July, 1981
Vol. 1, No. 7
Pages 269-316
ISSN:0273-2866
Box 701
Ames, Iowa 50010

Dairy and Food Sanitation

A Publication for Sanitarians and Fieldmen

- A Quality Control Program for the Food Industry
- Enumeration, Identification of Cultured Product Organisms
- Cleaning of CIP Systems
- Public Enemy Number One
- Causes of Rancid Flavor in Retail Milk Samples

A Publication of the International Association of Milk, Food and Environmental Sanitarians, Inc.

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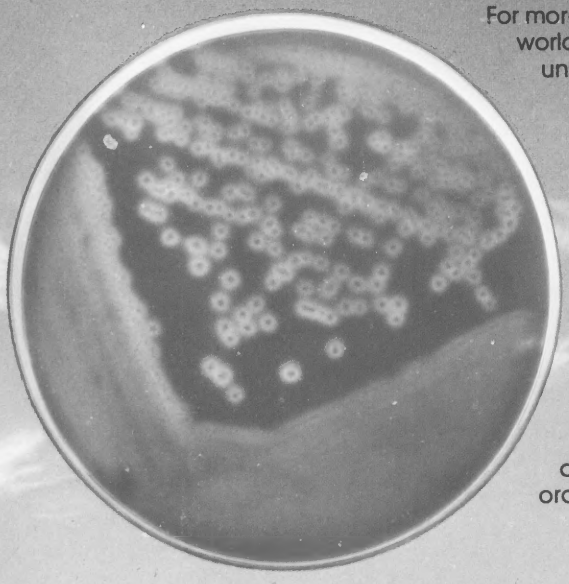

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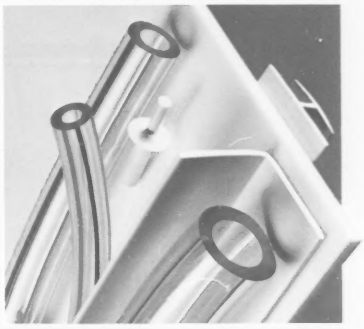

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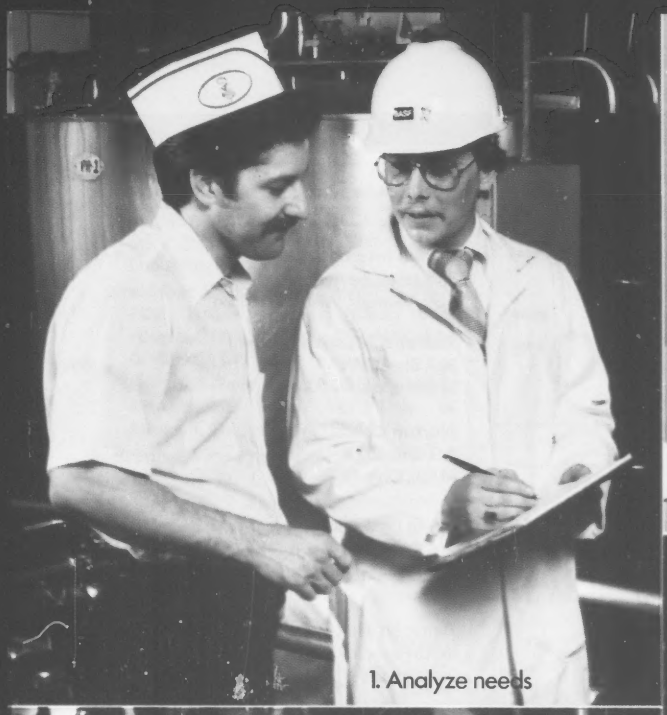
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Application to mail at second-class postage rates is pending at Ames, IA.

Dairy and Food Sanitation is issued monthly and published by the International Association of Milk, Food and Environmental Sanitarians, Inc, executive offices at 413 Kellogg, PO Box 701, Ames, IA 50010. Printed by Heuss Printing and Signs, Inc, 911 Second St, Ames, IA 50010.

Manuscripts: Correspondence regarding manuscripts and other reading material should be addressed to Jan Richards, PO Box 701, Ames, IA 50010, 515-232-6699. **"Instructions to Contributors"** can be obtained from the editor.

Orders for Reprints: All orders should be sent to IAMFES, Inc., PO Box 701, Ames, IA 50010. Note: Single copies of reprints are not available from this address; address reprint requests to principal author.

Business Matters: Correspondence regarding business matters should be addressed to Earl O. Wright, IAMFES, PO Box 701, Ames, IA 50010.

Subscription Rates: $50.00 per volume, one volume per year, January through December. Single copies $4.50 each.

Membership Dues: Membership in the Association is available to individuals only. Direct dues are $25.00 per year and include a subscription to either **Dairy and Food Sanitation** or the **Journal of Food Protection.** Direct dues and both journals are $40.00. Affiliate membership are $22.00 per year, plus state dues, and include a subscription, also. Affiliate dues and both journals are $37.00, plus state dues. Student membership is $7.50 per year, with verification of student status, and includes one journal.

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Dairy and Food Sanitation

July, 1981

A QUALITY CONTROL PROGRAM FOR THE FOOD INDUSTRY

"No one person can be entirely responsible for product quality. It can be said that the owner-manager of a company is responsible in that "the buck stops" there. Or, that the quality control supervisor is the person responsible because "that's his or her job." Well, is it? Isn't the foreman, for example, also responsible for quality?"

R. M. DARRAH

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Originally published in 1973 in the Journal of Food Protection, *this paper discusses the method used by Safeway's Dairy Division to arrive at a quality control program. It contains updated comments on the company's policy statement. The author's view on how specific segments of the program have worked after seven years of practice on aseptic sampling, environmental air control and current trends in quality control are offered.*

No modern, progressive food business can survive long without a vigorous quality program, supported with equal enthusiasm by top management and line supervision. All the claims dreamed up by an ad agency cannot convince the consumer that product X is high quality unless the product performs as promised.

