UW Dairy Pipeline

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To pasteurize or not to pasteurize —

Study indicates heat-treatment can be safe, effective alternative

The following article is excerpted from "Microbiological safety of cheese made from heat-treated milk," a three-part manuscript published in the Journal of Food Protection *by UW-Madison researchers* ***Eric A. Johnson, John H. Nelson****, and* ***Mark E. Johnson*** *(1990). Citations for each of the original articles are as follows:*

Part I. Executive summary, introduction and history. J. of Food Prot. *53(5):441-452;*
Part II. Microbiology. J. of Food Prot. *53(6):519-540;*
Part III. Technology, discussion, recommendations, bibliography. J. of Food Prot. *53(7):610-623.*

Milk heat-treatment, the process of heating milk at time-temperature conditions less severe than pasteurization*, has a long history of use. It provides two of the advantages of pasteurization: more consistent control of the cheesemaking process and more uniform cheese quality.

Because heat-treatment only partially inactivates enzymes, microorganisms, and other biologically active constituents of raw milk, cheese flavor development during curing is more rapid than in cheese made from pasteurized milk. Moreover, the flavor quality of some varieties of cheese made from heat-treated milk is considered by experienced judges to be superior to pasteurized milk counterparts. Such varieties include Cheddar, Swiss, and hard Italian-type varieties.

What's Inside:

Current regulations require that heat-treated cheeses be cured for 60 days before marketing, the same as for raw milk cheeses. Also, some cheese varieties must be made from pasteurized milk, including cottage, Jack, and mozzarella.

Still, the heat-treatment of raw milk can exert a significant role in producing microbiologically safe cheese. Recent, thorough research has affirmed that heat-treatment at 65.0-65.6˚C (149-150˚F) for 16-18 seconds will destroy virtually all naturally occurring pathogenic microorganisms in raw milk which are major threats to cheese safety.

An extensive review of epidemiological literature identified only six illness outbreaks transmitted via U.S.-produced cheese during 40 years, 1948-1988. The most frequent causative factor in U.S. and Canadian cheese-related outbreaks was post-pasteurization contamination. Inadequate time-temperature combinations used for milk treatment were not implicated.

Effect of heat-treatment on pathogen destruction

Literature defining the effect of milk heat-treatment on pathogen survival with commercial processing equipment has been scarce until very recently. The first systematic studies of pathogen survival during heat-treatment were conducted by Zottola et al. (26) with *Staphylococcus aureus*. The results demonstrated that heat-treatment effectively killed *S. aureus* in milk. No other reports on *Staphylococcus* trials were found.

*The Code of Federal Regulations (37) — 21CFR33.3(d) defines pasteurization as temperature-time conditions of at least 62.8˚C (145˚F) for 30 minutes (vat or holder method), 71.7˚C (161˚F) for 15 seconds (continuous or flash method), "or other time/temperature relationship which has been demonstrated to be equivalent thereto in microbial destruction."

