



DAIRY INNOVATION HUB



2021 Annual Report

Reflecting activities from July 1, 2020 – June 30, 2021



Table of contents

Our story	5
Accomplishments	9
Our leadership	10
Campus updates	14
Our partners	18
Research profiles	20
New faculty	30
Financial overview	34
Outreach efforts	35
Dairy Task Force 2.0	36
Award listing	38

On the cover: Veronica Justen is a professor of crop science at UW-River Falls. Her Hub-funded faculty fellowship focuses on novel dairy cropping systems to enhance farm economic and environmental resilience. Her study integrates cover crops into traditional dairy crop rotations to improve soil health and reduce nutrient run-off. *Photo by Pat Deninger/UW-River Falls.* Left: Cows at UW-Platteville's Pioneer Farm enjoy a meal after taking a turn in new milking robots. See story on p.17 . *Photo by Easton Green/UW-Platteville.* This report contains photos from various points during the pandemic and reflects evolving public health guidelines.

WISCONSIN DAIRY STATS

6,700
DAIRY FARMS
(as of Sept. 1, 2021)



more farms than
any other state

30.7
BILLION
pounds of milk
produced
annually



1,267,000
COWS
(That's almost half as
many cows as 1950!)



2ND NATIONALLY
in milk production



1ST NATIONALLY
in cheese
production



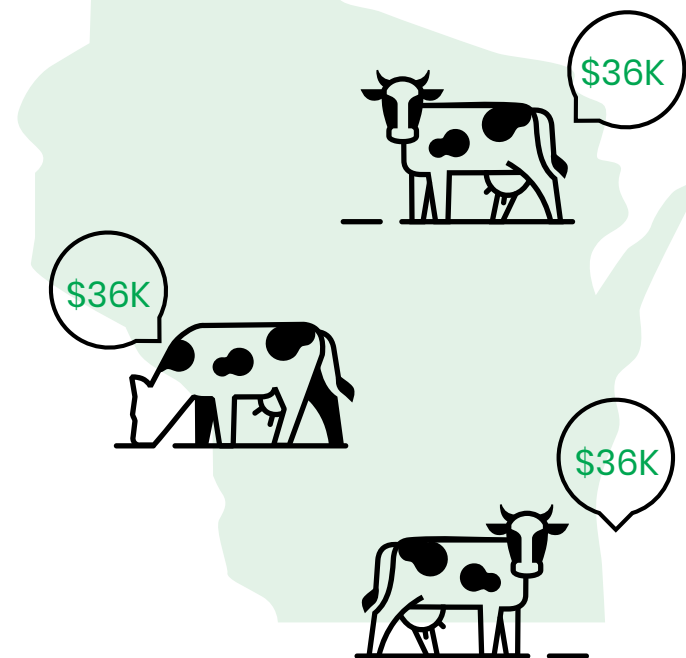
\$45.6 BILLION
in economic activity to the
state of Wisconsin

79K JOBS
in Wisconsin are dairy farming
or processing related

**EVERY COW IN WISCONSIN
GENERATES**

\$36,000

IN ECONOMIC ACTIVITY PER YEAR.



Sources: USDA NASS and Contribution of Agriculture to the Wisconsin Economy: An update for 2017 by Steven Deller, UW-Madison.

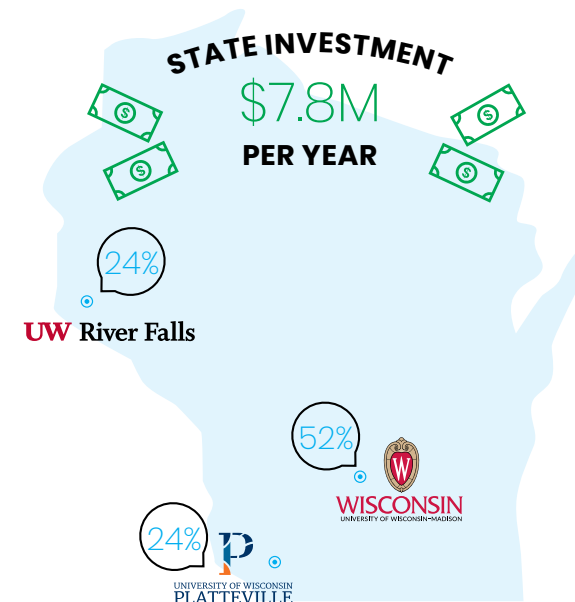
Our story

The Dairy Innovation Hub concept was first imagined during an informal meeting at Mitch Breunig's Mystic Valley Dairy in Sauk City. After the initial concept was developed, dairy groups and passionate dairy leaders partnered with UW System to bring this idea to reality.

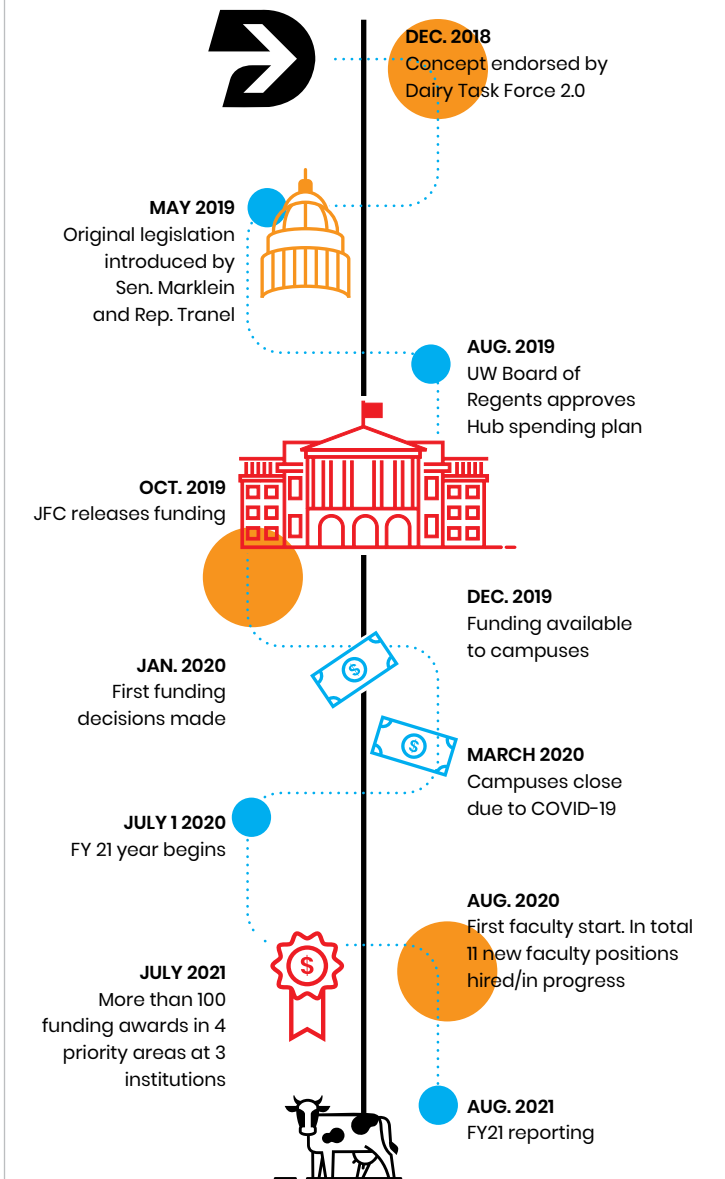
The concept was brought to the State's special Dairy Taskforce 2.0 in December of 2018 and was followed by introduction of legislation by Senator Howard Marklein and Representative Travis Tranel in May 2019. The following months included approval of a spending plan set to guide the Hub's efforts and funding became available to campuses in late 2019.

In less than two years, the Hub created mechanisms to manage the investment, funded more than 100 proposals and managed 11 faculty searches. In FY 21, two new faculty members began their new roles, the remaining nine start in FY 22. The accomplishments listed herein are the result of data collected from funding recipients to track progress and accountability.

THE DAIRY INNOVATION HUB, represents a \$7.8 million per year investment by the State of Wisconsin that harnesses research and development at UW-Madison, UW-Platteville and UW-River Falls campuses to keep Wisconsin's \$45.6 billion dairy community at the global forefront in producing nutritious dairy foods in an economically, environmentally and socially sustainable manner.



HOW DID WE GET HERE?



The Hub has four key priority areas:

Stewarding land and water resources

Reduce water use; improve soil health; improve air quality & limit use of land resources; develop alternative uses and markets for manure; and minimize nutrient losses to lakes and rivers.

Enriching human health and nutrition

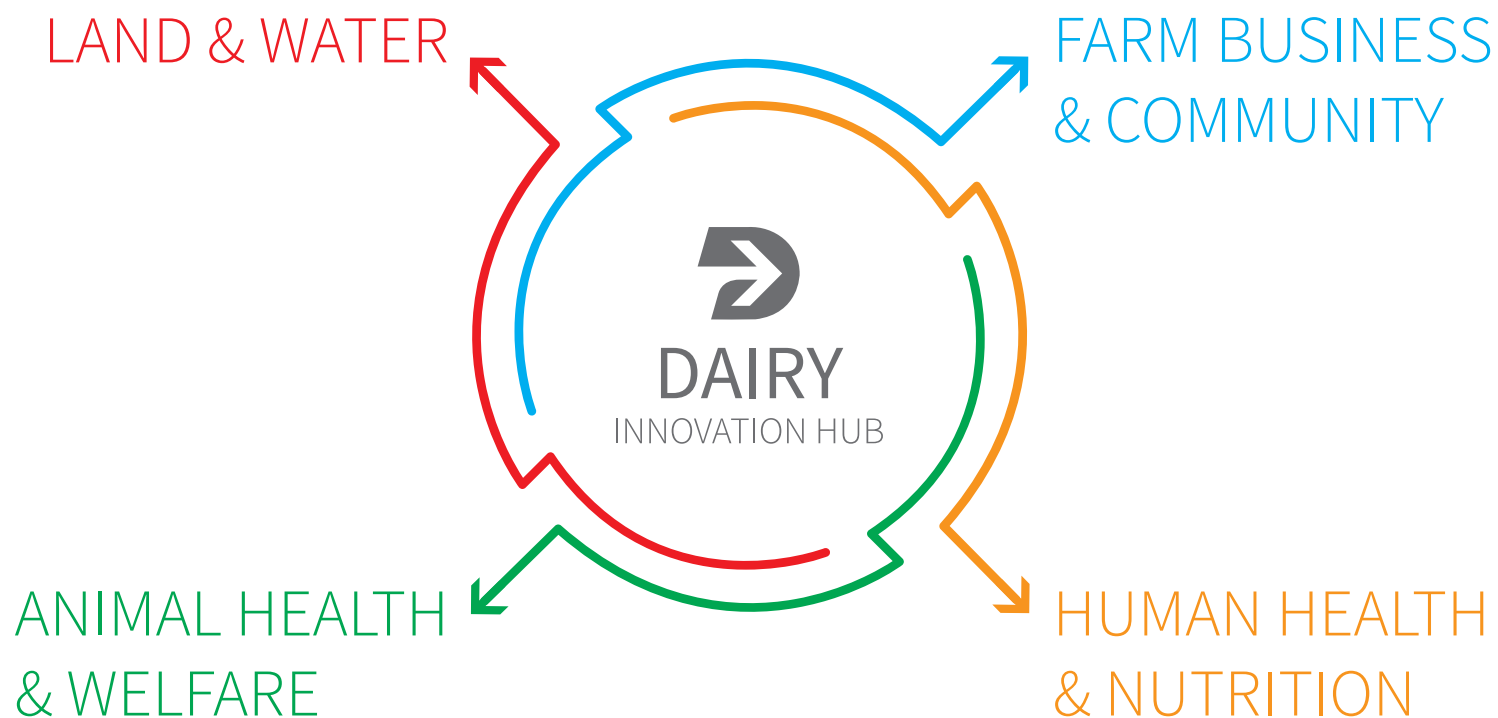
Limit risk of food-borne illnesses; reduce obesity & preventable health problems; create lactose-intolerant & allergy-free alternatives; improve the nutritional value of milk & meat; minimize pathogen risks in soil & water; and design packaging for convenience & shelf life

Ensuring animal health and welfare

Find effective alternatives to antibiotics; monitor animal health with sensor technologies; improve reproductive rates & replacement policies; reduce animal stress & enhance consumer trust; minimize risk of disease from animal contact; and deploy genomic selection for healthy animals.