No one person can be entirely responsible for product quality. It can be said that the owner-manager of a company is responsible in that "the buck stops" there. Or, that the quality control supervisor is the person responsible because "that's his or her job." Well, is it? Isn't the foreman also responsible for quality? He is, after all the person who translates a production order into finished products by directing the people on his shift to do specific jobs. And how about those people on the job, that individual or group who actually process the product? Aren't these people responsible for quality? The answer is YES.

Unless the person on the job is motivated to be quality-minded, to the point that he or she will not feel right letting anything go by that is below company standards, and unless his foreman makes him feel that only a top quality product will be tolerated, the quality battle is tough. A quality control supervisor on the floor helping to check line quality, taking samples, testing, and reporting results with thoughtful interpretation can go a long way toward improving quality. But if what he finds and reports is not understood by the employee, backed by the foreman, believed and backed by the manager, most of the quality control supervisor's effort is wasted.

The policy portion of the Safeway quality program will be discussed to provide an idea of its structure. Though established for dairy operations, the program is applicable to most food processing plants, also. A strong effort is made to involve directly both those people who are responsible for motivating others, as well as the people on the line who actually do the job.

A Policy Statement

The opening statement of the Safeway Milk Department Quality Program expresses the philosophy this way: Any quality program must begin with policies and attitudes fostered at the Division level, which are perpetuated and supported at the individual plant management level. These policies and attitudes *must* be passed on to the plant supervisory and quality control level-and firmly implanted in the performance of the personnel on the job. The following procedures are designed to be basic enough to be applicable to all plants, regardless of size, and to help plant management accomplish their goal, establishing "QUALITY AS AN ATTITUDE."

I. The Plant Manager will, by direction, example and actions, demonstrate that his plant shall be the leading plant in the Company in quality and housekeeping.
The Quality Control Supervisor will coordinate the efforts of the management team (Superintendent(s) and Supervisor(s) to accomplish this goal.

II. The prime emphasis of the program is two-fold: (1) to kindle in the cleanup and production people a pride in workmanship, in surroundings, and above all, in "Quality Products;" (2) to make each QC Supervisor an effective part of the plant management staff.
   a. The Quality Control Supervisor shall have the authority to shut down any or all operations when he has determined or strongly suspects that:
      1. a substandard product is being run
      2. an adulterated or contaminated product is being run
      3. any other conditions exist which in his opinion jeopardize the quality of a product from the customer or public health standpoint

      The Quality Control Supervisor must inform the Plant Manager and/or the Plant Superintendent, and if the problem cannot be resolved, it is the Plant Manager's decision for the disposition of the product. The Plant Manager will be at all times protecting the quality image of Safeway Stores and the interests of its customers.
   b. The Quality Control Supervisor should spend the time required on the plant floor investigating and observing.
   c. The Quality Control Supervisor should interview all new hires to indoctrinate the "Quality as an Attitude" position of Safeway and should be involved in the training of new cleanup personnel in proper techniques and must be informed when changes in the processing and/or CIP systems are being considered.

III. Superintendent and Supervisors will make specific housekeeping assignments for each employee. Each person will be responsible for the cleanliness and housekeeping in his or her assigned area. He will be held accountable for the appearance of that area at any time during his shift. This accountability will build pride, first in an area, and then in the plant.

IV. The Manager and/or Superintendent and all possible shift supervisors will examine the test reports and samples daily. The person directly responsible for a product (such as pasteurizer and cheese maker) should also examine the samples. Competitor samples, when available, should be reviewed at this time. Use the Black Light on a regular basis to check for surface growth on the cheese, sour cream and yogurt samples.

V. The Quality Control Supervisor will inspect the plant monthly in turns with the following persons: the Plant Manager, the Superintendent, the Supervisors and any of the trainees. It is expected that the aforementioned management persons will make at least one complete inspection each year. It is recommended that two or more of the above persons should make the inspection, working as a team; many more observations are possible this way. The above persons will make daily walk-through tours as part of their normal routine.

VI. Each plant will conduct weekly inspection tours in the manner they choose; observations may be recorded on their own inspection forms, the Company forms, or a note pad. Once per month the inspection will be recorded in detail on the long form furnished to the plant, and sent to Walnut Creek with a copy for the Quality Control Section Manager. Repeat items should always be marked with the number of repetitions so that the manager will be aware that follow-through action is required. Be sure to record any uncorrected repeat items on the monthly inspection before forwarding. Each supervisor will correct items with a score of four as time permits, and items with a score of three or below as soon as possible. Any item scored with a one will have corrective action assigned before the inspector leaves the area.

   The Plant Manager will follow through on inspections and see that corrective action is taken.

VII. Results of all quality control tests will be recorded on the appropriate control sheets in order to provide a permanent record of each product produced, from the raw material to the finished and shipped product. Deviations in quality should be highlighted by using a red pencil or pen to record and encircle poor or negative results. Swab counts, special counts, or anything you or your manager choose, may be recorded on these sheets to become a part of your lab record. It is suggested that a copy of these record sheets be posted daily and employees encouraged to watch the progress shown on these records.

VIII. The Shift Supervisor will see that all necessary and designated samples are collected for lab analysis. The operator closest to the operation will ultimately be assigned this duty, and the Shift Supervisor will ensure follow-through.

IX. The Plant Manager and the Quality Control Supervisor should inspect local plants supplying Lucerne labeled products at least once a year, preferably as a team.

X. Regular meetings between the Manager, Superintendent, Supervisors, Quality Control Supervisor and any other personnel at the discretion of the Manager are an important tool to open the lines of communication and to solidify quality progress.