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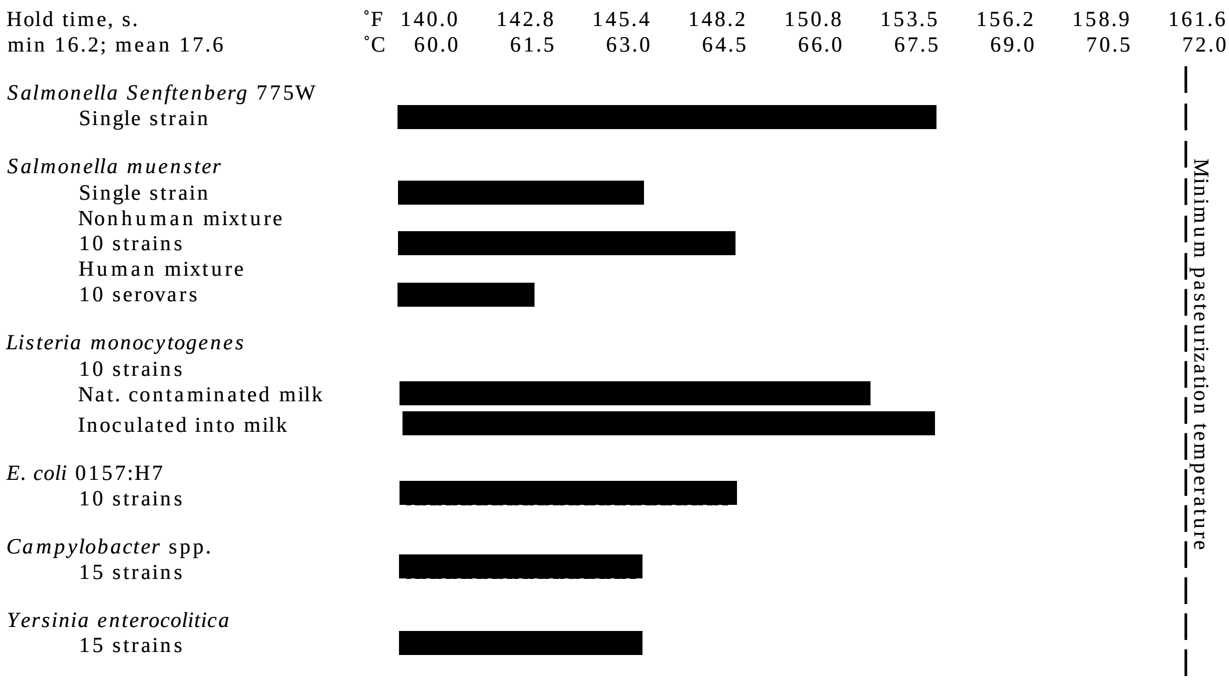
Table 1. Thermal inactivation temperatures in milk for various pathogens.



Adapted from D'Aoust et al. (6, 7) and Farber et al. (10)

D'Aoust et al. (6, 7) and Farber et al. (10) have published the results of their research on the thermal inactivation of several pathogens in milk. *Salmonella* species and strains of *Listeria monocytogenes*, and a group comprised of *Escherichia coli 0157:H7*, *Yersinia*, and *Campylobacter* were evaluated in three separate studies. Table 1 summarizes their data. The bars denote the detection of pathogens, each bar ending at the temperature at which no organisms survived the treatment.

Table 2 displays data for heat inactivation of several pathogens in milk, adapted from Kaplan et al. (14). The holding time, in seconds, required for complete inactivation is listed by temperature. Where a narrow range of times was reported, the higher value is listed. The treatment for *E. coli* 65˚C (149˚F) for 18 seconds is comparable to the 64.5˚C (148.2˚F) for 16.2 seconds reported by D'Aoust et al. (7). Heat-treatment requirements in Table 2 for *Salmonella* species tend to exceed those reported by D'Aoust et al (6). Data in Table 2 on other pathogens indicate that holding times of 16-18 seconds, commonly practiced commercially, require temperatures of 70˚C (158˚F) for *S. aureus*, somewhat lower for *Streptococcus pyogenes* (Group A) and *Mycobacterium tuberculosis*, 72˚C (158˚F) for *Brucella* species, and less than 65˚C (149˚F) for *Corynebacterium diphtheriae*.

More than a dozen other studies, including Doyle (8), Bunning et al. (3), Bradshaw et al. (2), Moats et al. (17), Morgan et al. (18), Dabbah et al. (5), Read at al. (23), Francis et al. (11), Gill et al. (13), Palumbo et al. (20), Obiger (19), Perez et al. (21), Sullivan et al. (25), and Enright et al. (9), have addressed the effect of heat-treatment on the survival of various pathogens in milk.

Overall, a review of the literature yielded definitive data on the inactivation, by controlled heat-treatment, of most of the pathogens known to frequent raw milk (Tables 1, 2). Most of the studies were done by inoculating milk with cultured pathogens at levels of 10^4-10^5 organisms per ml. Such high populations of pathogens are unlikely to be present in commingled raw milk

Table 2. Thermal susceptibilies of some pathogens in milk. Data refers to a total kill of pathogens in a suspension. The concentration of the suspensions used was not given in the source literature.

