

Dairy Pipeline

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A Technical Resource for Dairy Manufacturers

BEGINNING OF A NEW CHAPTER

EXCITEMENT BUILDS AS BABCOCK HALL CONSTRUCTION PROJECT BREAKS GROUND



Exterior rendering of the CDR addition.

The Center for Dairy Research (CDR) celebrated another step forward in the renovation of the Babcock Hall Dairy Plant and the construction of an addition for CDR. On September 7, more than 150 people gathered on the University of Wisconsin–Madison campus for a ground-breaking ceremony. The \$47 million building project will expand and improve CDR's cheesemaking capabilities and allow CDR to move forward in other areas like dairy ingredients and whey processing.

"I think this is a game changer for us and the industry," said CDR Director John Lucey.

The renovated Babcock Hall Dairy Plant will feature a new piping system to efficiently move milk and dairy products through the plant and expanded freezer and cooler spaces. Other improvements include a new raw milk receiving bay and ice cream maker for Babcock Hall's famous ice cream.

The expansion includes a three-story addition for CDR, complete with a new auditorium where CDR will

hold its short courses. The new facility will also increase CDR's cheesemaking capabilities, with a focus on specialty cheese. The addition will include new cheese vats, nine ripening rooms, and an area for the manufacturing of specialty cheeses. The ripening rooms, which will be fitted with precise temperature, humidity and air flow controls, will allow CDR cheesemakers to produce specialty cheeses like mold-ripened and smear cheeses. The new space will also allow CDR to research

and develop products such as specialty yogurts. Additionally, a new drier will allow CDR to produce and research new dairy ingredients.

"We will have the ability to make next generation ingredients like those used for infant formula and nutritional products," Lucey said.

The building expansion, which is projected to be completed in late 2020, will take place over three phases.

Phase one began in August with the demolition of the Science House, which was located next to Babcock Hall, and continues today with the construction of a new loading dock and drive-through milk receiving bay.

Phase two will be the construction of the three-story addition for CDR. This phase is expected to begin in early 2019 and take 12 to 18 months.

Phase three, the renovation of the Babcock Hall Dairy Plant, is planned to begin in early 2020.



During construction, the dairy plant will be shut down for about 13-14 months. However, the Babcock Hall Dairy Store will remain open and Babcock Hall ice cream will be made at an off-site manufacturing facility. Although the construction will cause some inconvenience, the project is long overdue. Babcock Hall hasn't been updated or renovated since it was constructed in 1951.

In her remarks at the ground-breaking celebration,



UW-Madison Chancellor, Rebecca Blank.

University of Wisconsin-Madison Chancellor Rebecca Blank noted, "Our patience has paid off. This facility is going to be one of the premier dairy education and research centers in the nation. And most importantly, it will be a hub for discovery and innovation for Wisconsin's dairy industry."

John Umhoefer, Executive Director of the Wisconsin Cheese Makers Association (WCMA), said the project represents a big step forward for the dairy industry.

"Investments in the Center for Dairy Research are investments in the future of the U.S. dairy industry," Umhoefer said. "As the global marketplace offers new opportunities, it's critical that we maintain our reputation for the highest quality dairy products and innovative processing practices."

A large part of the funding for the \$47 million project was raised by the dairy industry. Blank said it was one of the most successful fundraising projects on campus.

"Nearly 200 individuals and organizations gave \$16 million in the course of just eight months to make this dream a reality," Blank said.

An additional \$2 million in equipment was donated for a total of \$18 million raised through donors.

"It was critical that important leaders stepped up and urged their peers to actively support this project," Lucey said. "The fundraising very quickly snowballed. I think everyone was aware that this 60-year-old building was no



Rendering of new auditorium.



Rendering of new conference room.

longer fit for its purpose. Industry leaders also know that it will give great value back to the industry."

The Babcock Hall building project will increase CDR's capacity to work with and support the industry. Each year, CDR works with more than 100 dairy companies and more than 30 national and international dairy organizations, offering many education courses, technical support and new product development opportunities throughout the year.

For more information on the Babcock Hall building project, visit www.babcockhall.cals.wisc.edu or www cdr.wisc.edu/building.



Thanks to this group for helping to move the project forward.

Kate VandenBosch, Dean of CALS, UW-Madison; Scott Rankin, Chair, Food Science, UW-Madison; John Lucey, Director, CDR; Ron Buholzer, Klondike Cheese Co.; John Umhoefer, Executive Director, WCMA; Chancellor Rebecca Blank, UW-Madison; Dave Fuhrmann, Former President & CEO, Foremost Farms USA (retired); & Tom Hedge, formerly Schreiber Foods.