The Need for a Successful Quality Program

What goes into a quality program that works? I would not presume to claim that this formula will work for every situation. It does work for Safeway. Here is how it developed.

First. A middle management conference established goals for a program. Several people at the Home Office with considerable plant background sat down to discuss what was desired in a quality program. The scope of the program was determined, as well as where it would begin, and where it would go. Note that it was not determined where the quality control program would end, because it never really ends.

Second. Middle management wrote a draft of the proposed program and submitted it to top management for conditional approval. With considerable help from Robert Winslow on the original program and D. R. Morgan on the 1980 rewrite of the program, as well as from other people in the department, a draft was written

and submitted to the Milk Department Manager and the Division Manager.

Third. The draft program was sent to the plant or plants as a tentative program with Management support. The draft program was given a trial period, during which questions were raised and answered, and it was learned if the program really worked. This testing period was approximately a year.

Fourth. After the trial period a line management-middle management conference was called to make additions, corrections and to give the involved people a chance to air their views. When the meeting was over, it was no longer a management program, it was the Quality Control Supervisors' program and enthusiasm ran high. The "line management people" asked to attend the meeting included the Quality Control Supervisor from each plant, or the person designated to handle those duties.

Fifth. The final draft was made, including changes from the fourth step, then it was submitted for final management approval, and it became company policy.

If you followed these steps, you've written yourself a quality program. But now what? Nothing---unless you put it into action. Follow-through, like any successful management procedure, is the answer to a working program. No matter what your product is, there comes the temptation, when something goes awry in processing and packaging, to let the problem slide by, saying to yourself, "99% of the people will never notice it," or some such excuse. This is where your management is on trial. This is where you must face up to the follow-through that makes a real quality program work. Take the little loss now. Make the point to your supervisors and employees that the quality of your product is truly that important to you and the company.

Selecting A Quality Control Supervisor

Selecting and training a person to cover a job like this varies with the size of the operation and the program's complexity. In small plants a supervisor should be chosen to operate the program. He will take the proper samples either for his own analysis, if a laboratory is available or for analysis by an outside laboratory. He will conduct housekeeping surveys, most likely on a continuous basis, and will do a portion of line supervision at the same time.

In fluid dairy product plants with production levels of 10,000 gallons per day and more, a fulltime Quality Control Supervisor with enough background in processing to supervise the line only in relief and emergency situations will more than pay his way in butterfat and volume control, and control of returns and lost sales through Quality Control Procedures. Even larger plants may employ a Quality Control Supervisor and one or more part or fulltime technicians. The QC Supervisor should be free to spend much time on the line observing processes and procedures, temperatures and times, handling techniques, weights and fills, taking samples and making inspections on a continuous effort to keep control on quality.

Keeping complete and accurate laboratory records, maintaining supply inventories, supervising assistants, cooperating and communicating with the rest of the supervisory staff, take up another large share of the QC Supervisor's time.

The last item, communicating with the rest of the supervisory staff, is perhaps the key to training a QC person. Some aptitude for laboratory work is a prerequisite for consideration of a job applicant. The aptitude is necessary, but the ability to communicate to supervisors what the Quality Control Supervisor needs to correct in the plant is indispensable. If, in selecting and training a qualified person, you can also impart to him the importance of getting ideas across in a manner that gets cooperation, his job is half done. Show your QC Supervisor where and how to look for problems which test results tell him are there. Be sure he knows what "clean" means when he looks at equipment, what temperature and time relationships are important and how they affect the finished product.

As for the tests he'll do, that will depend on the kind of program that is designed and its goals, as well as how extensively the laboratory is equipped. The following is a summary of the program used in Safeway plants. It is minimal by design and each plant is encouraged to add tests it feels will give information it needs or to increase frequencies of the tests, as it feels is necessary. The ten-point policy statement previously given constitutes Section I of the Minimum Quality Program. A greatly condensed version of Sections II and III is outlined below.

Critical Control Points

Tests on producers, raw tankers and finished products should be run at least as often as directed in the following outline or with additional frequency as requested by the Plant Manager, with the approval of the District Manager. The Quality Control Supervisor is directly responsible for administering this portion of the program.

I. *Incoming Ingredients*

Raw Tankers -- Run the following tests on all tankers. Record results of all tests in order to maintain a history of your supply and for the recall procedure. Sufficient samples from regular and outside suppliers must be taken and examined for excessive bacteria count, flavor and odor, to insure the quality of the milk supply.

A. Flavor and odor.
B. Acidity, if indicated.
C. Temperature.
D. Butterfat - where necessary for information for standardization or accounting, and where possible to obtain a usable sample.
E. Solids not fat - where possible to obtain a usable sample, often enough to be aware of the quality of the supply.
F. Bacteria - 1/1000 loop method on SPC agar. On loads which may be under suspicion because of acidity or organoleptic examination, run direct microscopic observation before acceptance.
G. Disk assay or other approved antibiotic method - should be done on *all* incoming tankers. This test should be performed before separation whenever possible.
H. Ropy milk screening - *all* outside supplier tanks should be screened for rope as routine, and your own producers once a month.
I. Make regular inspections, using black light if possible of the tankers that deliver raw milk. Record dates and condition of the tankers.

II. *Other Ingredients*

Avoid being caught with poor ingredients on hand by setting up a procedure to check all incoming shipments of new ingredients. Records of incoming ingredient inspections are necessary for recall records. On carefully taken samples of all outside ingredients, perform those following tests which logically apply:

A. Inspect for excessive shipping damage and evidence of rodent or insect infestation damage visually and with the aid of black light.
B. Flavor, odor, body texture (organoleptic), and color.
C. On all lots of milk powder received take careful samples as near aseptically as possible and run disk assay or other approved antibiotics (unless antibiotic-free guarantee is with powder) and scorched particle test.
D. Bacteria, Coli, DCT where applicable and practical.
E. Check incoming shipments of liquid sugar and storage tanks for cleanliness and proper replacement of U.V. lights and filters.
F. Obtain a set of color standards from your carton supplier and check incoming shipments of cartons for proper color.