Organism	Time in seconds to kill at a temperature of:								
˚F	140.0	143.6	149.0	155.5	158.0	161.4	167.0	172.4	176.0
˚C	60.0	62.0	65.0	68.0	70.0	72.0	75.0	78.0	80.0
Salmonella anatum	-	85	43	18	9	6	5	-	2
S. typhimurium	135-198	90	40	14	8	6	4	-	2
S. enteritidis	-	140	70	26	13	8	5	-	2
S. dublin	-	140	65	25	13	7	3	2	-
S. senftenberg 775W					~20				
S. typhosa	82	42	19	7	5	3	-	2	-
Escherichia coli	125	48	18	-	-	7	4	3	2
Staphylococcus aureus	1,080-1,330	690	63	-	15	11	7	5	4
Streptococcus pyogenes (grp A)	180-192	135-144	65-70	-	8-10	7	5	3	2
Brucella melitensis	210	100	32	-	22	20	12	-	4
Brucella abortus	175	55-105	20-43	-	15-25	12-18	9	-	3
Brucella suis	225	120	56	-	25	17	9	6	4
Mycobacterium tuberculosis bovis	-	105-150	17-40	-	10-11	-	-	5	3
Corynebacterium diphtheriae	31	21	1-	-	3	2	2	-	2

Adapted from Kaplan et al. (14)

produced via contemporary dairy herd management practices.

A significant concern in the thermal inactivation of pathogens is potential survival of injured cells (1, 4, 17, 22, 24). Heat-injured cells are not metabolically active and cannot be detected on selective agar, but after repair may survive and grow in cheese. Garayzabal et al. (12) reported that *L. monocytogenes* in raw milk could not be recovered immediately after heating at temperatures from 60 to 73˚C, but grew after extended incubation. Smith and Archer (24) found that heat-injured *L. monocytogenes* was not recovered on differential plating media. Zottola et al. (26) were unable to recover *S. aureus* immediately after milk heat-treatment at 63.9-65.6˚C for 16-21 seconds, but later isolated viable staphylococci from cheese. Survival could reflect resuscitation of injured cells or post-heat-treatment contamination.

A second concern is the ability of certain pathogens, including *Salmonella*, to change their heat resistance when preheated or cultured at temperatures which exceed those for optimum growth but are sub-lethal (1, 15, 16). The change probably results from the expression of heat-shock proteins (1). These proteins may help protect cells against thermal destruction.

Effect of heat-treatment on cheesemaking

Heat-treatment or pasteurization will not adversely affect the cheesemaking process or the resulting physical properties of the cheese. Both types of heat-treatments are beneficial in correcting chemical changes that occur in raw milk due to cold storage. Thermization on the farm may have some benefit by controlling the number of psychrotrophic bacteria in cold stored milk.

However, some denaturation of whey protein does occur during pasteurization. Heat treatments slightly above current minimum pasteurization requirements can cause body/texture and moisture problems in cheese. Whey proteins can also lose functionality, which may affect their marketability.

Cheeses made from pasteurized milk ripen more slowly and probably not to the same flavor intensity as cheeses from raw milk. This has major adverse implications for the manufacture of processed cheese, which requires cheese with accelerated body breakdown and intense, sharp flavors. Swiss and hard Italian-type cheese, whose traditional flavor is strongly related to the activity of native milk enzymes and microflora, would also be adversely affected if pasteurized milk for cheesemaking were mandatory.

Conclusion

For decades, heat-treatment has been more an art than a science. Effectiveness is primarily measured by consistent cheese flavor quality and intensity, and means of control over the cheesemaking process. The recent research of D'Aoust et al. (6, 7) and Farber et al. (10) demonstrates that controlled heat-treatment at time-temperature combinations considerably less than required for legal pasteurization is highly effective against some pathogens. Heat-treatment at 66-67.5˚C (150.8-153.5˚F) kills *L. monocytogenes, E. coli 0157:H7, Campylobacter* spp., and *Yersinia enterocolitica* (Table 1). These organisms have been considered a significant risk to cheese safety.

Heat-treatment can also play a significant role in killing non-pathogenic organisms. Commercial scale raw milk heat-treatment at 64.6-65˚C (148-149˚F) for 15.5 seconds before concentration via evaporation resulted in a 1.71 log reduction of aerobic plate count and the virtual elimination of coliform organisms.