THE BENEFITS OF MICROFILTRATION

Technical Contributors: John Lucey, & Tom Szalkucki, CDR

What if there was a process that could increase cheese yield, efficiency and consistency, while producing a cleaner, more valuable whey — all without negatively impacting cheese quality? It might seem unlikely but it's possible. Microfiltration or microfiltered milk, which is used by the dairy industry in Europe, has the potential to provide many benefits to the U.S. dairy industry. Unfortunately, the use of microfiltered milk in dairy products is not approved by the Food and Drug Administration (FDA). The Center for Dairy Research (CDR) and others are working to change that.

The Fundamentals of Filtration

Microfiltration (MF) and ultrafiltration (UF) are membrane filtration processes that separate milk components based on molecular size. MF retains fat and larger proteins, such as casein, while allowing lactose, minerals, whey proteins and non-protein nitrogen to pass through. UF, on the other hand, retains both casein and whey proteins, while lactose and soluble minerals pass through (Figure 1).

The main difference between the two is that MF permeates a significant percent of the whey protein. This small difference provides a number of benefits, such as an increase in cheese yield. Since MF milk has less whey and more casein solids, cheesemakers get a greater yield from the same volume of MF milk as they would traditional milk. This also increases efficiency in the cheesemaking process as each vat will produce more cheese. For instance, for a standard Cheddar cheese made with 2.5% casein and 3.6% fat, using MF to increase the casein and fat by 1% would result in an extra 2,500 pounds of cheese per vat (assuming a vat size of 50,000 pounds).

MF is also beneficial to cheesemakers because the process allows for direct control of the casein concentration in the cheese milk. As Michael Culhane wrote in the March 2, 2018 issue of *Cheese Market News*, this allows for accurate standardization of casein and concentrates casein content to levels that optimize cheese plant performance and output. Having consistent, predictable levels of casein in the milk makes it easier for cheesemakers to have consistent coagulation. This will give the cheesemaker more consistent cutting times, which will improve the moisture content, which, in turn, helps cheese yield. Controlling the casein concentration in milk is especially helpful to cheesemakers who have to adjust the cheesemaking process due to seasonal changes in the milk. (For instance, Krisciunaite et al. (2012) [Int. Dairy

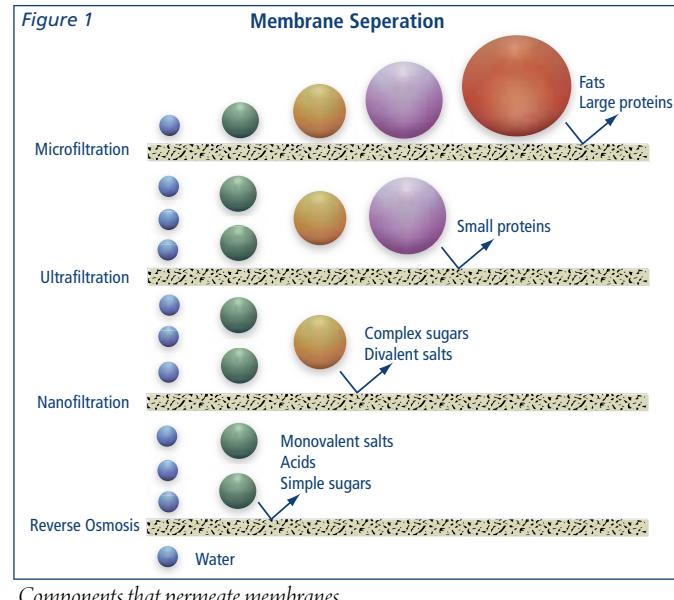
J. 23:45] reported that the WP:CN ratio of individual cows exhibited a seasonal variation ranging from 0.11 to 0.21). MF can produce a milk with a more consistent profile no matter the season.

In addition, MF more closely resembles the cheesemaking process than ultrafiltration. As described earlier, MF only concentrates casein and fat and allows most of the whey protein and lactose to be lost, which is much like the cheesemaking process. Compare this to UF, which concentrates casein, whey protein and fat, which is not as similar as the concentration processes involved in cheesemaking.

A New, Innovative Product

MF also has the potential to help the U.S. dairy industry open doors to an array of new ingredients and revenue streams for dairy producers because it produces a valuable permeate called native whey or milk-derived whey. Milk-derived whey has many advantages over whey that has gone through the cheesemaking process, such as not containing any starter culture, coagulant or coloring, making it a preferable ingredient for high-end applications like infant formula or nutritional protein powders. In addition, milk-derived whey also has a superior flavor and contains less fat than a traditional whey protein concentrate, which allows for a clearer appearance in food applications.