III. *Daily Production* (Raw Side)

A. Flavor and odor.
B. Acidity.
C. Temperature.
D. Butterfat, solids not fat.
E. Bacteria counts, 1/1000 loop method in SPC agar.

IV. *Daily Production in Process*

A. Butterfats: run determinations for each standardization on every product or separate tank or vat of product.
B. Solids not fat: run on all products each time produced where any milk solids fortification is used or where necessary to assure that solids are in line with company or regulatory standards.
C. Test each batch of fruit drink for flavor, odor, brix content, as soon as mixed up. Recheck batch from finished carton.
D. Prepare and make necessary checks and tests on cultures for cultured products, or handle and control the use of frozen cultures. Set up and administer a culture rotation plant.
E. Check body, texture, flavor odor, on each mix of cottage cheese, vat of butter milk, sour cream, before packaging (this should be done by Q.C. Supervisor and/or shift foreman, or by the packaging (this should be done by Q.C. Supervisor and/or shift foreman, or by the packaging machine operator who then reports any problem to his or her supervisor or Q.C. Supervisor.)
F. Take daily samples from aseptic sample plugs on major products at main points in system (HTST pasteurized tanks, bottle machine, surface cooler where used). Additional line samples at other points should be taken for trouble shooting problems. (We suggest increasing line sample size to a minimum of 10 cc for trouble shooting problems.)

V. *Daily Production (Packaged Products)*

A. Operators must catch and save for lab *the very first sealed bottle or package off the machine and the first two bottles or packages of each fluid product offered for sale* off the machine at the beginning of *each* product or size changeover. The machine operator should pull another sample for his or her own examination at the same time and taste the contents to assure that the right product is getting in the correct carton. This goes for cottage cheese as well as fluid products.
B. Pull at random, approximately at the middle of run of *each tank of product*, two more consecutive bottles or cartons for further tests.

VI. *Procedure for Collected Packaged Product Samples*

A. Save all first off samples for plating.
B. Flavor Sample #1 immediately. Check temperature and run a butterfat as quickly as possible. Check homo efficiency per Lab Manual.
C. Incubate Sample #2 in original carton overnight at room temperature and flavor.
D. Samples 3 and 4 (2 or more units each). Incubate one (#3) overnight at room temperature and plate per instructions in Lab Manual. Incubate #4 unit(s) at 45°F until open date

and again until 7 days past pull date. Organoleptic examinations should be made at each of these points. Samples may be plated at open date if so desired for information (Mosely test). Plate orange juice from concentrate each day it is made on acidified potato dextrose agar.

VII. When more than 10% of products are not keeping until 7 days past pull date, all efforts should be directed toward pinpointing the problems involved.
   A. The records from all of the tests and examinations must be organized so that any particular product produced can be recalled knowing tests on each ingredient in that product, the date of receipt, trucking company involved, and the supplier of that ingredient.
   B. Stop shipment on all questionable products until tests can confirm their status. This includes stopping shipment of poorly coded, soiled, leaking, or warm products until corrections are made. Plant Manager's authorization is required before shipment of any questionable product.

Additional Duties

I. Check daily: carton quality, temperature, open dates, and weights, on all products being run. (Some of the above samples [Section II] may be pulled at the same time.) Standardize Milk-O-Tester daily (if plant is so equipped.)

II. Test chlorine and C.I.P. solution strengths daily on each batch prepared. Supervisor on job should take and test all needed samples of C.I.P. solutions and chlorine solutions sampled when laboratory is not staffed. Check daily temperature of steaming, or strength of chemical sterilizing solutions at end of line.

III. Inspect as much cleaned equipment as possible once per week, and more often if lab results indicate specific problems. It is suggested that swabs be taken weekly *or* as the need is indicated by Lab results (direct method recommended). Report results to manager and include in Product Quality Summary as soon as results are available. Each process vat and product storage tank should be inspected once per week. Close cooperation between Plant Superintendent, Supervisors assigned to cleanup and Q.C. Supervisor will be necessary to achieve efficiency in inspections. Use the black light (long wave) for and during examination of processing and storage equipment.

IV. Check all plant indicating and recording thermometers against calibrated standard thermometer quarterly. Check cheese making and pasteurizing thermometers at least once a week. Keep log of dates.

V. Accompany (with or in place of plant manager or designated rep) all regulatory agency visitors.

VI. Ship Walnut Creek samples every two weeks on schedule suggested by Walnut Creek lab.

VII. Buy competitor samples and prepare blind sample judging panel for these products and send report complete with panel results to Walnut Creek as soon as completed. Cover *all products* semi-annually.

VIII. Prepare and submit 4-week closing laboratory report. See Additional Duties Section of Lab Manual for outline to follow (uniformity in these reports will allow compilation into informative newsletter for all Quality Control Supervisors).

IX. Check environmental air supply quality on a regular basis by exposing SPC and acidified yeast and mold plates for no less than 15 minutes in key locations. Take action to control yeast and mold in air supplies where viable air counts indicate such control is needed. Compressed air supplies should be checked periodically.

X. Check counter balance weights for each size product at least once per month where bottle and shot types are used or quarterly where solid types are used (because of possible damage or moisture absorption) and each time carton board is introduced. Scales should be checked monthly by a qualified scale service organization or a qualified technician from your plant; this check should include making sure the scale is level.