Defined, controlled heat-treatment of milk for cheesemaking can and should be an optional technology suitable for cheese safety systems. Controlled heat-treatment is readily feasible with equipment used for pasteurization. Definitions of its effectiveness, which could be based on lethality to pathogens or included as part of a multi-factor safety system, should be developed. Obviously, heat-treatment is not a total replacement for pasteurization, although it is highly effective against several pathogens. Pasteurization will continue to be an important process in the arsenal of cheese safety technologies.

Although no single technology can assure safe cheese, some have well defined safety roles or functions. These include mastitis prevention, pasteurization, lactic culture management, acidity/pH control, and salt addition. A variety of other technologies almost certainly can, or do, promote product safety, but effectiveness is ill-defined. These include heat-treatment, time-temperature profile of cheesemaking, curd heating, and curing conditions. These familiar options and practices deserve investigation which might readily enable improvements of current cheese safety systems.

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The Curd Clinic

Question: I've heard that I will get a more consistent percentage of fat on a dry basis (FDB) and a higher cheese yield if I standardize my cheese-milk according to its casein/fat ratio instead of its percent of fat. Is this true?

Answer: Yes, you can substantially increase your cheese yield by standardizing to casein/fat ratio. In addition, your cheese will have a more consistent composition than cheese made from milk standardized to percent fat only.

Seasonal variations in milk composition include a drop in both fat and protein during the summer. However, because the changes in protein content and fat content occur at different rates, the ratio of casein/fat in milk changes throughout the year. During the summer, the percent protein in milk is relatively low compared to the percent fat, and cheese yields fall. In the winter, the milk is relatively higher in protein, and cheese yields increase. If the plant is standardizing to a constant percent fat in the cheese-milk, the FDB will also vary seasonally. Variations in FDB will result in cheeses with differences in textural properties and moisture content.

To correct for these seasonal differences, protein and fat contents must both be considered when standardizing. Standardizing to a constant casein/fat ratio will produce cheese with a constant FDB year-round, thus taking advantage of all the casein available during the winter when protein content is high and maintaining a maximum yield during the summer when protein content is relatively low.

The economic impact of standardizing milk to obtain a constant FDB in the cheese has been

Table 1. Yield comparison of constant percent fat standardization vs. constant FDB standardization.

	Mozzarella - 51% moisture Standardize to 2.0% fat		Mozzarella - 51% moisture Standardize to 37% FDB		
Month	**Yield**	**Percent FDB**	**Yield**	**Percent FDB**	**Extra lbs cheese/cwt**
Jan	9.84	35.27	10.11	37.00	0.27
Feb	9.72	35.71	9.92	37.00	0.20
March	9.69	35.81	9.87	37.00	0.18
April	9.64	35.97	9.80	37.00	0.16
May	9.53	36.41	9.62	37.00	0.09
June	9.49	36.56	9.56	37.00	0.07
July	9.37	37.00	9.37	37.00	.00
Aug	9.47	36.65	9.52	37.00	0.05
Sept	9.69	35.77	9.88	37.00	0.19
Oct	9.90	35.05	10.21	37.00	0.31
Nov	9.91	34.95	10.23	37.00	0.32
Dec	9.92	35.00	10.23	37.00	0.31
Average	**9.68**	**35.85**	**9.86**	**37.00**	**0.18**

Adapted from Barbano (1)

illustrated by Dr. David Barbano of Cornell University. The extra cheese yield per hundred weight of milk that a mozzarella plant would produce by standardizing to a standard proper casein/fat ratio instead of a constant fat percentage is shown in Table 1, adapted from Barbano (1). According to Barbano, a mozzarella plant that processes 500,000 pounds of milk of average composition per day, 20 days per month, would increase its gross revenue by $154,000 per year (Table 2). This assumes a cheese price of $1.30 per pound and a whey cream value of $1.70 per pound. In this example, the cream price would have to rise above $2.40 per pound before selling the fat as cream would be more profitable than selling it as cheese. Currently, with the price of fat dropping and the price of cheese rising, standardizing to constant FDB is even more important than it was at the time this example was calculated.

Table 2. Gross revenue comparison of milk standardization to a constant fat vs. standardization to a constant cheese FDB.

