.gov

Dr. Leytem's research addresses challenges in sustainability of integrated livestock-cropping systems. Her research has focused on nutrient cycling and emissions of reactive nitrogen and greenhouse gasses from dairy production facilities as well as cropping systems utilizing manure as a nutrient resource. In addition she has worked on improving process based models for estimating emissions and nutrient flow at the farm scale as well as improvement of national and international inventory methodologies.

ROBERT WARD, Ph.D.

Associate Professor, Food Bioactives, Analysis and Technology and Health
Department of Nutrition, Dietetics, and Food Sciences
Utah State University
robert.ward@usu.edu

Bioactive Nutrients - PUFA and Inflammation - Gut Integrity

OWEN MCDUGAL, Ph.D.

Professor, Organic, Natural Products, and Food and Dairy Chemistry
Director, Food and Dairy Innovation Center
Founding Editor and Chief, AIMS Molecular Science
Department of Chemistry and Biochemistry
Boise State University
owenmcdougal@boisestate.edu

Dr. Owen McDougal is the principal investigator for a Phase 2 National Science Foundation Convergence Accelerator project. In this capacity, he leads the Dairy NutriSols convergent science team to develop chemometric software, integrate advanced manufacturing technology, upcycle minerals, and develop an employee pipeline for the dairy industry. Team and project work involves engagement with industry partners at Dairy West, Daisy Brand, Agropur, Glanbia Nutritionals, and Chobani. Dr. McDougal's research involves the acquisition of infrared spectra, Kjeldahl data, Leco analysis, high performance liquid chromatography separations, dairy protein powders, and ingredient testing.

He also works with scientists at Idaho National Laboratory to develop separation and valorization protocols for agricultural and food processing byproducts.

DONALD MCMAHON, Ph.D.

Professor Emeritus, Dairy, Cheese Technology, Milk Proteins
WDC Director Emeritus
Department of Nutrition, Dietetics, and Food Sciences
Utah State University
donald.mcmahon@usu.edu

Donald J. McMahon has conducted research in the dairy food science program at Utah State University for 30 plus years to better understand the chemistry and technology underlying conversion of milk into high quality dairy foods with enhanced nutritional properties. He directed the Western Dairy Center that serves as a regional center for dairy food research and technical training and was key in developing the BUILD Dairy program.

KONRAD MEISTER, Ph.D.

Assistant Professor, Biochemistry/Physical Chemistry
Department of Chemistry and Biochemistry
Boise State University
konradmeister@boisestate.edu

My lab is interested in biomolecules with unique interfacial properties and my lab tries to unravel how they work on the molecular scale and how we can use them in innovative dairy applications. Biomolecules we are currently working on are antifreeze proteins and their usage in frozen desserts, BSA and hydrophobins and their usage in foams, and lactoferrin and its antibacterial properties and ion binding capabilities. Recently, we also started using confocal Raman microspectroscopy to investigate the structural transitions of yogurt and cheeses as a function of temperature.

SHINTARO PANG, Ph.D.

Associate Professor, Food Chemistry, Food Safety and Quality
Department of Nutrition, Dietetics, and Food Science
Brigham Young University
shintaro_pang@byu.edu

Dr. Pang's research objective is to improve the safety, quality and nutrition of our food supply by developing rapid analytical methods that enable us to detect, quantify and/or characterize target contaminants or compounds present in food.

CAROLYN ROSS, Ph.D.

Professor, Sensory & Consumer Science
School of Food Science
Washington State University
cfross@wsu.edu

In the area of relating sensory perception to quantifiable characteristics, we have developed rapid novel sensory methods to relate to the response from various instruments, including the electronic tongue. Within dairy, we have applied these sensory and electronic tongue methods in assessing the quality of milk protein concentrate, and the perception of spicy cheese. Being a food scientist, I am also interested in determining the influence of raw ingredients and storage on final product quality and through collaborations with the WSU Creamery, we have performed such research in cheese. A final research area is the development of food products to address challenges facing specific populations. This includes working with older adults and designing meals containing dairy foods to address their specific needs. We also study oral processing in children with texture sensitivities, particularly children with Down syndrome.

PRATEEK SHARMA, Ph.D.

Associate Professor, Dairy Processing and Technology
Department of Nutrition, Dietetics, and Food Sciences
Utah State University
prateek.sharma@usu.edu

Dr. Sharma's research interests include material science approaches in manufacture and characterization of dairy foods. His research work focusses on cheese structure-function relationships, Food structure design and its impact on functionality of dairy ingredients and products, and Rheology of dairy products. Overall goal of his research program is to improve functionality of dairy ingredients and foods using process innovations.

GULHAN UNLU, Ph.D.

Associate Professor, Food microbiology and bacteriology
School of Food Science
Washington State University
gulhan.unlu@wsu.edu
Food, Dairy and Wine Microbiology - Bioactive Packaging of Foods - Food Biotechnology - Functional Foods - Microbial Food Safety - Food

Biopreservation - Bioconversion of Agricultural and Industrial Waste into Value-Added Products. Fermented dairy products incl. cheese, yogurt and kefir.