Many nutritional markets, including China, only accept uncolored whey in their high-end products. Currently, it is challenging for the U.S. to provide these markets with uncolored whey since the U.S. produces a lot of colored cheeses. The European Union, which allows the use of MF, is now using milk-derived whey to supply this ➔



lucrative market, while the U.S. is missing out on this opportunity. In addition, the market for milk-derived whey is expected to grow significantly in the next 10 years, making it even more imperative that the U.S. update its standards regarding MF.

Meeting with the FDA

This summer, the International Dairy Foods Association (IDFA) requested a meeting between representatives from the U.S. dairy industry and the FDA. The group representing U.S. dairy, which included CDR's Director John Lucey, as a technical advisor, asked the FDA to change its standards to approve the use of MF milk in dairy products. As mentioned, the FDA has approved the use of UF milk but not MF milk. There is concern by the FDA that in addition to altering the proteins, MF would also remove vitamins and minerals and change the nutritional content of the cheese.



Industry participants who met with FDA to discuss MF milk, left to right: Veronique LaGrange, ADPI; Elizabeth Fawell, Hogan Lovells; Bill Graves, DMI; Michael Culhane, Ph.D., Dairy Advance Business Consulting; John Lucey, Ph.D., Center for Dairy Research; Richard Scarsella, Great Lakes Cheese; Secretary Sheila Harsdorf, WDATCP; Michael Dykes, DVM, IDFA; Cary Frye, IDFA.

As part of his presentation to the FDA, Lucey shared data from a new study conducted by CDR on the impact MF milk has on cheese content and quality. In the study, CDR tested the hypothesis that cheese made with MF milk changes the nutritional content of that cheese.

"This study was trying to answer the question 'Does using microfiltration make an inferior product?' We didn't see any evidence of that," Lucey said.

The CDR study made cheese using traditional milk

(17% whey protein as a percentage of true protein), a MF milk with a 0.89 casein-to-true protein ratio (11% whey protein), and a MF milk with a 0.95 casein-to-true protein ratio (5% whey protein). Once CDR had produced the three cheeses with the different milks, they were analyzed for nutritional content. The results showed very little nutritional difference between the three cheeses. The only difference was that the cheese produced with the MF milk that had only 5% whey protein had slightly less sodium and slight higher vitamin A. Lucey hypothesizes that there was slightly more vitamin A because it is a fat-soluble vitamin and the MF processed cheese ended up with some extra fat. Additionally, in the MF process, some of the sodium in milk is filtered out. However, the differences were negligible and wouldn't show up on a food label or impact taste.

In addition to finding no impact on the nutritional content of the cheese, the CDR study conducted a number of other tests on the cheeses, including pH, sensory, rheology, texture, and performance. Again, the tests didn't find any significant differences in the cheeses.

"There was a significant increase in yield, in protein recovery, and in amount of solids recovered by doing this process [microfiltration], but no effect on quality," Lucey said.

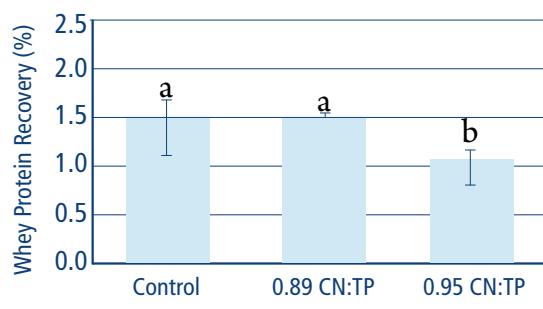
The CDR study also examined the differences in the whey protein recovery in the three cheeses and didn't find any major differences. Even the cheese made with MF milk that had about 50% of the whey proteins removed, didn't have a significant difference in the amount of whey protein retained in the cheese (Figure 2).

So, from a cheesemaker's perspective, the FDA's stance that MF alters the quality of the cheese because it removes whey proteins seems misguided because only trace amounts of whey protein actually end up in the cheese.

"We always felt this argument was weak because the whey proteins that are present in milk end up in the whey — that's why they're called whey proteins — they don't end up in the cheese," Lucey said. "So, whether you use microfiltration to take them out or you let the natural cheesemaking process create a whey and they're mostly lost in the whey, either way it's gone, it doesn't end up in cheese." ➤

Figure 2
Whey Protein Recovery in Cheese

Whey protein recovery in cheese is very low and even removal of around 50% of the whey proteins from milk did not impact their recovery in cheese.