Growing farm businesses and communities

Establish agricultural technology start-ups; use big data to optimize dairy farms; market specialty milk & meat products; develop skilled & tech-savvy rural workforce; improve financial literacy & return on assets; and understand supply chains, global markets and areas of opportunity.



Thinking globally, acting locally

MISSION: Position Wisconsin's dairy community for economic, environmental and social success by advancing science, developing talent and leveraging collaboration.

VISION: To be the world's preeminent source of bold new discoveries and talent development in dairy.

CORE VALUES:

- » **Awareness**
 - We are grounded by the realities of the dairy community. We seek to be dialed-in to the needs and conditions of our stakeholders.
- » **Learning and Discovery**
 - We support scientific advancement and evidence-based decision-making. We want to be a platform for lifelong learning and action.
- » **Collaboration**
 - We actively contribute to university partners and stakeholders working together as a team. We acknowledge the power of relationships.
- » **Respect**
 - We embrace diverse perspectives, cultures, audiences and business philosophies. We treat everyone with dignity and respect.
- » **Accountability**
 - We take the stewardship of resources seriously. We will take responsibility for the success or failures of our efforts.
- » **Creativity**
 - We encourage looking at common problems through a different lens. We will foster the spark of innovation and find answers to tomorrow's challenges.

Why is research and training so important?

- » Develop tools and technologies to produce more milk with less cows, land and water
- » Improve the quality of life for dairy animals and build consumer trust
- » Ensure a safe, abundant and nutritious food supply for ALL people
- » Recruit, train and retain talent to live and work in Wisconsin
- » Strengthen dairy economy by developing new products and uses for milk
- » Keeps Wisconsin dairy farms and businesses nationally competitive and rural communities strong



Photo by Jessica Cederquist/UW-Madison



We have funded short-term, high-impact projects and faculty fellowships, designed to yield research results that could be translated to the end-user in 1-2 years.



Dr. Heather White

faculty director | Dairy Innovation Hub

With guidance of building research capacity, recruiting top talent, supporting innovative research, and engaging in outreach and instruction across four priority areas, UW-Madison, UW-Platteville, and UW-River Falls set out to accomplish big goals. We faced challenges during COVID-19, like everyone, but focused on what we could accomplish. We are excited to welcome new Hub-funded faculty focusing on dairy to these campuses. They will build research and teaching programs and strive to bring in federal grant support, train undergraduate and graduate students, and share their research findings with the dairy community. These new research programs represent the early years of a career-long contribution to discovery in dairy.

Research is more of a marathon than a sprint. When challenges are identified, research questions are asked and results come on timelines of years, not days or weeks. This further emphasizes the importance of having existing expertise in Wisconsin to address critical challenges, working on tomorrow's solutions, and asking bold, daring questions. The Hub's strategy has been to balance this long-term vision with short-term victories.

Across the three campuses, we have funded short-term, high-impact projects and faculty fellowships. These projects were designed to yield research results that could be translated to the end-user in 1-2 years. We are excited to share early findings, some highlighted herein and at our events in November.

Research projects that span at least two campuses or directly involve Hub partners, have yielded stronger projects. This collaboration benefits students. We are working together to mentor graduate and undergraduate students using remote technology skills learned during the pandemic, which has removed distance barriers.

We are proud to share the accomplishments of the last year and hope you continue to engage in opportunities to learn more about projects funded in the first biennium.

Heather White

Accomplishments to date



More than **100 PROJECTS FUNDED** across three campuses and four priority areas

Total **\$8.8M SPENT & COMMITTED** since 2019



26 JOURNAL PUBLICATIONS published or in progress



11 FACULTY SEARCHES attracting top talent to Wisconsin



3 PATENTS one at each campus



51 RESEARCH PRESENTATIONS

"Who benefits from this research?"



Our leadership

Lactose is unique from other sugar crystals by their characteristic shape, allowing researchers to identify whether or not lactose crystals are present when developing new food products. The Hub focuses on all aspects of the dairy community, including human health and nutrition. Photo by Kayla Saslow from lab of Richard Hartel, food science/UW-Madison.



Kathryn VandenBosch

Dean, College of Agricultural and Life Sciences, UW-Madison

Here at UW-Madison, at the beginning of the Hub's third year, we are working hard to build Wisconsin's capacity for path-breaking research and to grow our talented work force. Both aims are key to assuring Wisconsin's continued status of as the innovative leader in the dairy community. I am proud of all those involved – from the Hub's director and campus steering committee who lead with vision, to the researchers who are crafting the investigations that will forge new knowledge to impact the future. And I continue to be grateful for the partnerships that have deepened this year with our colleagues at UW-Platteville and UW-River Falls, and with all the individuals and businesses who advise us and support this work.

When the Hub launched, we envisioned that it would be a talent magnet for those with established expertise and great potential. This has proven to be true. As of this writing, at UW-Madison we are wrapping up our first four faculty hires, and all our searches have attracted a strong pool of candidates. I can't wait for you to meet our new faculty, who are already networking within the state. I am also grateful to the young scholars – students and post-doctoral trainees – who have elected to spend time at UW-Madison as they build their careers.

Readers of this report have a treat in store as they gain an introduction to the work of the Hub this past year. For those who want to plow into all the details and to discuss goals and progress, we look forward to welcoming you to campus, both virtually and in person, in November of 2021 for the second Dairy Innovation Summit and first Dairy Innovation Symposium. Until then, thank you for your interest, and best wishes.



Wayne Weber

Dean, College of Business, Industry, Life Science & Agriculture, UW-Platteville

A key aspect of the Hub is harnessing top talent to help move the dairy community forward. At UW-Platteville, the two faculty hired last fall have already hit the ground running leveraging Hub support by securing significant external funding. We are also pleased to have recently hired our third faculty member with expertise in dairy food science and management and have launched a search for a post-doctoral scholar to focus on watershed-scale local food production.

As notable progress is being made regarding the Dairy Industry, Impact and Innovation (DI3) faculty fellowships, projects have been awarded for the second round of funding. Again, the highlight is innovation that

directly impacts dairy including projects ranging from the use of DAIRI (Data Automation Interface and Real-time Interaction) to the incorporation of biochar into manure systems. Additionally, the Hub at UW-Platteville continues to provide significant support of the established agroecosystems research.

UW-Platteville has also made major strides with facility upgrades at Pioneer Farm including the installation and implementation of automated milking systems, bedding systems and lab equipment upgrades.

Finally, we recognized our first Friend of the UW-Platteville Dairy Innovation Hub recipient, Chris Wilson, who has been highly engaged with related projects.



Dale Gallenberg

Dean, College of Agriculture, Food and Environmental Sciences, UW-River Falls

During year one, UW-River Falls developed a framework for efficient, effective, and accountable use – short term and long term – of the funding provided to us. This effort included setting in motion a significant enhancement of our capacity for cutting edge research that will positively impact the Wisconsin dairy community.

Three new faculty joined us this Fall, one each in dairy science, food science, and agricultural economics. A fourth faculty hire in progress will be joint in plant and earth science and agricultural engineering technology. Year three will see completion of two additional faculty hires.

We were very active this year with faculty research fellowships and equipment proposals across the Hub focus areas. Most projects are collaborative in nature, involving multiple personnel and often multiple departments. Collaborations also involve colleagues at UW-Madison and UW-Platteville. We have frequently said collaboration will be one of the most significant outcomes from the Hub, and this is proving to be true.

On behalf of UW-River Falls and all Hub participants, thank you again to the supporters of this initiative for the funding provided. We expect to continue to demonstrate the full value of this investment and make a difference for the Wisconsin Dairy industry.

Advisory council

The advisory council fosters two-way communication and idea generation between Wisconsin's dairy community and university partners.



PhD student Andrew Sommer of the Kerri Coon Lab pours out a liquid bait solution while switching out a fly trap. The lab is studying the potential role that flies play in transmitting mastitis- and enteritis-causing bacteria to dairy cows. Photo by Michael P. King/UW-Madison CALS

OPERATING PRINCIPLES:

- » Collaboration between three campuses
- » Brings ideas to the leadership committee
- » Advises funding priority areas
- » Shares outcomes with broader community
- » Maintains transparency and accountability
- » Curates a culture of mutual trust and honesty
- » Creates focus and balance; prevents mission creep
- » Honors talents; supports leadership and program structure

COUNCIL MEMBERS:



Aric Dieter
Landmark Services
Cooperative,
Dairy Business Association



Angela James
Department of Agriculture,
Trade & Consumer Protection



Rami Reddy
UW-Platteville



John Umhoefer
Wisconsin Cheese
Makers Association



Steve Kelm
UW-River Falls



Shelly Mayer
Professional Dairy Producers
of Wisconsin



Kent Weigel
UW-Madison



Heather White
faculty director (ex officio)



Mitch Breunig
Mystic Valley Dairy,
Dairy Business Association



Dave Daniels
Mighty Grand Dairy,
Wisconsin Farm
Bureau Federation



Tera Montgomery
UW-Platteville



Scott Rankin
UW-Madison

Campus updates

UW-Madison

FY 21 accomplishments:

- » Ongoing funding for six postdoctoral fellowships
- » Seven new awards for capacity building equipment
- » Thirteen awards for new short-term, high-impact research projects; Ongoing funding for seven projects selected in FY 20
- » Recruited four faculty positions: human health and nutrition, land and water stewardship, dairy economics and rumen microbial physiology
- » Six graduate student assistantships, including two for collaboratively mentored students from UW-Platteville and UW-River Falls

Steering committee:



Victor Cabrera
Animal and Dairy Sciences



Paul Mitchell
Agricultural and Applied Economics



Denise Ney
Nutritional Sciences



Scott Rankin
Food Science



Matt Ruark
Soil Science



Troy Runge
Biological Systems Engineering



Kent Weigel
Animal and Dairy Sciences



Heather White
Animal and Dairy Sciences



Heidi Zoerb
CALs External Relations

UW-River Falls

FY 21 accomplishments:

- » Four new awards for faculty research fellowships. Ongoing funding for six projects funded in FY 20
- » Nine awards for supplies and equipment grants
- » Recruited three faculty positions: animal welfare, food technology and community economic development
- » Onboarded new dairy herd research manager
- » Support for graduate student assistantship co-mentored with UW-Madison

Steering committee



Steve Kelm
Animal and Food Science



Peter Rayne
Animal and Food Science



Holly Dolliver
Plant and Earth Science



Brenda Boetel
Agricultural Economics



Joel Peterson
Agricultural Engineering Technology

Robotic milking system at UW-Platteville's Pioneer Farm

UW-Platteville

FY 21 accomplishments:

- » Facility and infrastructure upgrades at Pioneer Farm for research and Hub collaborations including installation of two A5 Lely milking robots
- » Two new scientists joined the faculty. Successfully recruited a third scientist in dairy food science and management
- » Six new awards for faculty research fellowships. Ongoing funding for seven projects selected in FY 20
- » Eight new awards for supplies and equipment
- » Support for graduate student assistantship co-mentored with UW-Madison

Steering committee:



Tera Montgomery
Animal Science



Rami Reddy
director, School of Agriculture



Chuck Steiner
director, Pioneer Farm



Krista Hardyman
Animal Science



Kevin Bernhardt
Agribusiness; Center for Dairy Profitability



Austin Polebitski
Civil and Environmental Engineering

Pioneer Farm is now home to two new state-of-the-art robotic milkers, enabling more opportunities for research and engagement across campus and the tri-state region. Funded through the Hub, the two Lely A5 Astronaut robotic milkers were installed and introduced to the nearly 200-cow herd in June. UW-Platteville is currently the only UW System school to operate robotic milkers.