Trends in Quality Control

A few words are needed about what appears to be trends in quality control in the food business. First of all, consumers are better informed and more critical than ever before and more vocal in those criticisms than ever before. Competition between food producers has practically closed the quality gap, leaving carefully considered rigid control of products as the only answer to the situation.

Automation has arrived in the quality field as it has in the rest of the food business. Automated fat and solids testing equipment, microwave moisture balances, automated bacterial colony counters, solid state electronics in everything-from pH meters to scales, improved and less expensive microscopes, and a host of disposable equipment-these are all indicative of the positive movement of Quality Control into the '80's.

A Final Word

All the consumer pressure, the automation, the move toward clean room techniques, increased regulatory action, spells more action in the Quality Control field, and an increased need for dedicated and capable people. We see a trend toward more audiovisual training aids as an adjunct to all that's previously been mentioned. Training will be aimed at all levels of plant activity from clean-up crews to plant managers. Training toward a Quality Attitude is a never-ending process.

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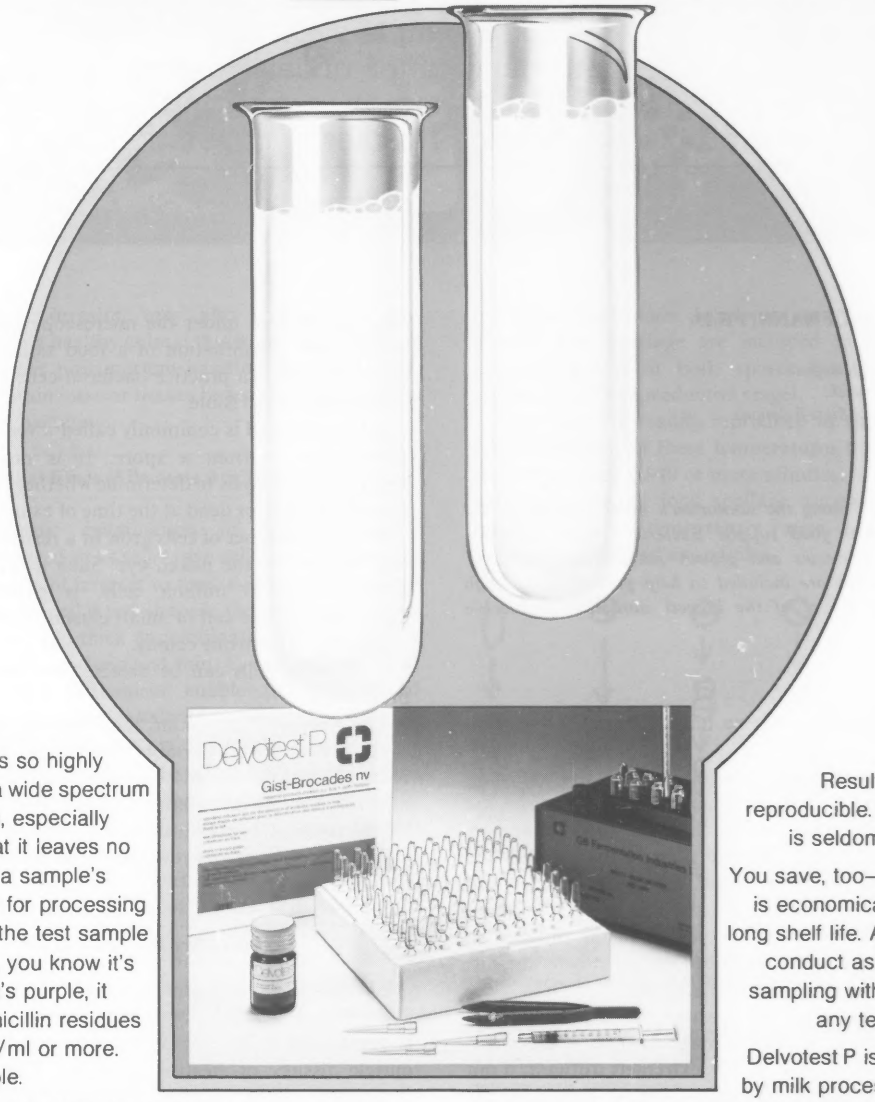

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Public Enemy Number One

"Analyzing a bacterium is not a simple task. An overview of bacteria should help practicing sanitarians better understand bacterial behavior. This becomes very basic information in combating one of the most basic sanitation problems, control of bacterial populations in food.

OLIVER W. KAUFMANN, PH.D.

Supervisory Microbiologist,
State Training Branch,
Division of Federal-State Relations
EDRO, FDA

Bacteria are among the sanitarian's worst enemies in the fight for a clean food supply. Bacteria - types, habitats, reproduction processes and growth patterns-are discussed. Charts and tables are included to help provide a thorough understanding of one of the biggest sanitation problems--bacteria.

Bacteria. So small, but so mighty. What is bacteria, exactly?

It is a mass of living protoplasm with the following characteristics: • It is microscopic -- sixty *Escherichia coli* cells can be placed along the diameter of a human hair. • It has a rigid cell wall giving it its shape. • It reproduces by transverse fission. In other words, one cell splits into two cells along the shortest axis. • It has a nuclear constitution which is passed to the progeny so that all cells in a bacterial culture are genetically similar. • It has no chlorophyll as do plant cells.

A single bacterial cell cannot be seen unless a microscope power of 1000 × magnification is used. But even under the microscope it is extremely difficult, if not impossible, to isolate one cell. In most instances, the numbers of bacteria in food samples submitted for microbiological analysis are greater than 10 cells per microscope field, so viewing is not a problem.

This means that the trained microbiologist can determine with some degree of confidence the types of bacteria present. No identification of the organism, however, is possible by such microscopic examination.