STEPHAN VAN VLIET, Ph.D.

Assistant Professor, Physiology, Nutrition Science, Metabolism
Department of Nutrition, Dietetics, and Food Sciences
Utah State University
stephan.vanvliet@usu.edu

Dr. van Vliet's research is performed at the nexus of agricultural and human nutrition. He routinely collaborates with farmers, ecologists, and agricultural scientists to study critical linkages between agricultural production methods, the nutrient density of food, and human health. Dr. van Vliet uses metabolomics and proteomics techniques to study the presence of bioactive compounds in foods and their impacts on human metabolic health. His work has been published in the American Journal of Clinical Nutrition, Scientific Reports, and the Journal of Nutrition.

AMBER MOORE, Ph.D.

Associate Professor, Extension Soil Fertility Specialist
Department of Crop and Soil Science
Oregon State University
amber.moore@oregonstate.edu

Dr. Amber Moore is an Extension Soil Fertility Specialist and Associate Professor with the Crop and Soil Science Department at Oregon State University. Dr. Moore has also been active in the WERA-103 committee since 2008 and is serving as the Western Nutrient Management Conference Chair in 2025. Her current Extension and research programs are focused on dairy manure, lime, and soil acidity, and nutrient management of PNW crops (potatoes, alfalfa, wheat, etc.).

CRAIG OBERG, Ph.D.

Professor, Emeritus, Dairy microbiology
Department of Microbiology
Weber State University
coberg@weber.edu

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

STEVE WINKEL, Ph.D.

Professor, Dairy Processing
Department of Animal and Food Science Brigham
Young University - Idaho
winkels@byui.edu

Dairy Processing, Food Safety and Quality, and
Product Development; Teaching Interests;
Introduction to Food Science, Survey of Food
Science, Food Laws and Regulations, Dairy
Processing, Product Development.

JOY WAITE-CUSIC, Ph.D.

Associate Professor, Food Safety and Quality
Systems Microbiology
Department of Food Science and Technology
Oregon State University
Joy.waite-cusic@oregonstate.edu

Joy's integrated food safety systems program
combines research, teaching, and outreach to assist
food production and processing industries (and
consumers) in improving food safety to minimize
foodborne illness. Joy's research program covers
four thematic areas: (1) pre-harvest food safety, (2)
process validation, (3) prevalence of pathogens
in food systems, and (4) microbiological quality
indicators and spoilage.

TAYLOR OBERG, Ph.D.

Assistant Professor, Microbiology
Director of operations USU Creamery
Department of Nutrition, Dietetics, and Food
Sciences
Utah State University
taylor.oberg@usu.edu

Dr. Oberg's research interests include the use of
next generation molecular methods to improve the
quality, functionality, and safety of dairy foods. His
current research areas include identification of
novel non-starter lactic acid bacteria and
characterizing their metabolic capabilities,
identification of alternate adjunct cultures to
decrease yogurt and cheddar cheese spoilage and
understanding how the redox potential of cheddar
cheese affects the microbiota and flavor.

RICHARD ROBISON, Ph.D.

Professor, Microbial Pathogens
Department of Microbiology & Molecular Biology
Brigham Young University
Richard_robison@byu.edu

Identification and characterization of microbial
pathogens in foods and other matrices; identification
of useful antimicrobial compounds produced by
bacteria.

MEIJUN ZHU, Ph.D.

Professor, Food Microbiology and Nutrigenomics
School of Food Science
Washington State University
meijun.zhu@wsu.edu

Her research interests center around food
microbiology, food safety, and the impact of dietary
bioactive compounds on gut microbiota and
chronic diseases. Specifically, she focuses on 1)
Exploring the influence of dietary factors and
bioactive food components on gut health and
associated metabolic diseases. She employs both in
vivo models and in vitro cell and tissue cultures to
elucidate the intricate interactions among nutrients,
microbiota, and gut epithelial health. 2) Developing
innovative methods to deactivate, intervene,
and detect foodborne pathogens and spoilage
microorganisms in foods and food production
environments, with a further exploration of their
applications in the food industry. Her research
incorporates analytic chemical, biochemical,
molecular techniques, and metagenomics,
complementary by traditional microbiological
approaches

SI HONG PARK, Ph.D.

Associate Professor, Microbiome in Foods and
Human Gut
Department of Food Science and Technology
Oregon State University
sihong.park@oregonstate.edu

Comparison of microbiomes in conventional and
organic raw milk collected from dairy farms. Gut
microbiome research in humans and animals
(poultry and mice) supplemented with dairy
products, prebiotics and probiotics. Identification
of cheese microbiome associated with safety and
quality. Genomic characteristics (virulence and
antibiotic resistance genes) of foodborne
pathogens using a whole genome sequencing.
Identification, characterization, and subtyping of
multiple foodborne pathogens (*Salmonella*,
Campylobacter, *E. coli*, and *Listeria*). Dr. Park's
projects involve cutting-edge molecular techniques
based on genomics, metagenomics and
transcriptomics.

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SOUTHEAST DAIRY FOODS RESEARCH CENTER

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