	Total value of cheese plus cream in dollars per cwt milk		Difference in dollars returned to the plant	
Month	**Standardize to 2% milkfat**	**Standardize to 37% FDB**	**Dollars per cwt milk**	**Dollars per day**
Jan	$15.99	$16.19	+.20	$1,000
Feb	$15.60	$15.75	+.15	$750
March	$15.47	$15.60	+.13	$650
April	$15.17	$15.29	+.12	$600
May	$14.97	$15.03	+.06	$300
June	$14.82	$14.87	+.05	$250
July	$14.65	$14.65	.00	$0
Aug	$14.75	$14.79	+.04	$200
Sept	$15.32	$15.45	+.13	$650
Oct	$15.71	$15.93	+.22	$1,100
Nov	$15.86	$16.08	+.22	$1,100
Dec	$15.86	$16.08	+.22	$1,100

Based on average U.S. milk composition in 1984, cheese price of $1.30/lb, cream price of $$1.70/lb, and a plant processing 500,000 lbs of milk per day, 20 days per month. Gross increase in annual revenue equals $154,000.

Adapted from Barbano (1)

Unfortunately, standardizing to a constant cheese FDB is mathematically more complicated than standardizing to a constant fat percent in cheese-milk. After the target FDB of the cheese has been determined, the milk composition needed to attain that FDB can be calculated manually using procedures described by Johnson (2). Alternatively, computer software is available that will do the calculation for you. A program developed by Dr. Mark Johnson and former UW graduate student Gary Kerrigan allows the cheesemaker to evaluate different methods of standardizing milk. The cheesemaker supplies the necessary information regarding milk composition, product values, and the costs and compositions of cream, condensed skim milk, skim milk, or nonfat dry milk to be used in standardization. The program then calculates both the amounts of standardization materials needed to reach the desired milk composition and the economic impact of the standardization. For more information on this standardization software, contact Mark Johnson at (608) 262-0275.

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Economics

Multiple component pricing fits bill for dairy industry

by Robert Cropp, Ph.D.

Since the introduction of the Babcock fat test over a century ago, milkfat has been the predominant variable in our milk pricing system. But with the continuing trends toward lowfat and manufactured dairy products fueling fundamental changes in the marketplace, multiple component pricing (MCP) will become increasingly important in future milk pricing.

MCP systems price milk on the basis of two or more milk components, such as skim milk, milkfat, total solids, solids-non-fat, protein, lactose, and a fluid carrier (water). Milkfat, protein, and solids-non-fat are the components most often separately priced. Quality factors are also frequently included. This style of milk pricing is now slowly replacing the longstanding practice of adjusting prices only for the butterfat content of the milk. USDA dairy market statistics indicate that today as much as 80 percent of the U.S. milk supply is marketed to buyers who offer some form of MCP.

The first formal MCP plan to be included in a Federal Milk Marketing Order (FMMO) was under the Great Basin Federal Milk Marketing Order in 1988 (FMMOs are the USDA regulatory agencies that set minimum prices paid for Grade A milk by plants within the same consumer marketing areas). This was of great importance to the development of MCP, which is now being considered in other FMMOs. To address the growing surplus milkfat problem, the 1990 Farm Bill instructs the USDA to invite multiple component pricing proposals in all FMMO areas. Depending on local interests, hearings will probably begin this year or next.

The fat, solids-non-fat, and protein components of milk are particularly significant to market value if the milk is to be used for manufacturing, i.e. cheese, butter, ice cream, or milk powder. The approximate increased yield of these products with the addition of one extra pound of protein in 100 pounds of milk is 1.7 pounds for cheese, 1 pound for nonfat dry milk, 1 pound for ice cream, or 6 pounds of creamed cottage cheese. As a result, manufacturing milk plants, particularly cheese plants, are adopting MCP plans. Some cheese operators claim it is difficult for them to operate under a pricing system designed for a fluid (beverage) market.

Fluid milk plants, on the other hand, have been reluctant to adopt MCP because higher protein content does not increase the yield of milk for fluid purposes. Fluid milk plant operators argue they get no higher return to cover the costs of higher solids-non-fat.