It is important to note that bacterial cells or clusters of cells can be seen under the microscope and the Direct Microscopic Examination of a food sample is possible because of this. In practice bacterial cells are stained to make them more visible.

A bacterial cell is commonly called a vegetative cell to differentiate it from a spore. It is not possible in microscopic analysis to determine whether the cells in the sample are alive or dead at the time of examination.

If a large number of cells grow in a restricted area they may be seen by the naked eye. Such a mass, generally greater than 10 million cells, is called a colony. Theoretically, one cell or small cluster of cells increases in number to form one colony.

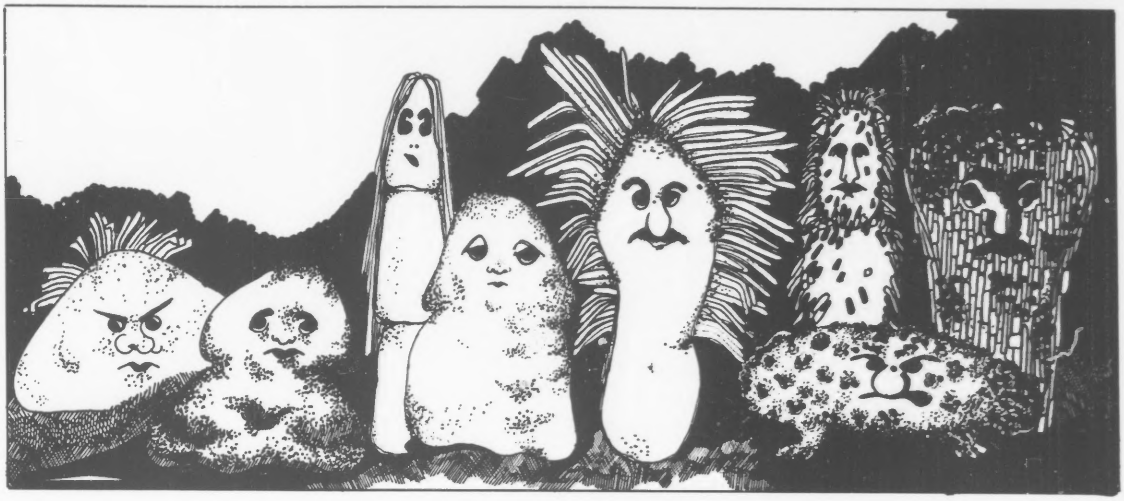
Only living cells can be detected by colony-counting procedures.

The Aerobic Plate Count, the *Clostridium perfringens* count and many other viable counts are, in fact, colony counts. Results obtained by a colony-counting procedure may not have direct relationship to the results obtained by microscopic examination. They are two completely different tests and one would expect two completely different results.

Where Are Bacteria Found?

Bacteria are found almost everywhere in the natural environment. The interior of sound fruits and vegetables is considered to be free of bacteria, as are the edible muscle tissues of healthy animals. This is of only theoretical value, however, because in the practical world, the handling a food product receives undoubtedly contaminates it.

Cutting cabbage with a knife, even a sterile knife, smears the external contamination throughout the cabbage interior where it was cut. The insertion of a thermometer into a roast forces the natural external bacterial flora of the animal into the product, contaminating what was a sterile product.



Post-mortem invasion may also contaminate the tissue, but with a healthy animal this is not particularly a problem. Proper post-mortem handling procedures do much to maintain interior tissues in a state relatively free of pathogenic bacteria.

What Kinds of Bacteria Are There?

A microscopic examination of bacterial cells--frequently referred to as vegetative cells--shows there are two major kinds of interest to food microbiologists. One kind of bacterial cell is rod-shaped; the cells may be long and thin, short and thick or combinations of the two. *C. perfringens* cells are long and thin, *E. coli* cells are short and thin. Such differences enable the experienced microscopist to provide valuable information on the microbiology of a food-processing operation.

Bacterial cells may also be spherical. *Micrococcus*, round cells occurring in large clusters, are generally nonpathogenic and normally found on skin. *Staphylococcus aureus*, which is responsible for Staph food poisoning is also a spherical-shaped cell. Staph organisms are normally found on the skin and in the nasal passages of 25-50% of healthy persons. Microscopically *Micrococcus* and *Staphylococcus* cannot be differentiated, but techniques to differentiate the viable nonpathogenic organism from the viable pathogenic organism are available.

How Do Bacteria Reproduce?

The bacterial cell reproduces only in the vegetative state. Bacterial spores do not reproduce but they can germinate to form vegetative cells that can reproduce. The vegetative cell divides by transverse fission and forms two cells, Figure 1. One important foodborne pathogen *Clostridium botulinum* and many organisms causing food spoilage are included in this group of bacteria that form both spores (resting stage) and vegetative cells (reproductive stage).

Most bacteria readily reproduce in the temperature range of 8-40C. At these temperatures the reproductive rate varies from 20-40 or more minutes. Most foodborne pathogens and all food spoilage organisms grow very rapidly in such a temperature range. These organisms are frequently called mesophiles.

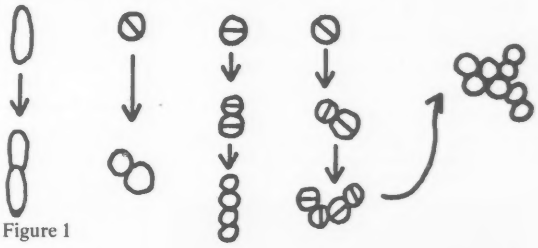


Figure 1

At temperatures of 41-60C the rate of reproduction may be a very rapid 15 minutes. One foodborne pathogen, *C. perfringens*, and several food spoilage organisms of importance to the canned food industry grow rapidly in this temperature range. These organisms are thermophiles.