"Because the Hub is so collaborative, it will open up opportunities for our students, and for others to learn from the robots as well, including farmers and a variety of dairy professionals," said Dr. Tera Montgomery, professor of dairy and animal science.

The information collected by the robots varies widely, from health data such as somatic cell count, to advanced lactation information, including milk components and production, to cow behavior.

The robots will provide several opportunities for research and learning across many disciplines outside of agriculture as well.

"One of our Hub-funded faculty fellowships this year is exploring cybersecurity on the farm," said Montgomery. "All of the data we are collecting is in the cloud, so researchers can use the robots and the technology to teach their students about how we deal with the reality of cyberattacks in agriculture and what that means for our industry and the food chain."

Montgomery cited other areas of potential collaboration, including construction management students studying the design and build of the systems and engineering students exploring the machine and learning how it interacts with the animals.

Montgomery said the robotic milkers will enable more off-campus research collaborations as well, including on the federal level as plans are being made to work with the U.S. Department of Agriculture's Dairy Forage Research Center in Madison. *Story adapted from an original article by Alison Parkins, UW-Platteville communications.*



Cory Weigel, Pioneer Farm Dairy Enterprise Manager, gives a guided tour of the newly re-modeled robot facility. Photos by Easton Green/UW-Platteville.

Our partners



Amy Penterman

president | Dairy Business Association

“This next-generation research reflects the broad, positive impact of the state’s dairy community. The dairy hub is ensuring that we continue to lead in growing our economy, strengthening our rural communities and protecting our natural resources.”



Shelly Mayer

executive director | Professional Dairy Producers of Wisconsin

“It’s absolutely astonishing how quickly the Hub transitioned from being established to making bold new discoveries. It’s exciting to see renewed affirmation that Wisconsin will continue to be looked to as the world’s leader in dairy innovation.”



Randy Romanski

secretary-designee | Wisconsin Department of Agriculture, Trade and Consumer Protection

“Dairy is a significant part of Wisconsin’s heritage and economy. Our state is where the world turns for strong leadership and high-quality dairy products. From ensuring healthy soil and water, to protecting human and animal health, to optimizing farm business practices, the work of the Dairy Innovation Hub will benefit our entire state and the dairy community for generations to come. The state is proud to invest in the successes of Wisconsin dairy and serve as a resource to the industry as it pursues continued innovation and development.”



Kevin Krenz

president | Wisconsin Farm Bureau Federation

“The Dairy Innovation Hub strives to be the global leader for sourcing new discoveries and developing talent in dairy. Not only is the Hub promoting our state’s \$45.6 billion dairy community, but it is also utilizing dairy’s most skilled leaders to provide innovation through important research. Continued growth through science and research is critical for the dairy community’s viability both now and in future. The work that the Dairy Innovation Hub is doing now will provide greater options for generations of dairy farmers in the future.”



John Umhoefer

executive director | Wisconsin Cheese Makers Association

“In Wisconsin and across the country, innovation is key to the success of the dairy industry. The pursuit of new technologies and products is a critical part of meeting the changing needs, preferences, and expectations of consumers worldwide. The Dairy Innovation Hub provides a platform where research and education meet and new, creative ideas flourish.”

Research profiles



Stewarding land and water resources

Laura Ward Good

senior scientist | Department of Soil Science
UW-Madison

Jim Beaudoin

software developer | Department of Soil Science
UW-Madison

Project title: Mobile maps and application records for better manure management

Summary: Wisconsin's manure management guidelines designate certain areas as off-limits for manure application due to the high risk of contamination of either groundwater or

*Beaudoin and Ward Good developed an app to help farmers better apply manure.
Photo by Michael P. King/UW-Madison CALS*

surface water. Some of the restrictions are based on soil type and some are based on proximity to surface features like wells or streams. The [SnapPlus nutrient management planning software](#) used throughout the state has companion on-line maps in the SnapMaps GIS system that display these areas. Consulting agronomists working with dairy farms have said that identifying these restricted areas for manure applicators in the field is a real problem. The SnapPlus Manure Application Realtime Tracker (SMART) app allows farms to download field restriction maps to an iOS or Android mobile device and display the application path. The application maps can also be uploaded to SnapMaps.

An important part of this project is field testing the app on dairy farms. A first pass at testing the SMART prototype revealed that, along with tracking the location of manure applications while spreading, farm operations really need to know the amount applied for updating nutrient management records. Ward Good and Beaudoin added additional features to SMART and it now documents field application rates in a format that can be directly imported into SnapPlus.

The SMART project is now entering into a more extensive phase of on-farm testing. "We anticipate that this testing will result in ideas for improvements leading to an app that truly fits the needs of dairy farms striving for economically and environmentally sound manure management," says Ward Good.

This app is something researchers have long known is needed to make accounting for dairy manure nutrients on crop land both easier and more precise. The Dairy Innovation Hub provided the resources and framework to get the project going.

Stewarding land and water resources



Xiaoyu Feng

postdoctoral fellow
Department of Biological
Systems Engineering
UW-Madison



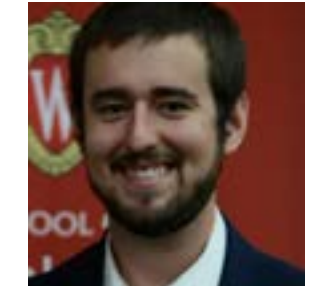
Rebecca Larson

associate professor
Department of Biological
Systems Engineering
UW-Madison



Matthew Digman

assistant professor
Department of Biological
Systems Engineering
UW-Madison



Joseph Sanford

assistant professor
School of Agriculture
UW-Platteville

Project title: Efficacy of manure nutrient prediction and variable rate technology to improve nutrient use efficiency on Wisconsin dairy farms.

Summary: Applying manure nutrients to meet agronomic needs can maximize yields and minimize nutrient losses to the environment. Unfortunately, current methods require lab testing weeks before or after land application. In addition, manure analysis does not reflect the nutrient concentration of the entire manure storage contents. Near infrared sensing systems provide real-time estimates of manure nutrients, allowing application rates to be adjusted in the field. While this has great potential for improvements in manure application systems, the ability to accurately predict nutrients and the impact to the entire cropping system needs to be assessed to determine if this technology holds value for farmers.

This research aims to assess manure nutrient sensing systems in the lab to determine the ability to measure manure nutrient constituents in comparison to accepted laboratory methods. In addition, a sensing system is being integrated on a manure tanker to assess the impact to nutrient variability and to crop yield compared to traditional application methods.

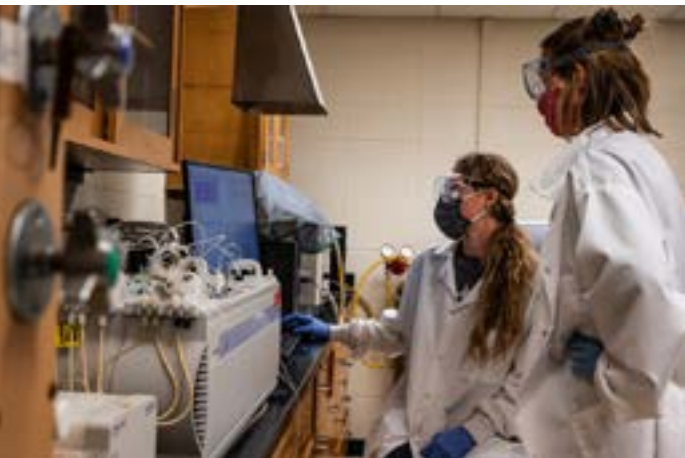
"The Dairy Innovation Hub has made this applied research possible. This work will provide Wisconsin farmers and manure applicators data on manure nutrient sensing systems so they can make scientific-based decisions on technology selection and practical operational information," says Larson.

This work can also provide data needed for regulatory agencies and policymakers to decide if this system is acceptable for facilities that require reporting on manure nutrient application, Larson added. Improving efficiencies in manure nutrient application systems is an added benefit. Improved nutrient applications have the potential to improve yield consistency across fields and reduce over application of nutrients, improving environmental sustainability.

Postdoc Xiaoyu Feng works in the lab to determine manure nutrient concentration. Her position is funded by the Hub.



Stewarding land and water resources



Top: Environmental science students Marlee Dietrich and Cierra Kirkwood analyze water samples for Jill Coleman Wasik, associate professor of plant and earth science. Middle: Natasha Rayne, associate professor of plant and earth science and Patrick Woolcock, assistant professor of ag engineering and technology, use the Elementar for chemical analyses of soil, compost and feed. Bottom: Heather Davis, lab manager and Holly Dolliver, professor of plant and earth science use a microwave digester to break down samples for elemental analysis. Photos by Pat Deninger / UW-River Falls

Equipment

Create a flexible, collaborative lab space for modern and robust solid sample processing to be utilized by multiple Hub-funded researchers and to enhance student learning. Award includes equipment and partial construction costs.

Lead faculty: [Heather Davis](#) and [Holly Dolliver](#), Department of Plant and Earth Science, UW-River Falls.

Summary: As a comprehensive campus, UW-River Falls has historically focused on teaching and co-curricular experiences for undergraduates. The Dairy Innovation Hub allows faculty and staff to conduct more research, in addition to teaching. This mission leverages faculty talents and increases student engagement opportunities, but also exposes certain challenges.

A greater emphasis on research means the need for additional lab capacity. The most immediate need was to provide space to keep water and liquid sample preparation and analysis separate from solids like soil, compost, manure, feed and food samples to avoid problematic and costly cross-contamination issues.