Interest in MCP continues to grow as an increasing share of the milk is used for manufactured dairy products, particularly cheese. In 1960, 43.1 percent of the milk marketed nationally was used for fluid milk and cream, 24.9 percent for butter and associated skim milk products, and only 10.9 percent for cheese. By 1990, fluid utilization had dropped to 37.6 percent, butter had fallen to 15.8 percent, while cheese accounted for 30.1 percent of the milk. Cheese production will consume an even larger share of the milk supply during the next decade.

Another consumption trend has been from whole milk to lowfat and skim milk. As a result, the value of milkfat relative to skim milk has declined. In 1960, the average producer blend price (weighted average price) for all FMMO milk was $4.47 per hundredweight. Milkfat accounted for 55 percent of this value and skim milk 45 percent. The average producer blend price for all orders in 1989 was $13.30 per hundredweight, with milkfat accounting for just 41 percent and skim milk accounting for 59 percent. These higher proportionate values for skim milk make a strong case for testing and pricing skim milk components.

In summary, MCP plans will increasingly be used not only by manufacturing plants, but in additional FMMOs, especially those utilizing a relatively large share of their milk for manufacturing. MCP is a more equitable means of milk pricing for both the dairy producers and the milk plants.

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Plant evaluation tips from the WDATCP professionals

by ***Tom Leitzke****, Director, Bureau of Food Safety and Inspection and* ***Everett Johnson****, Technical Specialist (Food Division of the Wisconsin Department of Agriculture, Trade and Consumer Protection)*

The Food Division of the Wisconsin Department of Agriculture, Trade and Consumer Protection is responsible for licensing and inspecting the 386 dairy plant currently operating in Wisconsin. During our physical sanitary inspections, we usually find numerous aspects of equipment design and maintenance that are in need of improvement. As these deficiencies are potential sources of bacteria that can contaminate dairy products, we encourage plant operators to evaluate their facilities and take corrective actions.

Safeguard your products against contamination — inspect your plant with an eye for what our inspectors are likely to find. Items commonly noted during our inspections include:

- Condensation from equipment frames, walls, and ceilings dripping into dairy products or onto processing equipment. This can cause contamination of the food product.
- Ineffective disinfection of food processing equipment, i.e. lack of sanitizing facilities for manually cleaned processing equipment.
- Improper trapping and irregular cleaning of floor drains, creating a source of odors and possible bacterial contamination.
- Poorly designed food processing equipment frames resulting in areas that are difficult to clean and maintain in a sanitary condition.
- Equipment with unsealed tubular frameworks, which can accumulate moisture and cause foul odors.
- Excessive accumulations of fat and cheese solids in brine systems. This is due to improper maintenance.
- Deteriorating wooden 640 cheese forms. These are unsanitary and uncleanable.
- Use of corroded metal cheese barrels, which are uncleanable.
- Broken protective jackets on fiberglass pipe insulation in areas with open food product. Raw, exposed edges of the insulation can be a source of contamination.

Violations such as those listed above have a distinct potential for product adulteration. For more information on sources of contamination or common plant deficiencies, contact Everett Johnson at (608) 266-7248.

UW dairy research projects: Cheese technology

Numerous dairy-related research projects are underway at UW-Madison. The following are only those concerning cheese technology.

1. Construction of a gene bank of *Lactobacillus helveticus* CNRZ 32: Cloning and characterization of the aminopeptidase and threonine aldolase genes. Dr. James Steele, Dept. of Food Science.

2. Development of the process technology and flavor enhancement of reduced-fat cheese. Dr. Mark Johnson, CDR and Dr. Robert Lindsay, Dept. of Food Science.

3. Physical and thermal properties of different cheeses. Dr. Sundaram Gunasekaran, Depts. of Agricultural Engineering /Food Science.

4. Effect of post-processing on cell viability, cell permeability, and enzyme activity of *L. helveticus* cheese starter culture. Dr. Mark Etzel, Dept. of Food Science.

5. Development of a systemic approach for producing cheese as a food ingredient. Dr. Norm Olson, CDR/Dept. of Food Science.

6. Control of color formation in smoked cheese. Dr. William Wendorff, Dept. of Food Science.

7. Effect of fat, moisture, and salt on the freezing qualities of Cheddar cheese. Dr. William Wendorff, Dept. of Food Science.