If the organism can grow or survive at temperatures in excess of 60C, it is a thermoduric bacterium. Since most spores can survive 60C, all sporeforming organisms are considered to be thermodurics when in the spore state.

It should be emphasized that the classification system just discussed is based on the cell's reproductive rate in temperature ranges optimum for growth of different kinds of bacteria. In the practical world of food microbiology, it is important to know, in addition to the reproductive rate, whether an organism will grow at a given temperature--regardless of the speed of its growth.

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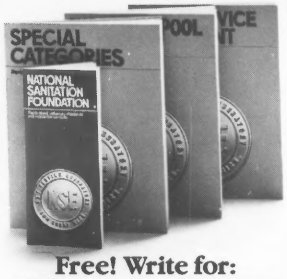

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The fact that reproduction occurs is the important point. The fact that it reproduces very slowly is of considerable consequence; long shelf life of a food contaminated with a psychrophile provides the time needed for production of many bacteria, resulting in quality deterioration and a possible health hazard.

C. botulinum Type E cells, for example, will produce colonies in nine days at 8C, but will produce colonies in only two days at 16C. Under the latter conditions this organism is a mesophile, but under the former it is a psychrophile. Type E cells can also reproduce, though very slowly, at temperatures as low as 4C.

Psychrophilic, mesophilic and thermophilic are terms frequently encountered in science writing. They describe organisms which grow at 7C or less, 8-40C, and greater than 41 C, respectively. From a practical viewpoint, the terms psychrophile and psychrophilic can be applied to any organism which grows in a refrigerator at 7 C or less, regardless of the growth rate involved. The growth rate is an activity of the cell that the investigator or sanitarian cannot ascertain in a practical situation.

Whether reproduction does or does not occur is a detectable phenomenon, one of interest to the investigator-sanitarian. The term psychrophile becomes meaningful to the food microbiologist if one ignores the rate of growth and focuses on whether the organism does or does not grow. Most organisms of importance in food microbiology which reproduce at 7C or less will reproduce much more rapidly in the mesophilic range.

It should be made clear that the terms mesophilic and psychrophilic are classifications. In the microbial world there is considerable cross-over between these two classes. With respect to thermophiles, there is also some cross-over into the mesophilic range. *C. perfringens*, for example, will increase 100-fold in less than four hours at 46C but requires three days to increase 100-fold at 21C.

At temperatures below freezing, foodborne pathogens do not grow. But foodborne pathogens can survive the temperatures employed in freezing food. The number of cells present may very well be reduced after freezing and thawing, but one cannot depend on quick-freezing to render a food free of disease or spoilage-producing organisms.

Freezing is used in the laboratory to preserve bacteria for decades. It is likely that the bacteria in frozen foods may also be preserved and manifest themselves when the environmental conditions are better suited to their growth.

How Do Bacteria Grow?

Bacterial growth usually refers to an increase in the number of cells, not to an increase in size of a single cell. A theoretical growth curve is shown in Figure 2. A bacterial cell will not start to reproduce until environmental conditions are suitable. Considerable biochemical activity, but no increase in cell numbers, takes place during the initial phase of growth. This period is called the lag phase of bacterial growth.

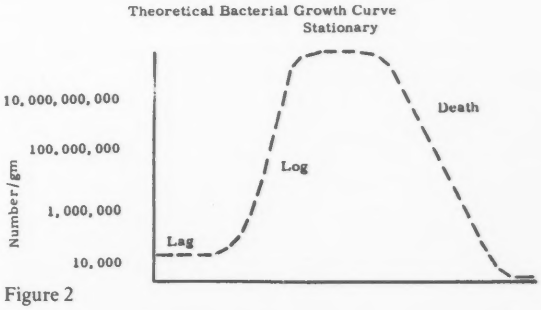


Figure 2

The duration of the lag phase varies considerably--the more undesirable the conditions, the longer the lag phase. Since recommended refrigeration temperatures are undesirable for the reproduction of most foodborne pathogens, little, if any, biochemical activity or cell development occurs under these conditions and the lag phase is prolonged.

In refrigerated chicken a la king, for example, *Salmonella*, even when the initial level is 10 million per gram, are in the lag phase for about three days. With "true" psychrophilic spoilage bacteria, such as *Pseudomonas*, the lag phase under the same conditions may be only several hours.

It is important to note that the duration of the lag phase in a practical situation is always an unknown quantity because the conditions which influence it can never be determined. It may be as short as minutes or as long as days. Since it is generally impossible for the investigator to determine the length of the lag phase, it cannot be considered as a factor in analyzing the microbiological hazards in a food-processing operation except in certain specific applications.

After the organism has become adjusted to the environment or has adjusted the environment to suit its needs, rapid reproduction begins. This stage of the growth cycle is called the logarithmic (log) state of development because the increase in number, when plotted graphically on a log scale, gives a straight line.

The generation time, time it takes for one cell to form two, is shortest in the log phase of growth. In this phase, mesophilic organisms double in number every 20-40 minutes. With thermophilic organisms the generation time may be as short as 15 minutes at 115C.

The log phase of growth is self-limiting. In most instances, the organisms cease to multiply rapidly after 10-20 hours, and the number of new cells forming equals the number of old cells dying. The viable population become constant and this causes the cycle to "level off."

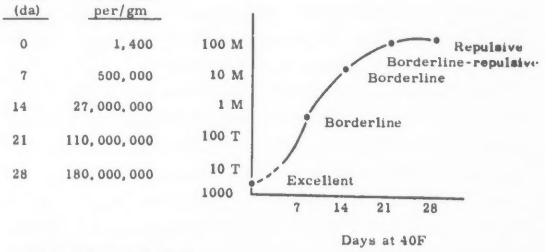
The third stage of the bacterial growth cycle is the stationary phase. It persists for various periods of time, and almost invariably represents a bacterial level far in excess of that which interests the food sanitarian-microbiologist from a health viewpoint. Foods with this level of bacteria, unless they are fermented foods, do not pose a health problem as they almost invariably will be unacceptable from a purely physical standpoint.