Construction on the new analytical lab for solid samples began in the summer of 2021 and finished in time for the Fall semester. In addition to the enhanced space, the lab includes equipment critical to research that is working to improve water quality, soil health, human health and animal health. The lab is shared by three departments: animal and food science, plant and earth science and agricultural engineering and technology.

The lab can analyze samples for carbon, hydrogen, nitrogen, sulfur and oxygen. This kind of elemental analysis is in high demand in agricultural, environmental and food industry work.

"We are proud of the extensive student and faculty research conducted in CAFES. Prior to the Dairy Innovation Hub, the lab was primarily a student space," says Davis. "Now the space supports six faculty members and numerous classes. We expect the demand for this space to increase over time."

This project will increase research capacity, foster collaboration between faculty in different fields, and expose students to elemental analysis techniques that were previously handled off-campus.

Stewarding land and water resources



Sonja Maki

assistant professor

Department of Plant and Earth Science, UW-River Falls



David Zlesak

professor

Department of Plant and Earth Science, UW-River Falls

Equipment

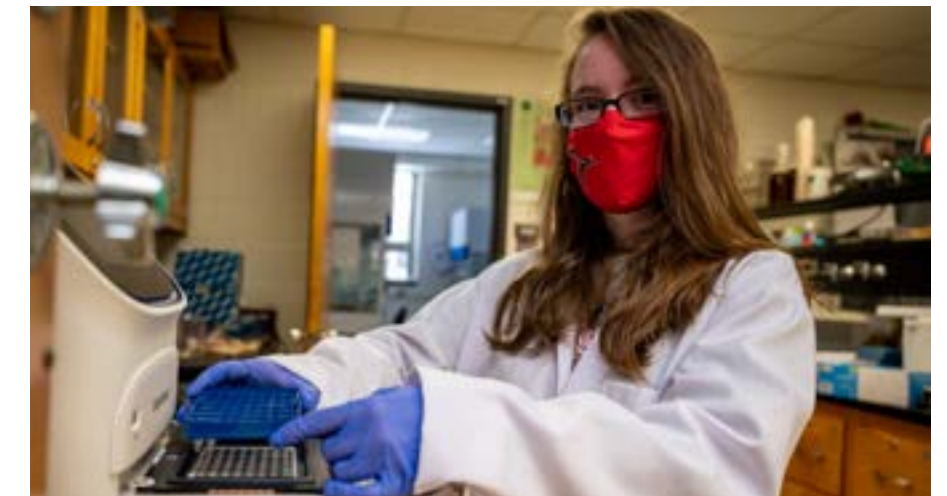
ThermoFisher QuantStudio 3 qPCR machine to study nodulation, disease susceptibility and resistance, and flowering in dairy forages.

Summary: Plant breeders work to improve the genetic potential of plants. For dairy farmers, this translates into high-quality feeds like corn, soybeans and alfalfa, grown with less resources and under time-sensitive and stressful conditions.

Many of these genetic gains start in the lab using techniques like quantitative real-time polymerase chain reaction or "qPCR" to study the expression of genes. In common dairy forages like alfalfa, qPCR can be used to study nodulation, disease susceptibility and resistance, and flowering. Maki is working with undergraduate student Emily Larsen to measure the expression of flowering genes by qPCR in legumes, while Zlesak uses qPCR in plant disease resistance and virus detection projects.

"For the Plant Tissue Culture class, we are excited to use the qPCR machine to test regenerated plantlets for viruses. We are able to learn our rate of success at virus elimination and hopefully have a clean version of the mother plant variety for future research applications," says Maki.

With specialized qPCR equipment, Maki and Zlesak have new capacity for plant breeding and plant physiology projects. They have the ability to more precisely measure nucleic acids like DNA and RNA and compare gene expression levels between different plant tissues or across plant developmental stages. The instrument and associated supplies also expand faculty, staff and student capability and collaboration opportunities to engage in innovative research.



Emily Larsen is an undergraduate student at UW-River Falls who works with Sonja Maki to quantify the expression of genes involved in the flowering of legumes used as forage. Larson uses a qPCR machine funded by the Dairy Innovation Hub to collect this data. Photo by Pat Deninger / UW-River Falls

Enriching human health and nutrition



Bidhan Roy
associate professor
Mechanical and Industrial
Engineering, UW-Platteville

Project title: Measuring the rheological properties of ice cream to predict its mouth-feel sensations.

Summary: Wisconsin dairy farms supply many small family-owned businesses that manufacture cheese, butter, yogurt and ice cream. These products have complex solid-liquid (rheological) properties that influence customer taste satisfaction. Ice cream is a particularly challenging food because it exists in the three phases of solid, liquid and gas. The size and distribution of ice crystals (solid), dairy products (liquid) and air bubbles (gas) affect taste, texture and body. Ice cream is also expected to have qualities, such as smoothness and creaminess, that humans cannot objectively quantify. The interrelation between these variables can be assessed through statistical techniques.

Roy and Zolper developed a method to bridge ice cream ingredients to sensory characteristics and rheological properties. They selected a baseline ice cream recipe and varied the primary ingredients (cream, sugar and starch) to produce eight variant recipes. The ice cream samples were served to 27 UW-Platteville students who simultaneously completed a taster survey to produce a statistical representation of the public's taste preferences.

The samples will be tested in an Anton-Paar Rheometer to determine how the ingredients affect rheological properties such as shear stress, viscosity, and melt rate. The results will be correlated to the sensory studies to better understand how ingredients influence customer satisfaction. This will allow ice cream manufacturers to 'tune' their recipes in order to meet customer expectations. The statistical approach to ice cream optimization can also be adapted to other dairy products to enhance their qualities.



Thomas Zolper
associate professor
Mechanical and Industrial
Engineering, UW-Platteville



Environmental engineering student Victoria Chanez conducts sensory surveys to determine common features of customer satisfaction when it comes to ice cream. Photo by Andy McNeill/UW-Platteville

Ensuring animal health and welfare



Dario Oliveira
postdoctoral fellow | [Lab of Joao Dorea, assistant professor](#)
Department of Animal and Dairy Sciences | UW-Madison

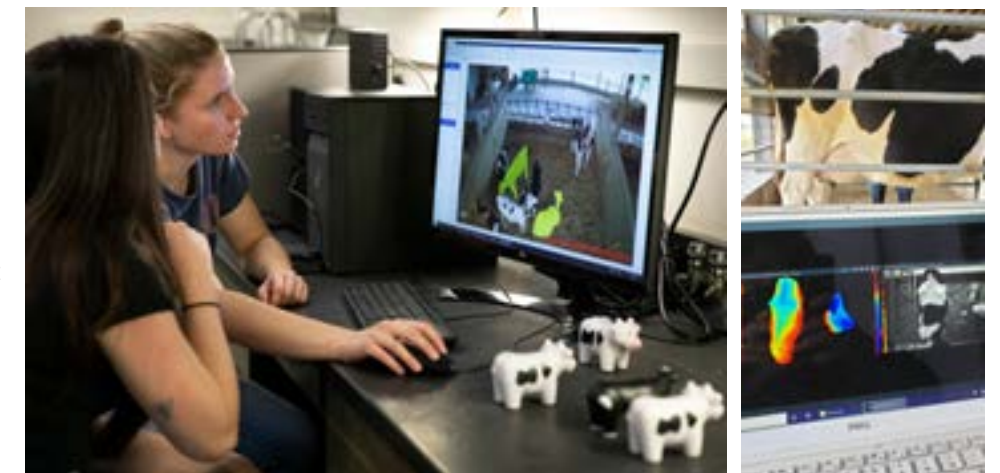
Project title: Harnessing the power of computer vision systems to improve animal health and welfare in transition dairy cows

Summary: Nearly all cows will experience negative energy balance in order to support the high energy demands of lactation during the transition period. This can lead to a variety of metabolic disorders. Body condition score is a commonly used tool to monitor and manage these disorders. However, body condition is a periodic, subjective measurement that cannot detect small changes in body shape or composition. Consequently, the development of a computer vision system to assess body condition scores

in real-time will play a crucial role to precisely detect changes in body condition. The objective of this project is to develop a platform that uses sensors for real-time detection of body shape and animal behavior. Results will be used for precise and early detection of metabolic disorders and associated health problems. This research is being conducted with guidance from Joao Dorea, assistant professor in the animal and dairy sciences department.

The primary research goal is to develop artificial intelligence technologies to solve real-world problems on dairy farms. Implementing computer vision systems enables data-driven solutions that can directly impact dairy farmers' life.

In the Dorea lab, researchers conduct experiments that involve handling dairy animals, implementing sensor infrastructure, and developing analytical methods for farm management decisions. This work will help farmers early identify animals at high risk of developing a health issue. Sophisticated analytical tools have been developed and preliminary results show that computer vision systems can detect health problems during the transition period much sooner than traditional means.



Clockwise: PhD student Ariana Negreiro and undergraduate Abigail Wick-Lambert work with dairy barn camera footage. Images of each cow are used to detect changes in body score. Oliveira collaborates virtually with the research team. Photo by Michael P. King/UW-Madison CALS

Growing farm businesses and communities

From left: Research team members Siena Finlayson, Haden Hartwig, Dante Pizarro, MaryGrace Erickson and Kate Wells



Right: Encouraged by feed, a heifer places her head in the Green-Feed unit to measure methane emissions in her breath.



Equipment

C-Lock Inc. GreenFeed unit for enteric methane, carbon dioxide emission and oxygen consumption of large animals fed and managed in free-stall barn and in pasture.

[Lab of Michel Wattiaux, professor](#)

Department of Animal and Dairy Sciences | UW-Madison

Summary: Greenhouse gas emissions from dairy systems are an increasing societal concern. Methane emission data are essential to assess production efficiency and the environmental implications of dairy management practices. To date, Wattiaux's research team has conducted three studies using the GreenFeed equipment. The unit also benefits additional studies directed by colleagues in the Department of Animal and Dairy Sciences.

In the first study, graduate student Kate Wells in collaboration with Matt Akins, at the Marshfield Agricultural Research Station (MARS), looked at average daily gain and methane emission of dairy heifers grazing stockpiled pastures. This management practice allows standing forage to accumulate for grazing at a later period, often for fall and winter grazing after dormancy.

In the second study, graduate student Dante Pizarro, focused on growth performance, nitrogen excretion and methane emission of dairy heifers fed total mixed rations containing 0%, 20%, or 40% of Kernza straw, a perennial grain for human consumption.

In the third study, graduate student MaryGrace Erickson is testing the effects of two levels of dietary crude protein and the effect of a 48-hour oscillation cycle between the two levels on lactation performance, nitrogen excretion and methane emission.

In a study directed by Kent Weigel, graduate student Kaylee Riesgraf uses the GreenFeed unit to investigate the effects of neonatal and pre-weaning stressors on heifer feed efficiency. The first group measured by the GreenFeed unit is split into heifers that were housed as pairs vs individually pre-weaning. The second group consists of heifers that were exposed in-utero to heat stress vs cooled. The data from the GreenFeed unit will be valuable to investigate differences in methane emissions between treated and non-treated groups and general yearling Holstein emission data. Riesgraf's collaborative assistantship involves mentors from both UW-Madison and UW-River Falls and is funded by the Hub.



Kaylee Riesgraf, Master's student at UW-Madison and a recent graduate of UW-River Falls.