8. Heat-resistance of pediococci and lactobacilli isolated from raw milk and Cheddar cheese. Dr. Mark Johnson, CDR.

9. Acceleration of cheese ripening through the use of selected protease-peptidase preparations, freeze-shocked lactobacilli and microencapsulated enzymes and microorganisms. Dr. Norman Olson, CDR and Dr. Morsi El-Soda, visiting scientist, CDR.

10. Improving the flavor of enzyme-modified cheeses by control of lipase action in supercritical CO_2. Dr. Richard Hartel, Dept. of Food Science.

11. Effects of concentration of cations, especially calcium, on the primary and secondary phases of enzymatic milk clotting. Dr. Richard Hartel, Dept. of Food Science.

12. Mechanisms of injury to *Lactococcus lactis* spp. lactis during spray drying. Dr. Mark Etzel, Dept. of Food Science.

13. Effect of starter culture produced glutathione on cheese flavor development. Dr. James Steele, Dept. of Food Science.

14. Genetically-modified bacteriocinogenic lactic starter cultures and associated bacteriocins for control of pathogenic bacteria in unpasteurized high-moisture cheese products. Dr. John Luchansky, Food Research Institute.

15. Examination of thermoinducible bacteriophages from temperature-sensitive strains of *Lactococcus lactis* spp. cremoris. Dr. James Steele, Dept. of Food Science.

This and That...

John Jaeggi, a cheese technologist with 14 years of commercial cheesemaking experience, joined the CDR staff June 10. An assistant researcher at CDR, Jaeggi will participate in a variety of research projects and conduct many of the Center's pilot-plant cheesemaking trials. Prior to joining the Center, he worked at the Chalet Cheese Coop in Monroe, WI. He also operated the Jefferson Center Coop in Twin Grove, WI, from 1984 to 1988.

###

Dr. Morsi El-Soda of Alexandria University in Egypt arrived for his fifth annual visit to CDR on July 1. During his two-month stay, Dr. El-Soda continued work on a joint project with CDR Director **Norm Olson** to develop new cheese ripening systems for Cheddar, Romano, and Egyptian Ras cheeses. The two researchers plan to use enzymes isolated from cheese-ripening bacteria to enhance flavor development and speed ripening.

###

Dr. Kamal Kamaly, a member of the Food Science faculty at the University of Monofia in Egypt, is collaborating with CDR Senior Scientist **Mark Johnson** on a project to determine the lytic characteristics in bacteria associated with cheese ripening. When bacteria in the cheese lyse, or burst, they release enzymes that help the cheese develop proper flavor and texture. Johnson and Kamaly hope to speed up the ripening process by finding ways to increase the frequency of bacterial lysis. Dr. Kamaly, who earned his Ph.D. with Dr. Elmer Marth at UW-Madison in 1988, began work on the project in April. He will continue working at CDR until March of 1992.

###

Paul McSweeney, a doctoral candidate from Ireland, began a year-long appointment as a CDR research intern in August. A student of Dr. **Pat Fox** at University College, Cork, Ireland, McSweeney will work with Drs. **Norm Olson** and **Mark Johnson** at CDR on a study of specific proteolytic activity of rennet on casein.

###

Dr. Pieter Walstra of Wageningen Agricultural University in The Netherlands taught a two-week-long Food Science course, “Physical Chemistry of Milk and Dairy Products,” at UW during late July and early August. CDR videotaped the course, and will soon add it to the CDR Videotape Library of educational and training tapes. Dr. Walstra, who also participated in the CDR Visiting Scientist Mentor Program during his visit, is head of the Department of Dairying at Wageningen, and has worked as a visiting professor at the University of

Minnesota. During his stay, he also gave seminars at Dean Foods in Rockford, Ill., and Schreiber Foods Inc. in Green Bay, Wis.