Microfiltration and the Global Marketplace

According to a study from the U.S. Dairy Export Council (USDEC), MF milk is produced by about 40-50 plants in the European Union for the pretreatment of cheese milk. Each year, more European companies start or increase their production of MF milk. For instance, Valorlait, a joint venture company established by a raw milk cooperative in northern France, began microfiltering milk in 2012 with an initial milk capacity of 500,000 pounds. Since then, the company has expanded its operations three times with growing demand for cheese milk pretreatment.

"They're [Europe] ramping up investment and we're kind of sitting on our thumbs because we haven't modernized our standards, and thus our companies are not investing" Lucey said.

Meanwhile, it could take several years for the FDA to reach a decision on MF. Lucey is optimistic that the FDA will provide clarity and approval on the use of MF milk much like it did last year for UF milk. The FDA could issue a waiver allowing the use of MF or it could update all of the standards regarding filtered milk, which haven't been updated in several decades.

"I would prefer that they basically modernize and formally update the standards, which they haven't done in a long time," Lucey said. "I think that's probably the best thing to do to help with promoting greater innovation while protecting high quality cheese products."

As an example, Lucey cited the Codex Alimentarius, which regulates products for international trade. Lucey pointed out that the Codex Alimentarius essentially says milk and products derived from milk can be used to produce dairy products.

"Let's worry about making good quality dairy products rather than trying to micromanage which type of milk concentration process a plant wants to use, as that continues to evolve with ongoing innovation," Lucey said.

Lucey encourages members of the dairy industry to continue to work with FDA to set clear and consistent standards for milk that allow the use of MF milk in the production of dairy products. If interested you can contact Cary Frye, Senior Vice President of Regulatory Affairs at IDFA, at cfrey@idfa.org.

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CDR WELCOMES NEW STAFF MEMBERS

Shelby Anderson, Communications Specialist

Shelby edits the *Dairy Pipeline* and supports the organization in its mission to promote dairy research and provide technical support and education. He has extensive experience as a writer and editor. For more than a decade, he edited a statewide magazine covering public education. Shelby looks forward to continuing the *Dairy Pipeline*'s tradition of providing technical and timely articles to the dairy industry. Don't hesitate to contact Shelby with ideas or comments. He can be reached at sanderson@cdr.wisc.edu or 608-262-8015.



Rebecca Kimball-Kilgore, Research Specialist

With years of experience within the dairy industry at Foremost Farms USA, Rebecca has extensive knowledge of many chemical and microbiological testing techniques of various dairy products. She is excited to have the opportunity to continue to enhance these skills in the analytical lab of CDR and provide accurate data to both researchers and industry clients. Rebecca has a degree in microbiology from the University of Wisconsin-Madison and enjoys working in CDR's environment of continuous research, outreach and education.



Jason Pronschinske, Associate Research Specialist

Jason hails from Alma, a small farm town in western Wisconsin where the dairy industry thrives. As an undergraduate at the University of Wisconsin-Madison, he worked in CDR's analytical department where he found the laboratory to be the perfect place to blend his love of science and dairy. After graduating this past spring with a degree in biochemistry, Jason is happy to continue his work at CDR conducting testing and research on a wide variety of dairy products. Jason hopes that his work at CDR will help the dairy farmers back home and throughout the industry. 🌎



THE HOLISTIC APPROACH TO PREVENTING DEFECTS IN CHEESE

Technical Contributors: Andy Johnson, Gina Mode & Dean Sommer, CDR

Cheesemakers know that the process of making cheese is both an art and science. There are many variables that need to be monitored and controlled. When a defect appears in a cheese, it can be hard to pinpoint what went wrong and, therefore, difficult to prevent it from happening again.

In this article, we will take a holistic look at preventing cheese defects—from the microbiology, the environmental factors, and the salting process—to help cheesemakers avoid defects and consistently produce high-quality cheese.

Good Cheese Starts with Good Milk

In a presentation this summer at the American Cheese Society Conference in Pittsburgh, Gina Mode, Assistant Coordinator of the Cheese Industry and Applications program for the Center for Dairy Research (CDR), emphasized that, “It is an accepted fact in the cheese industry that the cheese can be no better than the milk from which it is made.”

The quality of milk is determined by its flavor, odor and appearance. Quality is commonly measured quantitatively by determining bacterial content, somatic cell count and the presence of sediment or extraneous matter. These properties of milk interest the cheesemaker because they impact the characteristics of the finished cheese.

For instance, milk with high levels of problematic bacteria can result in gas development or off flavor in the cheese. Bacteria in milk originate from soils or vegetative matter and may come from a lack of cleanliness at milking. Teat cleanliness is imperative to the production of high-quality milk. Pre-milking teat treatment should include thoroughly cleaning the teats and using a teat dip. Other sources of contamination can include bedding material, improperly fermented or stored silage, mud, feces, and dirty cows’ legs.