Growing farm businesses and communities



Albert Boaitey

assistant professor | Department of Agricultural Economics, UW-River Falls

Project title: Calf management practices, animal welfare and the social sustainability of the dairy industry

Summary: Changes in consumer preferences, the emergence of substitute products, and the increased role of health, environmental and farm animal welfare considerations in food choice pose significant challenges to the US dairy community.

One of the most important, yet controversial farm animal welfare issues facing the industry are concerns about current calf management practices. Specifically, the separation of calves from cows and how calves

are housed post separation. While farmers and other dairy experts favor cow-calf separation, data from many consumer surveys suggest the opposite. Previous work also suggests that consumers prefer group housing to individual housing methods. However, the extent to which housing choice addresses consumer concerns about calf separation is unknown. Most importantly, the role of concerns about calf management in consumer dairy product choice decision has not been previously addressed.

There may be creative ways through which farmers can address these concerns to ensure the long-term financial and social sustainability of the dairy community. Using data from consumer and farmer surveys, Boaitey's team will analyze perceptions relating to calf management under different information treatments. The intended outcomes include an increased understanding of perception and knowledge gaps between consumers and farmers, increased farmers' understanding of consumer perspectives and increased adoption of incremental animal welfare improvements by dairy farmers. This research is being conducted in collaboration with Sylvia Kehoe, professor of animal and food science.

To date, data from national and Wisconsin surveys of consumer views has been analyzed. Analysis will allow researchers to identify points of convergence to improve the social sustainability of the dairy community. This three-year study began during the summer of 2020.

“Identifying a middle ground that allows farmers to meet societal expectations will improve the strategic position of dairy, its profitability and the overall wellbeing of the communities in Wisconsin who depend on a thriving dairy community.”



Kehoe and Boaitey review data from national and state surveys. Photo by Pat Deninger/UW-River Falls

Growing farm businesses and communities



Heidi Zoerb
 associate dean
 External Relations and
 Advancement, UW-Madison, CALS

Project title: [Dairy Innovation Student Challenge](#)

Collaborative opportunity open to all UW System students

Summary: During the 2020 fall semester, the Dairy Innovation Hub partnered with Hyper Innovation, an agency that bridges the gap between corporations and innovative tech solutions to drive growth and value, to

host a Student Challenge. This competition was an opportunity to harness the creativity of UW System students to discover novel solutions for the dairy community. Student projects focused on one of three challenges derived from recommendations from the Dairy Task Force 2.0:

- Enhancing the shelf-life of Wisconsin dairy products
- Encouraging dairy product consumption by Wisconsin students
- Utilizing IOT or robotic technologies to enhance operations

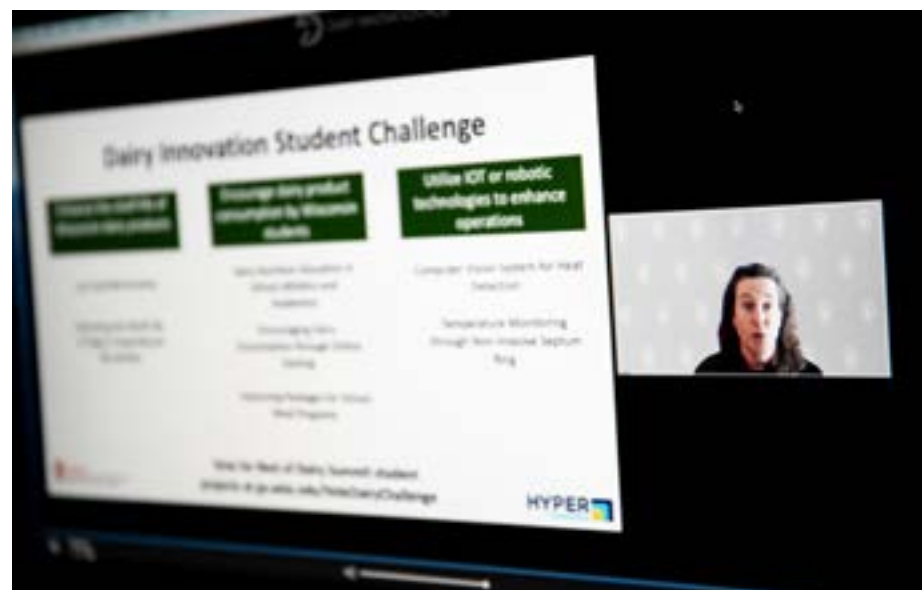
Eight industry mentors included faculty members at the three campuses, plus professionals with Wisconsin dairy organizations and from the start-up community in Madison. Mentors provided the student teams with access to their connections and experience and gave them real-world advice.

In all, five student teams presented seven different solutions, two each in “Enhancing shelf-life” and “Using technologies” and three in “Encouraging dairy product consumption.”

The Challenge included 12 students total, and two teams that presented two solutions each. Participants included undergrads, MBA, MS and PhD students from a variety of disciplines. The Dairy Innovation Hub Student Challenge was open to all students at UW-Madison, UW-Platteville and UW-River Falls. All Challenge activities were hosted virtually to follow public health guidelines.

A major motivation for creating this program came from how frequently it seems that agriculture is missing from conversations about innovation and entrepreneurship.

“You always see pharma and other health sectors or software highlighted in these discussions, but agriculture is missing from



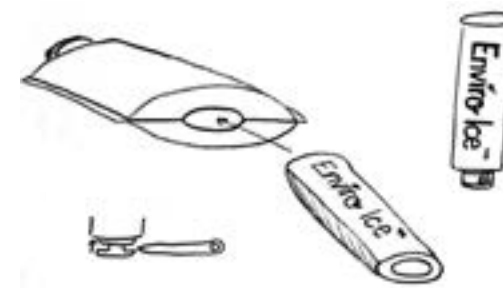
Heidi Zoerb and the Student Challenge were featured during the growing farm business and community track at the first annual virtual Dairy Summit, November 17, 2020. The Challenge included students from all three universities participating in the Hub and mentors from dairy companies and stakeholder groups. Photo by Michael P. King/UW-Madison CALS

venture capital roundtables and media coverage of start-up businesses,” says Zoerb. “The dairy community deserves more attention in innovation circles.”

Encouraging students to develop new and creative solutions to challenges is a way to interest some of our best minds in this important sector.

According to Zoerb, the Hub is encouraging cross-disciplinary projects and out-of-the-box thinking about the future of Wisconsin dairy. These short-term projects are a great way to test new ideas and to draw new talent to the field.

This project encouraged students to think about the many opportunities in dairy, and the goal is that at least some of them will consider making their career in dairy. The hope is also that new perspectives the students’ brought will be incorporated into new product ideas and approaches by dairy farmers and processors.



A sketch of a shelf-stable, quick-cool milk pouch that a team of four students designed for the Dairy Innovation Hub Student Challenge. Illustration courtesy of Caroline Lunning. Graphic above by Janelle Jordan Naab/UW-Madison CALS.



Ultra-filtered, ultra-high temperature, aseptic milk pouch with integrated cold pack

Cold milk has long been offered alongside lunches and snacks in elementary schools, traditionally served in paper cartons. But those cartons require refrigeration, and they’re far from beloved by students. This has prompted schools and the dairy industry to look for another option to encourage milk consumption.

Enter food science major Caroline Lunning. She partnered with three other students to develop an innovative design for a shelf-stable, quick-cool milk pouch. With support from an industry mentor, the team submitted its concept last fall to the UW Dairy Innovation Hub Student Challenge.

“It was really gratifying to have an opportunity to work with other students, outside of the curriculum, to apply what we’re learning to something so important,” says Lunning, a returning adult student who previously cooked in restaurants for 20 years.

For their efforts, the students received an enthusiastic thumbs-up from their mentor, John Holevoet, director of government affairs for the Wisconsin Dairy Business Association. “Fluid milk packaging really lags behind in the creativity department,” he says. “It was really impressive to see a group of students come up with a cool new idea on how to do it.”
 Story adapted from an original article in *Grow* magazine by Jori Skalitzky, BSx’22 UW-Madison.

New Faculty profile



Ryan Pralle

assistant professor | Animal and Dairy Science
UW-Platteville | start date Aug. 2020

Pralle is an assistant professor and joined UW-Platteville as a tenure-track faculty member supported by the Dairy Innovation Hub, engaging in research, outreach

and teaching. His research strives to develop data-driven management tools and strategies to optimize nutrient supply and metabolic health of individual cows.

Pralle was raised on his family's 400-cow dairy farm, Selz-Pralle Dairy, in Humbird, Wis. He earned his BS (2015) and PhD (2020) in Dairy Science at UW-Madison. Pralle's doctoral research focused on the bovine metabolic disorders ketosis and fatty liver, using molecular and bioinformatic techniques to further unravel the pathology of those disorders and to develop prediction tools to diagnose cows with ketosis. His future research interests include data-driven management strategies to optimize dairy cow performance through nutritional grouping and in-line milk prediction.

Pralle's research and outreach program supports Wisconsin dairy farmers, livestock nutritionists, farm consultants and veterinarians by providing research focused on ruminant nutrition for the efficient, profitable and environmentally sustainable production of milk and other dairy products. Pralle also teaches courses focusing on ruminant nutrition, animal health and welfare and he advises students majoring in animal and dairy science.

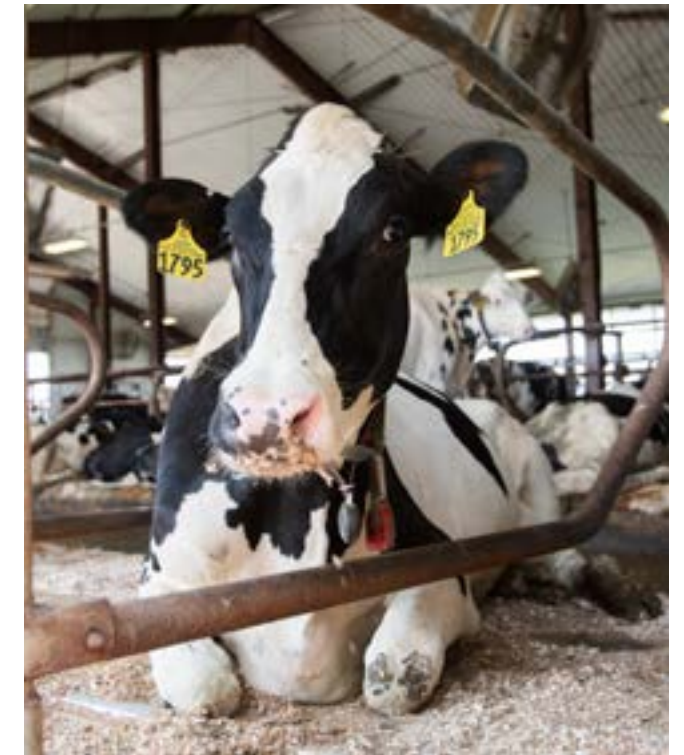
Continue reading to learn more about Pralle.

What do you consider your biggest accomplishment or most significant experience so far at UW-Platteville?