###

Dr. Albrecht Grasshoff of the Institute for Process Engineering in Germany arrived at UW in September to begin work evaluating cleaning methods for milking systems. Dr. Grasshoff, whose visit is funded in part by CDR's Scientist Exchange Program, will join Assistant Professor of Agricultural Engineering **Doug Reinemann** on a project to develop standardized non-microbiological procedures for cleanability assessment of clean-in-place milking systems. His visit will last until June, 1992. During their study, the two scientists will utilize facilities at the new UW Milking Research and Instruction Laboratory to simulate a wide variety of on-farm milking situations.

###

Promega, a Madison biotechnology company, is marketing two new, rapid tests designed to detect microorganisms in milk and milk products. According to the company, the **Enliten** Milk Total Viable Organisms Assay (TVO) and the Enliten Milk Direct Microscopic Count Assay (DMC) are faster and more accurate than conventional procedures. Promega is marketing the TVO assay as a two-hour test that replaces the two-day standard plate count. TVO also detects cold-growing bacteria that are often missed by a standard plate count. DMC is a 10-minute screening assay for bacteria in raw milk that Promega says is more accurate than current microscopic examination procedures. The company's 10-minute videotape describing the TVO assay is available to interested dairies. For more information contact Promega at 1-800-356-9526.

###

A new book on *Listeria monocytogenes* by UW Emeritus Professor **Elmer Marth** and **Elliot Ryser**, Ph.D. is now available. Published by Marcel Dekker Inc., 270 Madison Ave., New York, NY 10016, the book is intended for food processors, food scientists, sanitarians, health professionals, and college coursework. Topics such as *Listeria* classification, behavior, incidence in food and food processing facilities, and detection methods are covered in 15 chapters. Two appendices include hundreds of bibliographic references and the formulae of numerous culture media used to isolate and cultivate the pathogen. The book is priced at $165 in the United States and Canada, and $189.75 in all other countries.

###

Dairy Resource Center

These informational video tapes are available for loan or purchase from the listed sources.

Babcock Fat Test and ***Mojonnier Fat Test***
Contact: Dave Stukenberg
Federal Milk Market Admin. Lab
P.O. Box 1485
Maryland Heights, MO 63043

Safe Milk Hauling: You're the Key
Contact: Donna L. Scott
Dept. of Food Science
8 Stocking Hall
Cornell University
Ithaca, NY 14853

Manufacturing Fontina-type Cheese
Contact: Wayne Geilman
CalPoly State University
San Luis Obispo, CA 93407

The Bulk Milk Hauler: Protocol & Procedures
Contact: Iowa State University
Media Resources Center
121 Pearson Hall
Ames, IA 50011

HACCP — The Total Quality System
Contact: National Cheese Institute
888 Sixteenth St. NW
Washington, DC 20006
(202) 296-4250

The Art of Cheesemaking
Contact: Wisconsin Milk Marketing Board
8418 Excelsior Dr.
Madison, WI 53717
(608) 836-8820

Calendar of Events

Sept. 23-27 ***Wisconsin Cheese Technology Short Course***, The Inn Towner Hotel, Madison, WI. Call Bill Wendorff at (608) 263-2015.

Nov. 7 ***CDR Lowfat Cheddar Seminar,*** The InnTowner Hotel, Madison, WI. To register call the CALS Conference Office at (608) 263-1672. For program information call (608) 262-2217.

Oct. 21-23 ***Whey Protein Workshop: Chemistry, Manufacture, Functionality, Utilization,*** Holiday Inn-East Towne. Co-sponsored by CDR and the American Dairy Products Institute. To register call the CALS Conference Office at (608) 263-1672. For program information call Sarah Quinones at (608) 262-2217.

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Jan. 6-10, 1992
Ice Cream Maker's Short Course. Call Bob Bradley at (608) 263-2007 for information. To register call the CALS Conference Office at (608) 263-1672.

Jan. 13-16 **Milk Pasteurization and Process Control School.** Call Bob Bradley at (608) 263-2007 for information. To register call the CALS Conference Office at (608) 263-1672.

April 29-30 ***Dairy Products Technical Conference,*** O'Hare Marriott, Chicago, IL. Sponsored by CDR and the American Dairy Products Institute.

The *UW Dairy Pipeline* is published by the Center for Dairy Research and the University of Wisconsin Extension to update the Wisconsin dairy manufacturing industry on recent developments in applied technology. Funding is provided by the Wisconsin Milk Marketing Board.

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