In addition to the basic tests used to measure milk quality, CDR staff recommend that cheesemakers monitor levels of certain bacteria that can cause gas formation or off flavors in cheese. In raw milk, counts for heterofermentative bacteria (gas producers), like *lactobacillus*, should be <10 cfu/ml. For pasteurized milk, heterofermentative bacteria should be <1 cfu/ml.

The Importance of Clean Equipment

The presence of too many bacteria during milking can

lead to other problems, such as contamination of milking equipment, and, later on, equipment in the cheese plant. For instance, cracked rubber gaskets on milking equipment can be a source of bacteria buildup. If the equipment is not properly cleaned, a biofilm of bacteria can form.

Biofilms are a buildup of bacteria that can adhere to surfaces on milking equipment and surfaces in the cheese plant, such as pasteurization equipment and other product contact surfaces. Bacteria in biofilms are more resistant to heat and sanitation as they produce a sticky, protective layer, making them difficult to remove once established.



Example of poor milking conditions.

Dean Sommer, Cheese and Food Technologist for CDR, says that, “Once a biofilm has started to form, the normal wash procedure will not likely remove it. A more aggressive chemical cleaning procedure including use of enzymes, needs to be implemented to remove the biofilm before the plant can go back to their normal cleaning procedure.” If you suspect you have a biofilm issue, you can consult with your cleaning chemical supplier.

Biofilms can be avoided in the cheesemaking plant by keeping on top of regular and thorough cleaning of equipment. In fact, Sommer says, the most common mistake that cheesemakers make is not doing routine tear-down inspections of the equipment in their cheese plants.

“Either the cheesemaker or their quality assurance person should, at least monthly, do a visual inspection of their equipment,” Sommer said. “This means tearing equipment apart, to ensure that it has been properly cleaned.”

Other common mistakes regarding cleaning include: improper wash procedures, improper wash frequency,

running out of chemicals, running out of hot water, not monitoring and measuring the chemical strength of the cleaning solutions regularly, improper or lack of sanitizing procedures for equipment, poor equipment design so that it isn't easily cleanable, not giving the cleaning staff the proper training and enough time to get the job done right, and using poor quality cleaners.

Bacteria + Substrate + Conditions = Cheese Defects

Why is good milk and clean equipment so important in the cheesemaking process? One of the main culprits in causing defects in cheese is the presence of too many gas-producing bacteria, which typically comes from poor quality milk and contaminated equipment. Add in a substrate (food for the bacteria to eat), like lactose, and the right conditions, such as warm temperatures, and the bacteria will produce carbon dioxide, which can cause splits or cracks in cheese or puffy packaging.

In recent years, CDR staff have seen an increase in gassy cheese defects like slits and puffy packages in Parmesan, Swiss and Cheddar cheeses. Most gas-producing bacteria are obligate heterofermentatives, including certain species of *lactobacillus* that use lactose and galactose as a substrate.

If the cheese develops gas less than one week after it is manufactured, that indicates that the bacteria source is contamination in the raw milk, biofilms or unclean equipment. Early gas development is often an indication of coliform bacteria or yeast.

If the gas development is late (after more than a month of ripening) the most likely culprits are obligate or facultative heterofermentatives from the raw milk. A milk clarifier or a bactofuge could be used to remove the harmful bacteria, especially spores. These processes can remove about 90-99% of spores and 70-85% of vegetative bacteria cells from the raw milk prior to the heat treatment.

Another point to note is that while pasteurization reduces bacteria counts, it is only effective if initial levels of bacteria in the raw milk are at acceptable levels. For instance, raw milk should have <1 anaerobic spore/ml, <100 lactobacilli/ml and <100 coliforms/ml.

The Right Conditions

Another factor that can cause defects is storing or



An example of gassy Cheddar cheese.

ripening cheese at an improper temperature. Elevated storage or ripening temperatures increase the likelihood of defects. Since most problems for cheese arise when it's stored around 50°F, it is recommended that cheese be ripened or stored below 50°F. However, cheese also develops flavor faster at warmer temperatures so it can be a tradeoff between increasing your risk of defects and ripening your cheese faster.

Other factors to consider are the use of an adjunct culture that, when added to the cheese, can overwhelm the contaminants and inhibit the bacteria that produce gas and off flavors.

Avoiding Defects from Salting

Salting is a key step in cheesemaking and, when done properly, can improve the flavor and help control microbes and acid levels. Achieving the proper salt level in a cheese is very important. If cheese doesn't have enough salt it may result in a flat flavor, too much acid development, a pasty and weak body, abnormal ripening and a bitter flavor. However, too much salt can produce tough body and slow ripening.