There are a couple things I am proud that I was able to accomplish in the first year. First, I was able to complete and publish my first research project at UW-Platteville! It was a collaborative project that utilized subclinical ketosis prediction equations and DHI records to evaluate the consequences of subclinical ketosis across 335 Midwest herds and over 240,000 lactation records. We had a lot of cool insights from this data, such as higher producing cows having lower subclinical ketosis prevalence and the association of new milk traits (i.e. fatty acid groups and differential somatic cell count) with subclinical ketosis. Second, I was a recipient of the 2021 Midwest American Dairy Science Association Young Scholar award, which recognizes my doctoral research accomplishments.

What research projects are you involved in? Have you been collaborating with other campuses?

My research projects span three core disciplines: dairy cow nutrition, predictive analytics, and applied dairy management. Most of my projects contain a mix of these. For example, Dr. Heather White and I received a grant from the UW-Consortium for Extension and Research in Agriculture and Natural Resources to develop a blood biomarker panel for cow fatty liver. Investigating fatty liver and the biomarkers is the nutrition component and the panel development involves predictive analytics; the management component will be our research implementing the panel on participating dairy herds to evaluate transition cow success. Another project that I am spearheading is looking into proactive tools for monitoring manure phosphorous excretion, such as predicting milk phosphorous as an indirect measure. This project has



received support from WiSys and industry partners (i.e. VAS and Eurofins).

What classes did you teach this year? Did you advise any students or student clubs? Undergraduate research?

I taught ruminant nutrition last spring and I teach dairy cattle management this fall. I co-advise the Alpha Gamma Rho fraternity (Beta Gamma chapter). This year I advised Bailee Peters in an independent study (Meta-Analysis) and Jaynie Rule (UW-CERANR). Also, I assisted several students in their undergraduate research projects with Dr. Peter Lammers: Olivia Kepner and Erin Kammann.

What excites you about working with the Dairy Innovation Hub, and what do you hope your work does for Wisconsin dairy farmers?

The most exciting component is the investment in research at our smaller campuses, which is creating a lot of opportunities for teaching and training our students. I hope that my work at UW-Platteville will connect our students and Wisconsin farmers to innovative technology and approaches for managing dairy cows for greater productivity, efficiency, and health.

In addition to teaching and research, are you involved in any outreach efforts

Most of my outreach efforts have been focused on providing technical advice to dairy farmers and

consultants, as well as providing seminars locally. Recently, I became a committee member for Targeting Excellence in Wisconsin. Targeting Excellence is a non-profit that provides scholarships to students committed to food animal agriculture.



Clockwise: Pralle leads a summer 2021 tour of the dairy facility at Pioneer Farm including newly installed milking robots, funded by the Hub. The farm's 200-cow dairy herd plays a significant role in his work in ruminant nutrition and other strategies to improve cow health and farm management. DATCP Secretary-designee Randy Romanski recently visited Pioneer Farm to tour Hub-funded additions including milking robots and manure technology. He met with Pralle and others during his tour of Southwest Wisconsin.

New Faculty profile



Joseph Sanford
assistant professor | Soil and Crop Science
UW-Platteville | start date Aug. 2020

Sanford is an assistant professor in the School of Agriculture and faculty researcher for the Dairy Innovation Hub at UW-Platteville. His research interest is in agriculture wastewater

agricultural wastewater treatment, recycling and reuse, for the environmental sustainability of dairy farms and surrounding communities in Southwest Wisconsin. Sanford also teaches courses in nutrient management and water quality and mentors students in the Agricultural Engineering Technology program and students with an interest in biological systems engineering. He mentors students with research projects in his area of expertise.

Continue reading to learn more about Sanford.

What do you consider your biggest accomplishment or most significant experience so far at UW-Platteville?

My biggest research accomplishment so far would be getting grants written and funded. Over the last year I have submitted 13 grants, with five being funded and three still pending. I am really excited to get going on research with undergraduate researchers. Another significant experience at UW-Platteville so far was getting the opportunity to teach this spring. I had never taught a course myself (only as a teaching assistant in the past) and really enjoyed the experience, which I was not sure would be the case.

What research projects are you involved in? Have you been collaborating with other campuses?

I am involved in a number of research projects including investigation of manure nutrient sensing technology, PFAS leaching through agricultural soils, edge of field phosphorus recovery, vegetative treatment areas, and anaerobic digestion. I have collaborated with a number of faculty from UW-Madison including Dr. Digman (BSE), Dr. Larson (BSE), and Geoff Simmering (Soils). I also have collaborators at UW-Green Bay and UW-Stevens Point. I have also made a number of private industry collaborators

management including management of farmstead and edge of field run-off, nutrient management, precision manure application, water recovery and recycling, pathogen inactivation and transport, and emerging agricultural contaminants such as PFAS.

Sanford grew up on a hobby farm (surrounded by dairy farms) in Oregon, Wis. where he developed a love of the environment and agriculture that shaped his future career goals. His passion for research began as a sophomore working on the co-digestion of manure with food processing plant waste. He earned a BS (2013), MS (2016) and PhD (2020) in biological systems engineering at UW-Madison. Sanford's previous research focused on nutrient removal from tile drainage effluent and biochar applications for agricultural nitrogen management. His future research interests include management of farmstead run-off, specifically silage pad run-off, and the use of vegetative treatment areas (VTA's) and biochar as tools to manage nitrate run-off to impact ground water quality.

Sanford's research and outreach program supports Wisconsin dairy farmers, farm consultants and systems engineers by providing research focused on



including a manure sensing company based in Denmark and a manure drying company in Minnesota that I hope to continue collaborating with.

What classes did you teach this year? Did you advise any students or student clubs? Undergraduate research?

This spring I taught nutrient management in agriculture in the soil and crops sciences department in the School of Agriculture. In addition, I taught the laboratory portion of introduction to environmental engineering in civil engineering department. I have not gotten involved with student clubs yet, but I do have four undergraduate researchers currently employed in my lab working on research projects.

What excites you about working with the Dairy Innovation Hub, and what do you hope your work does for Wisconsin dairy farmers?

The Dairy Innovation Hub has provided me with a lot of opportunity for both research and teaching in the field of agricultural waste management. The research and outreach program I am growing I hope will provide Wisconsin dairy farmers with practical and cost effective methods for managing waste and nutrients at their facilities resulting in better environmental and economic sustainability.

In addition to teaching and research, are you involved in any outreach efforts?

Outreach has been a struggle over the last year due to COVID, but I have had numerous opportunities to meet with dairy farmers in the state and private industry stakeholders in the field of manure management. Discussion with these stakeholders have helped me better define my research



and outreach program to meet the needs of Wisconsin dairy industry. This coming year I am planning to be aggressive in my outreach program and giving back to the dairy community in Wisconsin.

Anything else that you want to share?

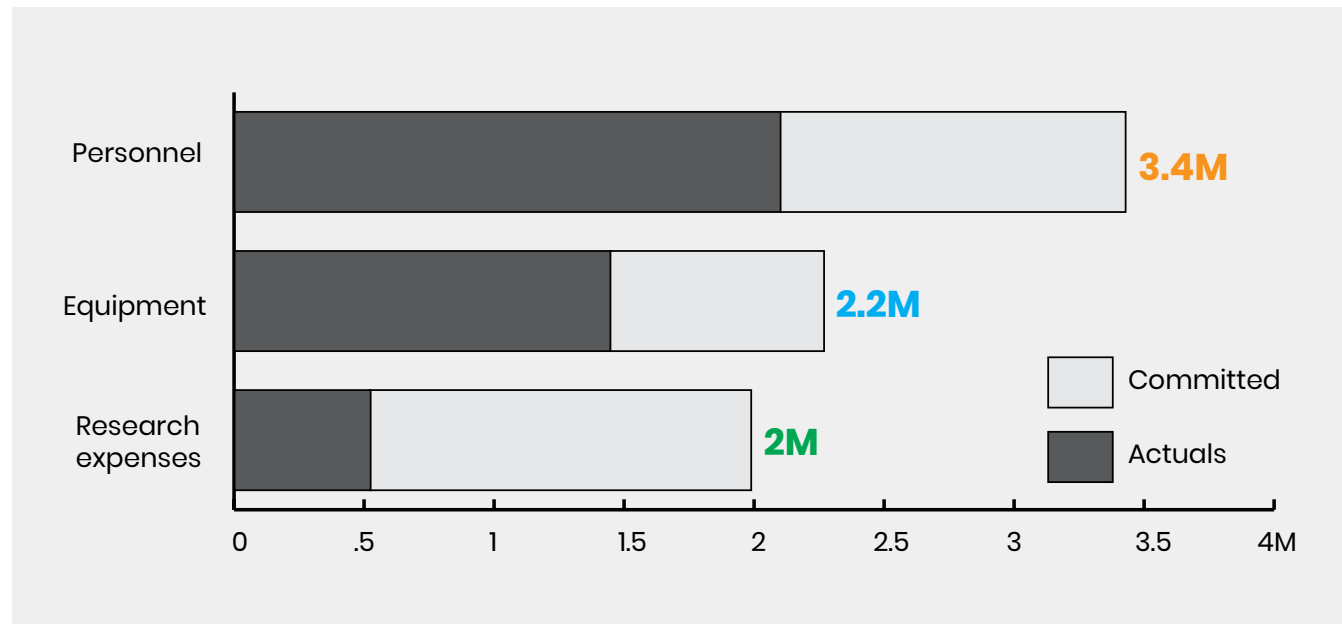
Feel free to contact me with any concerns regarding agricultural waste or nutrient management!



Top left and bottom: Student researchers Zach Flitsch and Annabelle Wojahn, environmental engineering majors mentored by Sanford, collect in-place soil cores for a project looking at PFAS leaching through agricultural soils in Wisconsin. Top right: The Boerger manure press, funded by the Hub at Pioneer Farm, aids Sanford's manure projects.

Financial overview

Fiscal Year 21: July 1, 2020 – June 30, 2021



With funding approved in October 2019, the initial \$1M FY 20 and \$7.8M FY 21 biennium investments have already seeded recruitment of new talent, equipment investments and research projects. Early funding commitments and those forecasted for FY 22 align to the approved spending plan.

'Committed' funds represent dollars that are committed to a specific award but have not yet been spent. 'Actuals' represent funds that have been spent and cleared the Hub's accounting systems. Awards often span multiple years and are tracked according to their approved budgets, resulting in partial spending in a given fiscal year.

Communications and outreach efforts

SOCIAL MEDIA



- » 736 followers on Facebook, Twitter and YouTube
- » 162,000 impressions on Twitter
- » 2,726 views on YouTube
- » Top Facebook post: "3D printing using waste milk", UW-Platteville, 3,800 reach
- » All organic reach, no sponsored posts

MEDIA MENTIONS

- » 245 popular press mentions
- » Eight press releases sent to promote funding decisions at UW-Madison, UW-Platteville and UW-River Falls

OUTREACH IMPACT

- » 26 public and stakeholder presentations given. Including campus centers, conferences, information sessions for public audiences, trade groups, agencies and legislators

E-NEWSLETTER

In September of 2020, the Hub launched a quarterly e-newsletter. This publication is sent to 500 (and growing) Hub stakeholders, funded researchers, dairy leaders, state agencies and key legislators. Increasingly, citizens and related public groups are interested in Hub initiatives and have subscribed to the e-newsletter. Anyone interested in receiving updates from the Hub can sign up at dairyinnovationhub.wisc.edu. All content is free and publicly available.