To avoid these defects and reach the proper salt level, the first step is to determine the appropriate salt/moisture (S/M) ratio for the cheese variety. For instance, Cheddar cheese has a suggested S/M ratio of 4.5-5.5% whereas blue cheese has a higher S/M ratio of 8-10%.



Gas damage in a 640 block.

During the salting process, it is important to test daily all vats of cheese to determine the S/M ratio. If the cheese is not in the proper range, make adjustments to how much salt is being added. If adding salt directly to the curd, know that approximately 50% of the salt added in a dry salted cheese is retained in the cheese. From there, you can estimate how much additional salt needs to be added or reduced. Additionally, achieving the correct salt content and S/M ratio can also depend on compositional changes in the milk, especially those that occur seasonally. ➔

"Cheesemakers should continue to test salt and moisture routinely, preferably daily, on at least one batch of cheese" Sommer said. "Plot the results to see if they are in range or if they are trending up or down on their salt/moisture ratio."



An example of weak body cheese.

For brine salted cheeses, the testing/monitoring concept is the same, but to adjust the salt content the easiest way is to increase or decrease the amount of time the cheese spends in the salt brine solution. Proper sampling of brine salted cheese is important to ensure a representative sample is used for the analysis. It can take weeks for the salt to equilibrate throughout the cheese.

Educate Your Sellers

With all of the work that cheesemakers put into their product, it's important to work with retailers to ensure that the cheese is transported, stored and presented properly to customers. Exposure to light and oxygen, warm temperatures, and improper sell-by-date labelling and packaging systems can damage an otherwise good product.

The first step is to talk with customers and learn how the cheese will be used (food service or retail). It's important to work with your cheese sellers to educate them on reasonable shelf life for the cheese. In some cases, the composition of the cheese may need to be adjusted to meet your cheese seller's demands for shelf life and performance.

Educate sellers so they know the proper packaging systems for your cheese varieties. Improper packaging can lead to problems like mold contamination. Blue cheese, which needs oxygen to stay fresh, is sometimes put in vacuum packaging that starves the mold of oxygen resulting in discoloration and off flavors. Make sure sellers know and understand the ideal temperature and humidity conditions for your cheese during storage and display. This is especially important as the bacteria in cheese that flourishes in warmer temperatures are the same bacteria that cause unclean flavors in cheese such as "barny/cowy" or "soapy" flavors.

Light can also damage cheese, causing discoloration and even off flavors like "cardboardy" and "tallowy" flavors. For instance, for cheeses packaged in clear film, light

intensity in the display case should be less than 250 footcandles.

"If your sellers are retailers, spend some time in their stores to learn how they are displaying your cheese and issues they are having," Sommer said. "If you work together, you can give the consumers the best possible cheese quality."

Keep Learning

When it comes to avoiding defects in the cheesemaking process, Sommer says one of the biggest steps cheesemakers can take is to continue their education. Attend CDR's short courses to expand your knowledge and expertise (see the list of upcoming short courses on the back page).

Or reach out directly to CDR. Cheesemakers are always encouraged to contact CDR for help and resources on all topics related to cheese. For more information, contact:
Dean Sommer | dsommer@cdr.wisc.edu
Gina Mode | gmode@cdr.wisc.edu
Andrew Johnson | ajohnson@cdr.wisc.edu.

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CDR will also be hosting a short course on "Making Consistent, Quality Cheese with Membrane Concentrated Milk" on December 11-13 at Babcock Hall on the University of Wisconsin-Madison campus. For more information, visit [www.cdr.wisc.edu/shortcourses](http://www cdr wisc edu shortcourses).

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DEVELOP YOUR PRODUCT AT CDR

Have an idea for a new product? Or need help getting a dairy ingredient or recipe to function correctly? The Center for Dairy Research (CDR) can help. CDR's Dairy Ingredients and Functionality group offers a fee-for-service option that connects companies with the Center's expert staff and facilities to help research and develop products or ingredients.

CDR's Dairy Ingredients, Beverages & Cultured Products Coordinator KJ Burrington and Associate Researcher Susan Larson, Ph.D have helped numerous companies develop new products, test ingredient functionality and/or troubleshoot. The fee-for-service option is flexible—Burrington and Larson work with companies to meet them where they are in the product development process. CDR can help companies develop a product from the ground up, assist with the final steps of commercialization or anything in between.



KJ Burrington, CDR, talking to a client.

Ingredient Functionality

There are three different types of projects that CDR primarily helps clients with—ingredient functionality, applications, and troubleshooting. In the ingredient functionality area, CDR researchers can measure the performance of dairy ingredients and help companies that manufacture the ingredients to understand their functional characteristics.