DAIRY SUMMIT AND DAIRY SYMPOSIUM



A public event featuring research funded by the Hub was a core deliverable envisioned when funding was approved by the state legislature. The inaugural Dairy Summit was held virtually and achieved 332 registrations, 405 live views and 436 on-demand views after the conference. The 2021 Dairy Summit is slated for Nov. 17 and a new event, Dairy Symposium, will debut on Nov. 18. Registration is free for all events.

FY 21 FINANCIAL HIGHLIGHTS:

More than **\$2.2M** for capacity building **EQUIPMENT**

Total **\$7.8M** FUNDS ALLOCATED for dairy initiatives

Dairy Task Force 2.0

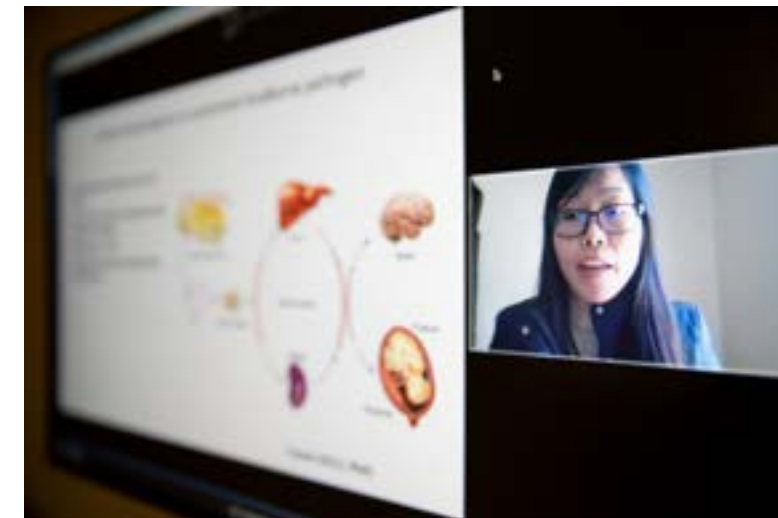
Alignment with final recommendations

In June of 2018, the [Wisconsin Dairy Task Force 2.0](#) was created as a joint effort between DATCP and the UW System with the goal of recommending actions to maintain a viable and profitable dairy community in Wisconsin.

The task force made 51 recommendations to achieve the initial charge. The creation of a “Dairy innovation

Hub” was one of the top-rated recommendations. Today, the task force’s initial recommendations help steering committees prioritize projects funded by the Hub.

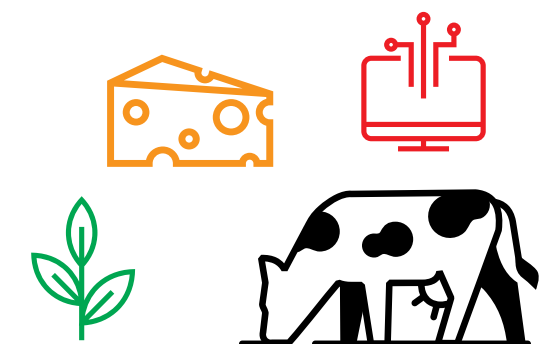
Hub-funded projects in fiscal year 21 aligned to more than 12 specific recommendations plus general areas of importance identified by the task force.



Recommendation	Aligning projects
Capital for new and emerging technology	Analyzing the costs and benefits of manure management regulations for dairy farm economic viability and soil and water sustainability. Reducing lifecycle environmental impacts and improving profitability of Wisconsin dairy systems through improved cropping management.
Create an app for dairy producers and associates on major topics	Competency of flies to acquire and transmit pathogenic bacteria to dairy cows. Mobile maps for better manure management.
Educational programming for non-farm audiences	Dairy Innovation Hub student challenge.
Emphasis on value-added and specialty cheese in Wisconsin	Glycomacropeptide (GMP) derived from cheese whey: Treating obesity by manipulating hunger hormones and the gut microbiota. Dairy residue bioconversion into designer (D) - Lactic acid. Development of milk-protein-based 3D printing bio composites using spoiled milk and whey from dairy processing waste. Whey-fortified fermented milk for inhibiting intestinal inflammation. Manufacturing natural cheeses containing bioactive peptides with improved antihypertensive properties.
Encourage young people to pursue ag careers	Dairy Innovation Hub student challenge.
Increased collaboration in the UW System and with private industry	Competency of flies to acquire and transmit pathogenic bacteria to dairy cows. Dairy Innovation Hub student challenge. Local virtual enclosures to enforce managed grazing.

Recommendation	Aligning projects
Increasing milk quality standards	Nanosculpted silicon membranes for shape-based biological separations. The genetic determinants of gastrointestinal tract colonization by <i>Listeria monocytogenes</i> .
Need for regulatory certainty and consistency	Analyzing the costs and benefits of manure management regulations for dairy farm economic viability and soil and water sustainability. Water quality, nitrogen use efficiency, and soil health: The shovel-ready projects of the UW-Discovery Farms.
Need to study the impact of dairy and agriculture on local communities	Network analysis of dairy supply chains. Changing agricultural land: Understanding impacts on southern Wisconsin’s dairy farms and rural communities.
Support for public and private partnerships	Dairy Innovation Hub student challenge.
Work to conduct detailed consumer preferences and insight studies	Measuring the rheological properties of ice cream to predict its mouth-feel sensations.
Dairy Innovation Hub	Funding was included in the 2019-21 state biennial budget. The Committee on Joint Finance has released budget funds to the University of Wisconsin System. A Dairy Innovation Hub Advisory Council was announced.

Top from left: Tu Anh Huynh, assistant professor of food science at UW-Madison spoke at the 2020 Dairy Summit about her research involving *Listeria monocytogenes* and her goal to improve food safety practices, cattle health, and development of new drug therapies against food borne illness. Photo by Michael P. King/ UW-Madison CALS. Hal Evensen, professor of engineering physics at UW-Platteville, along with a senior design class, created virtual enclosures to manage grazing at Wilson Organic Farms in Cuba City. This motorized cart connects to a grazing fence system and is controlled by a mobile device. Photo by Hal Evensen.



Award listing

FY 2021 funding decisions by priority area

Awards in this section were selected by panels of faculty colleagues through a competitive proposal process where faculty and staff submitted a research idea, budget and justification.

Stewarding land and water resources

UW-Madison

Equipment

- Hyperspectral Imaging instrument for precision dairy farming - Zhou Zhang, Department of Biological Systems Engineering
- Indwelling loggers for high-resolution, continuous monitoring, of rumen physiological data - Michel Wattiaux, Department of Animal and Dairy Sciences
- Mid-infrared spectroscopy platform for rapid assessment of soil, feed and dairy product nutrients for sustainable dairy production across Wisconsin - Alfred Hartemink, Department of Soil Science

Short term, high impact grants

- Cocktail forage mix yield, quality and use in cow rations - Matt Akins, Department of Animal and Dairy Sciences, Marshfield Ag Research Station
- Refining dairy forage rotations with cool season annual grasses - Jason Cavadini, Marshfield Ag Research Station
- Ammonia emissions inventory of different management practices and dairy farm settings - Horacio Aguirre-Villegas, Department of Biological Systems Engineering

Graduate student assistantships

- Increasing environmental stewardship of dairy forage production systems with cover crops - Mentor: Francisco Arriaga, Department of Soil Science. Student: Walker Crane
- Pyrolyzing dairy manure solids to recover manure nutrients - Mentors: Rebecca Larson, Department of Biological Systems Engineering; Joseph Sanford, School of Agriculture, UW-Platteville (collaborative) Student: Olivia Kepner

UW-Platteville

Faculty research fellowships

- Evaluation of biochar incorporation into manure systems for improving air quality and odor management - Joe Sanford, soil and crop science
- Wood templated high efficiency and low-cost ceramic membranes for dairy wastewater treatment - Zhezhen Fu and Edoardo Rubino, mechanical and industrial engineering

Equipment

- Greenhouse gas monitoring equipment to expand research capacity - Joe Sanford, soil and crop science
- Benchtop X-Ray diffractometer for materials analysis - Zhezhen Fu, mechanical and industrial engineering
- Equipment needs for measurement of dynamic soil properties - Chris Baxter, soil and crop science

Stewarding land and water resources, continued

UW-River Falls

Faculty research fellowships

- Updating manure excretion values in SNAPplus for better nutrient management planning - Joel Peterson, Department of Agricultural Engineering Technology

Equipment

- Analytical lab construction to house equipment to analyze water for phosphorous, nitrogen, and potassium, with capability for more elements/nutrients - Heather Davis and Holly Dolliver, Department of Plant and Earth Science
- Plant growth chambers for forage and cover crop research - Veronica Justen, Department of Plant and Earth Science

Growing farm business and community

UW-Madison

Equipment

- Biochemistry Analyzer to test if residues remaining after milk processing can be microbially fermented into valuable products - Timothy Donohue, Department of Bacteriology

Short term, high impact grants

- DairyTrader®: An instantaneous cull dairy cow price estimation to help farmer decision-making - Guilherme Rosa, Department of Animal and Dairy Sciences
- A new approach to nutrient management planning on Wisconsin dairy farms - Scott Sturgul, Department of Horticulture; Nutrient and Pest Management Program
- Dairy and environment online course development - Rebecca Larson, Department of Biological Systems Engineering

Graduate student assistantships

- Dairy residue bioconversion into designer (D) - Lactic acid - Mentor: Timothy Donohue, Department of Bacteriology. Student: Grace Enzien
- Assessing maize silage yield and quality using UAV-based hyperspectral imagery and machine learning - Mentor: Zhou Zhang, Department of Biological Systems Engineering. Student: Jiahao Fan

UW-Platteville

Faculty research fellowships

- Decision making using DAIRI (Data Automation Interface and Real-time Interaction) - a platform for connecting farmers to their data - Austin Polebitski, civil engineering and Arghya Das, computer science
- Performing a risk assessment for the dairy farm - Joshua Yue, computer science and software engineering, Ryan Pralle, animal and dairy science and Yanwei Wu, computer science and software engineering
- Design of a microgrid for the future dairy plant at UW-Platteville - Gholamreza Dehnavi, Mehdi Roopaei and Xiaoguang Ma, electrical and computer engineering

Growing farm business and community, continued

Equipment

- Selective laser sintering 3D printer acquisition for dairy protein-based composite materials development - John Obielodan, mechanical engineering and Joseph Wu, chemistry
- Software and hardware to perform dairy farm risk assessment - Yanwei Wu, computer science and software engineering

UW-River Falls

Faculty research fellowships

- Preliminary comparison of carcass composition, average daily gain and feed efficiency of HoSim Cattle vs. Angus x Holstein Cattle - Arquimides Reyes and Steve Kelm, Department of Animal and Food Science
- Understanding the impact of dairy farm changes on social capital in rural Wisconsin - Christopher Holtkamp, Department of Plant and Earth Science

Ensuring animal health and welfare

UW-Madison

Equipment

- Gas chromatograph and mass spectrometer for analysis of compounds found in forages, rumen fluid and gases, and blood/milk samples - Luiz Ferraretto, Department of Animal and Dairy Sciences
- A centralized histology and microscopy software resource to disentangle gene-environmental interactions that drive fetal programming and nutrient partitioning in the dairy cow - Vanessa Leone, Department of Animal and Dairy Sciences