The Center can test for a number of characteristics such as heat stability, water-holding capacity, foaming, emulsification, gel strength, hydration characteristics, and more. Over the years, researchers at CDR have developed methods for testing the performance attributes of just about any dairy ingredient. For example, CDR has used the information from milk protein and whey protein ingredient hydration characteristics to help optimize the performance of these dairy ingredients when used in beverages and yogurts. CDR also uses their functionality methods as a benchmarking tool to help select and recommend the type of dairy ingredient that best fits a specific food application.

Applications

The Dairy Ingredients and Functionality group can also help clients use dairy products in a variety of applications, such as beverages, drink mixes, yogurts, bars, baked goods, confections, soups, and sauces. The

staff at CDR provides a strong base of knowledge in the use of milk and whey protein ingredients, as well as non-protein ingredients such as permeate in all types of applications. This is an area that is continually changing and developing not only at CDR but in products across the world. For instance, CDR can help companies use permeate to reduce sodium in a product or add whey protein ingredients to boost the protein content. The Center can also help companies use dairy ingredients to develop better texture, retain moisture or improve a product's ability to gel or hold water. Burrington and Larson have also helped companies develop recipes that are organic and/or feature a "clean label" (no preservatives or artificial colors or flavors).

In addition to helping companies develop new products for the retail market, CDR staff can also help clients develop products for special events such as trade shows. Perhaps you want to showcase how your product, such as milk protein concentrate, can be used in a variety of applications. The Center can help develop and produce bars, beverages or other applications to highlight how your ingredient can add value to a product.

Troubleshooting

Not every company has a research and development team and, even if it does, a second set of eyes can be helpful. For instance, CDR can help ingredient manufacturers resolve an issue one of their consumers might have with their ingredient. Or, CDR can work with food manufacturers to improve an ingredient's performance.

Success Stories

CDR is here to help. Staff have worked with a variety of big and small companies. Recent clients include tera'swhey (whey protein), Country Ovens (Rapid Whey), and Jouzge (protein bars). In the case of Jouzge, Burrington and Larson helped Dana Wendt, creator and owner of Jouzge, not only develop the protein bars but also find a co-packer. They also connected her with opportunities like the Land O'Lakes Inc. Dairy Accelerator program. ➔



"I'm so thankful to all those who have helped along the way and particularly CDR who helped us to secure partners and break this start-up process into meaningful steps," Wendt said.

CDR also helped develop Rapid Whey, a shelf-stable, ready-to-drink muscle recovery beverage made with 100% tart cherry juice and dairy whey. It was developed in partnership between CDR, Country Ovens and the University of Wisconsin–Madison (UW) Athletic Department. John Dettmann, Director of Performance for UW athletics, contacted CDR about formulating a natural recovery drink that would provide UW student athletes with a delicious whey protein option that also meets strict NCAA nutritional requirements. Dettmann also contacted Mike Johnson, President of Country Ovens, to see if he could provide the cherry juice for the drink as well as manufacture the end product.

"It was a really rewarding process to work with UW and CDR," Johnson said. "With their inspiration and expertise, they blended two wholesome yet different products to make a nutritious and refreshing recovery drink. We created a product that is not only beneficial to the active athlete, but also for the young, those with an active lifestyle and to seniors needing a boost to their systems. We are pleased to be able to provide this product to our customers."

Today, the drink is used by UW student athletes and endorsed by professional athletes. It is also available in the retail market and on the website www.countryovens.com.

Work with CDR

Additionally, the work that CDR does for its clients stays the property of the company. Staff can also offer a confidentiality agreement to companies, if needed.

“We’ve enjoyed working with a variety of companies on a number of different products,” Larson said. “It’s really rewarding work and we always look forward to working with new clients and to continue to move the industry forward.”

For more information on working with CDR on dairy ingredients, contact KJ Burrington at burrington@cdr.wisc.edu | 608-265-9297.



MONOGRAPH TOUTS THE ADVANTAGES OF DAIRY PROTEIN

With an increase in the global demand for high quality and economical protein sources, the U.S. Dairy Export Council (USDEC) has released a monograph comparing the properties and functionality of dairy and plant proteins. The monograph prominently features research from the Center for Dairy Research (CDR) conducted by KJ Burrington, Coordinator of Dairy Ingredients, Beverages & Cultured Products; Susan Larson, Ph.D Associate Researcher; and Hong Jiang, Research Specialist.

Using CDR's research, the monograph outlines how dairy protein outperforms plant protein in most applications in the food industry. For instance, CDR's research found that whey protein performs significantly better than plant proteins in high-acid applications, such as shelf-stable juices and protein drinks. In addition, whey protein isolate stays clear in high-acid conditions, making it an ideal ingredient for clear, ready-to-drink beverages. CDR research cited in the monograph also found that milk and whey protein are more heat stable than plant protein, making them better candidates for aseptic (shelf-stable) products.

In sensory panel testing conducted at North Carolina State University it was found that dairy proteins provide more desirable characteristics and tastes than plant proteins. Research also shows that dairy protein provides more nutritional value than plant proteins. Dairy proteins are more easily digested by humans and contain more essential amino acids than plant proteins. In addition, dairy proteins, like whey protein isolate, contain a greater

The monograph also explains how dairy proteins are more readily available and economical than plant proteins. For ➔

instance, in 2016, the total volume of dairy proteins produced in the U.S. was greater than the entire global production of plant proteins. The production and use of plant proteins also generally involves more processing than dairy proteins, further driving up costs.

In closing, Burrington said the monograph makes a strong argument for versatility of dairy proteins, "The overall message is dairy proteins can provide the desired flavor, function, and nutrition to just about any food application."

You can download the complete monograph, "A New Era for Protein: Why U.S. Dairy Delivers in the Crowded Protein Marketplace," at www.ThinkUSAdairy.org. Select "Using Dairy," "Resources & Insights" and then "Latest Resources" or visit <https://bit.ly/2L3zSod>. ☀

additional presenters from the dairy industry.

During the short course, CDR recognized several special guests, including Dave Thomas, retired professor of sheep management and genetics at the University of Wisconsin–Madison; Kalit, who has worked with CDR for several years; and William Wendorff, Professor Emeritus, Food Science, University of Wisconsin–Madison. Wendorff has played a major role in establishing the dairy short course program at UW/CDR and conducted research on sheep milk and cheese.



Bill Wendorff, retired Food Science professor, UW–Madison and Samir Kalit, University of Zagreb, Croatia

The CDR short courses are offered throughout the year in Babcock Hall and cover a variety of dairy topics. The Master Artisan Short Course is designed for advanced cheesemakers and is one of the courses that cheesemakers can take to work towards their Master Cheesemaker designation. For more information on the CDR short courses, visit www.cdr.wisc.edu/shortcourses or view the list of 2019 short courses below. ☀

2019

- Milk Pasteurization ▶ January 8-9
- Successful Retailing ▶ January 14-15
- Batch Freezer ▶ January 16-18
- Certificate in Dairy Processing ▶ January 24-April 11
- Process Cheese ▶ February 19-21
- Business 101 ▶ March 5-6
- Cheese Technology ▶ March 11-15
- World of Cheese from Pasture to Plate ▶ April 22-26
- CIP ▶ April 30
- HACCP ▶ May 1
- Certificate in Dairy Processing ▶ May 2-July 25
- Applied Dairy Chemistry ▶ May 7-8
- Cheese Grading ▶ June 4-6
- Milk Pasteurization ▶ August 6-7
- Certificate in Dairy Processing ▶ September 4-November 27
- Cultured Products ▶ September 10-11
- Master Artisan Course ▶ September 17-19
- Cheese Technology ▶ October 7-11
- Dairy Ingredient Applications ▶ October 22-23
- Dairy Protein Beverages ▶ October 24-25
- Cheese Grading ▶ November 6-8
- Ice Cream ▶ December 3-5
- Making Consistent, Quality Cheese with Concentrated Milk ▶ Dec. 10-12



John Jaeggi, CDR and Dave Thomas, retired professor, UW–Madison

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Short Course Calendar:

- ▶ Ice Cream, November 28-30, 2018
- ▶ Making Consistent, Quality Cheese with Concentrated Milk, December 11-13, 2018
- ▶ Milk Pasteurization, January 8-9, 2019
- ▶ Successful Retailing, January 14-15, 2019
- ▶ Batch Freezer, January 16-18, 2019
- ▶ Certificate in Dairy Processing, January 24-April 11, 2019

For detailed information on each CDR short course:
www.cdr.wisc.edu/shortcourses

Events

A logo for the "dairy FORWARD DAIRY FORUM 2019" event. It features the word "dairy" in green, "FORWARD" in large orange letters, and "DAIRY FORUM 2019" in green. Below the text is a graphic of many yellow triangles pointing to the right.

A logo for the "2019 CHEESE INDUSTRY CONFERENCE". It features a photograph of various cheeses and the text "April 17 & 18, 2019", "2019", "CHEESE INDUSTRY CONFERENCE", and "Alliant Energy Center Madison, Wisconsin".

To sign up for a hard copy of the Dairy Pipeline newsletter call, fax or e-mail your mailing information. Change of address? Please help us keep our mailing list current!