Short term, high impact grants

- Innovative solutions for a sustainable improvement of dairy cow fertility - Francisco Peñagaricano, Department of Animal and Dairy Sciences
- Innovative methods to detect and protect against heat stress in Wisconsin dairy calves in a hutch environment - Jimena Laporta Sanchis, Department of Animal and Dairy Sciences
- Dietary fiber and starch digestibility effects on feeding behavior and lactation performance - Luiz Ferraretto, Department of Animal and Dairy Sciences

Graduate student assistantships

- Improving the performance of dairy heifer operations by understanding maternal and management stressors impacting heifer growth and feed efficiency - Mentors: Kent Weigel, Department of Animal and Dairy Sciences; Melkaye Melka, Department of Animal and Food Science, UW-River Falls (collaborative). Student: Kaylee Riesgraf

UW-Platteville

Faculty research fellowships

- Leveraging automated milking systems to employ targeted saturated fatty acid supplementation strategies to early lactation dairy cows - Ryan Pralle and Peter Lammers, animal and dairy science

Ensuring animal health and welfare, continued

Equipment

- Individual feed intake monitoring system for cross-disciplinary dairy production research - Ryan Pralle, animal and dairy science
- Refrigerated centrifuge for feed, manure and tissue sample processing and assays - Jim Hampton and Ryan Pralle, animal and dairy science
- Bale processor to improve feed efficiency and consistency at Pioneer Farm and provide teaching and outreach opportunities - Chuck Steiner and Justin Dougherty, Pioneer Farm

UW-River Falls

Faculty research fellowships

- Evaluation of effectiveness and pain behaviors between two caustic paste brands when disbudding calves - Sylvia Kehoe and Kate Creutzinger, Department of Animal and Food Science

Equipment

- Cal-Meter for cow-side determination of subclinical hypocalcemia in mature dairy cattle - Steve Kelm, Department of Animal and Food Science
- Handheld, portable blood gas machine - Sylvia Kehoe, Department of Animal and Food Science
- Calf barn expansion and related monitoring equipment for added research capacity Individual calf pens for added treatment group capacity - Greg Zwald, Farm Manager
- Multi-purpose bench top research space at Mann Valley Farm - Greg Zwald, Farm Manager
- Weaned calf structure to support additional calves and increased research capacity - Greg Zwald, Farm Manager

Enriching human health and nutrition

UW-Madison

Equipment

- High-speed refrigerated floor centrifuge dedicated to understanding antibiotic resistance in *Listeria monocytogenes* isolates from dairy cattle and dairy farms (Biological Safety Level-2) - Tu Anh Huynh, Department of Food Science

Short term, high impact grants

- Strategies to inhibit development of biogenic amines and associated defects in ripened cheeses - Mark Johnson, Center for Dairy Research
- In situ real-time soil nitrate leaching sensing for sustainable dairy production - Jingyi Huang, Department of Soil Science
- Determining consumer preferences for health and other product attributes of dairy milk - Beth Olson, Department of Nutritional Sciences
- Whey protein-polyphenol nanocomplexes to reduce fat in whipped cream - Audrey Girard, Department of Food Science

Graduate student assistantships

- Manufacturing natural cheeses containing bioactive peptides with improved antihypertensive properties - Mentor: Rodrigo Ibanez Alfaro, Center for Dairy Research. Student: Ben Ilesalnieks

UW-Platteville

no awards in this area for FY 21

UW-River Falls

Equipment

- Dairy processing laboratory to support new faculty research and outreach program – Peter Rayne, Department of Animal and Food Science

New faculty funded by the Hub

The following individuals were recruited during or began their positions in FY 21. Their expertise represents previous gaps in areas critical to the success of Wisconsin dairy.

UW-Madison

Margaret Kalcic, assistant professor to explore and develop innovative land and water stewardship solutions related to dairy production. *Start date Jan. 2022.*

Charles Nicholson, associate professor specializing in dairy economics and agribusiness related to the U.S. and Wisconsin dairy supply chain, dairy markets and policy. *Start date: Jan. 2022.*

Hilario Mantovani, assistant professor specializing in rumen microbial physiology as it relates to animal biology and advancing sustainability of animal sourced food systems. *Start date: Jan. 2022.*

Joe Pierre, assistant professor focusing on the links between milk components and human health, leading to new dairy products for individuals across the human life cycle consistent with “personalized nutrition”. *Start date: Oct. 2021.*

UW-Platteville

Joseph Sanford, assistant professor specializing in agricultural and biological systems engineering with a focus in agricultural wastewater treatment. *Start date: Aug. 2020. See profile on p. 29.*

Ryan Pralle, assistant professor specializing in ruminant nutrition for the efficient, profitable and environmentally sustainable production of milk and other dairy products. *Start date: Aug. 2020. See profile on p. 27.*

Zifan Wan, assistant professor specializing in dairy food science and management with focus on product development to enrich human health and nutrition and economic sustainability of dairy farms and communities in Southwest Wisconsin. *Start date: Aug. 2021.*

UW-River Falls

Luis Peña-Lévano, assistant professor specializing in community economic development to support dairy farmers, agriculture start-ups, rural entrepreneurs, and regional partnerships. *Start date: Aug. 2021.*

Kate Creutzinger, assistant professor specializing in dairy animal welfare, working to improve management, quality of life and sustainability. *Start date: Aug. 2021.*

Grace Lewis, assistant professor specializing in dairy processing supporting dairy companies, entrepreneurs, farmers, service providers and students with technology, product development and processing systems. *Start date: Aug. 2021.*

Capacity-building infrastructure funded to date:

Awards in this section were selected by campus leadership and steering committees based on strategic areas of need to benefit multiple research areas, students, staff and outreach to the dairy community.

UW-Madison

- Insentec Roughage Intake Gates – The Emmons Blaine Arlington Dairy Research Center now has the ability to control of what individual cows are eating and how much. Like a dinner plate, the gates work by allowing a cow to use specific areas of bunk space. Certain headlock gates will open for certain cows or stay shut so she cannot eat from that space. The gates allow for more research on an individual cow basis.
- Lab renovations for new faculty members:
 - » Jimena Laporta, Department of Animal and Dairy Sciences
 - » Francisco Peñagaricano, Department of Animal and Dairy Sciences

UW-Platteville

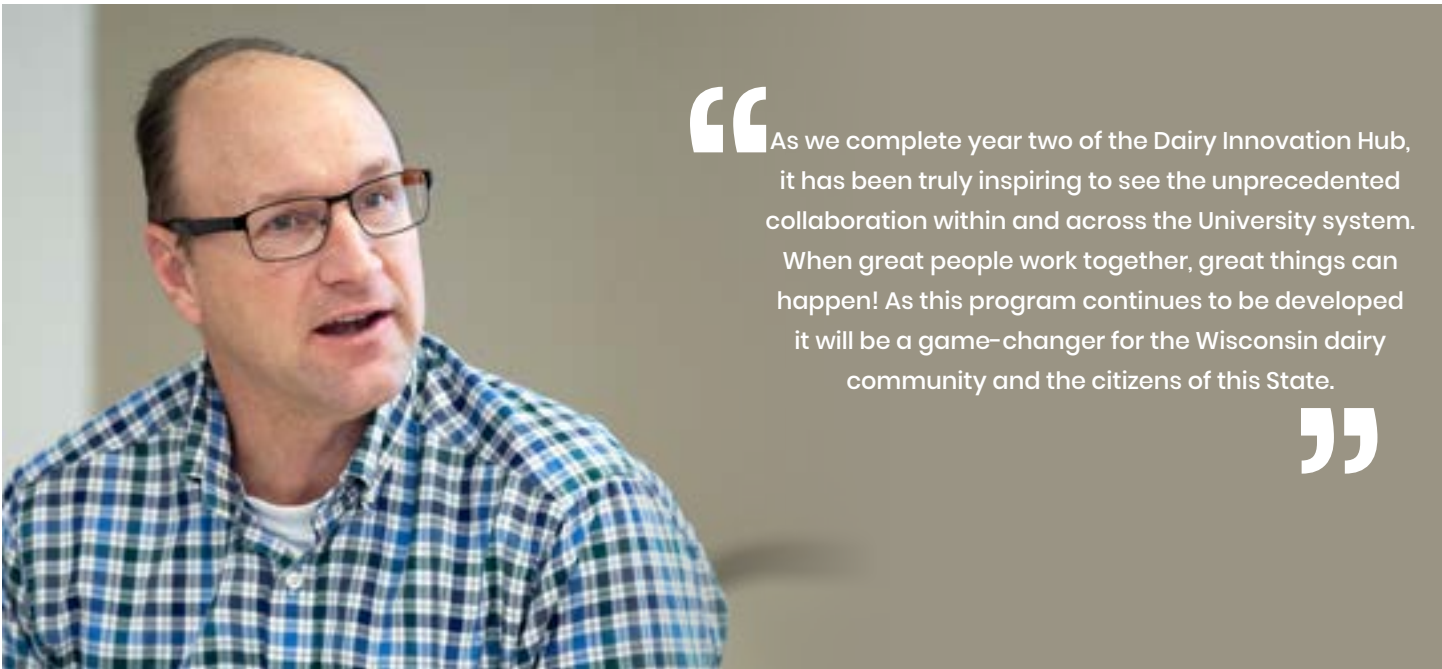
- Lely A5 Astronaut robotic milking system – Pioneer Farm is now home to two new state-of-the-art robotic milkers, enabling more opportunities for research and engagement across campus and the tri-state region. The robots were installed in June 2021 and introduced to the nearly 200-cow herd at Pioneer Farm shortly thereafter. UW-Platteville is currently the only UW System school to operate robotic milkers.

UW-River Falls

- Large capacity chilled centrifuge for blood sample preparation – Larry Baumann, Department of Animal and Food Science; Sylvia Kehoe, Department of Animal and Food Science
- Ultracold freezer for long-term storage of blood and tissue samples – Larry Baumann, Department of Animal and Food Science; Sylvia Kehoe, Department of Animal and Food Science; Young Dal Jang, Department of Animal and Food Science
- Mann Valley Farm dairy infrastructure to increase research and teaching capacity – Greg Zwald, UWRF Mann Valley Farm Manager
 - » Fencing project to split milking herd barn from single group to two groups to allow research
 - » Partial purchase of Case IH Tractor to assist with composted manure research

Emily Voelker, a senior majoring in agriculture studies, uses equipment supported by the Hub to turn compost windrows. Compost must be turned regularly to promote microbial activity to break down organic matter. Patrick Woolcock, assistant professor in the Department of Agricultural Engineering Technology, has a faculty fellowship, also supported by the Hub, exploring expansion opportunities for the Mann Valley Farm's dairy manure composting program. Photo by Pat Deninger/ UW-River Falls





“As we complete year two of the Dairy Innovation Hub, it has been truly inspiring to see the unprecedented collaboration within and across the University system. When great people work together, great things can happen! As this program continues to be developed it will be a game-changer for the Wisconsin dairy community and the citizens of this State.”

Mitch Breunig
Mystic Valley Dairy | chairman | advisory council



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