In most instances the cell population will "level off" when the number of cells approaches about 10 billion per milliliter or gram of food. In actual practice, when the bacterial level is greater than 10 million per milliliter or gram of nonpathogenic bacteria, quality deterioration is readily detectable.

Figure 3 shows that at a bacterial level of one million per gram, the quality of cooked ham is rated as "borderline." At 100 million per gram, the rating is "borderline repulsive." Although relatively high levels of bacteria are required to impair food quality, it is important to note that nowhere near the maximum cell population is required to impair food safety.

Growth Curve Correlating Bacterial Levels With Physical Defects In Wrapped Non-Vacuum-Packed Sliced Cooked Ham

Actual Data	
Time (da)	Total No. per/gm
0	1,400
7	500,000
14	27,000,000
21	110,000,000
28	180,000,000



Adapted from FT (1963)

Figure 3

When the number of cells which are dying, for whatever reason, exceeds the number of new cells being produced, the total number of living cells declines. Death may occur at a definite rate, resulting in a decrease which gives a straight line when data (survivor bacterial count) are plotted on a log scale. This phase is called the death phase. If the death rate persisted long enough it would result in the destruction of all the cells, and the organism would become extinct.

Nature has not permitted this to occur. The death phase tapers off, especially in the natural state where no effort is made to kill all the organisms, and a variable percentage of the maximum cell level survives to undergo the cycle again later. Note however, that a bacterial population is not instantaneously killed when subjected to a lethal condition. A specific percentage of the viable bacteria at that time is destroyed per unit of time.

Analyzing a bacterium is not a simple task. An overview of bacteria should help practicing sanitarians better understand bacterial behavior. This becomes very basic information in combatting one of the most basic sanitation problems, control of bacterial populations in food.

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Enumeration, Identification of Cultured Product Organisms

Eight basic organisms are used in the manufacture of cultured milk products — cheeses, buttermilk, sour cream, and others. Methods for identification and counting of the organisms present in various products are discussed.

HAROLD L. RASMUSSEN

Marschall Division
Miles Laboratories
Madison, Wisconsin

In the production of cheese and cultured dairy goods, eight culture organisms are utilized. The enumeration and identification of these organisms, is described, along with the effects various agars have on the products, how-to procedures, and clearly explained methods of identification.

Covering the enumeration and identification of cultured product organisms effectively is difficult without going into great detail. Basically, however, there are eight basic culture organisms most widely used in cheese production and the manufacture of cultured dairy products.

For purposes of a clear presentation, the eight organisms have been grouped into three areas:

Homofermentative mesophilic bacteria

The homofermentative mesophilic bacteria are those with the primary function of producing lactic acid through fermentation of lactose at temperatures ranging from 22-32° C. This group includes *S. cremoris* and *S. lactis* bacteria.

Cheddar, colby and other types of American hard cheeses, cottage cheese and cultured buttermilk are products produced with these organisms.

Homofermentative thermophilic bacteria

The homofermentative thermophilic bacteria produce lactic acid by fermentation of the lactose in milk at higher temperatures. The organisms in this group are *S. thermophilus, L. bulgaricus* and *L. acidophilus*. Optimum temperature for growth of *S. thermophilus* is from 40-45° C and from 45-50° C for lactobacilli.

The *S. thermophilus* and *L. bulgaricus* organisms are used in manufacture of cheeses where high cooking temperatures are required, such as Swiss cheese and the Italian varieties. They are also used to make yogurt. Their associative growth produces the characteristic yogurt flavor, unlike that found in any other fermented milk product. Another organism sometimes found in the Swiss and Italian cheeses and yogurt is *L. helveticus*.

The principal application of *L. acidophilus* today is in concentrates which are added to pasteurized milk to make such products as "Sweet Acidophilus" milk.

Heterofermentative mesophilic bacteria

The heterofermentative mesophilic organisms ferment the citrates in milk to produce carbon dioxide gas and the flavor compound, diacetyl. They are sometimes referred to as the aroma bacteria. Organisms in this group are *S. diacetilactis* and *Leuconostoc citrovorum.*

The *S. diacetilactis* organism ferments lactose in milk to produce lactic acid as well as carbon dioxide and diacetyl. *L. citrovorum*, on the other hand, produces mainly diacetyl. Most leuconostoc organisms produce little or no acid in milk and rarely coagulate it.

These flavor-producing organisms are used to develop taste and aroma in products such as cultured buttermilk, cottage cheese dressings, sour cream and cream cheese.

Enumeration

Once the types of organisms used in manufacture of cultured products are understood, the next step is to look at enumeration procedures.

None of the cultured product organisms grow very well---if at all---in Standard Methods agar, the medium used to determine total aerobic bacterial counts in milk and uncultured milk products. Special media containing

"Special media containing additional nutrients and special metal salts, in some cases, are required for support of good growth and colony development in agar plates. Plating procedures used in enumeration of cultured product organisms are the same as any other plating process, with the exception of the agar types used and, in some cases, the incubation conditions."

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Plating procedures used in enumeration of cultured product organisms are the same as any other plating process, with the exception of the agar types used and, in some cases, the incubation conditions.

Before discussing media, it should be emphasized that no preference is meant to be displayed for any one media supplier. For purposes of identification, Difco and BBL products are named. Other media suppliers furnish the same formulations.

Either Standard Methods phosphate buffered water, Butterfield's Buffer, or peptone dilution water may be used for serial dilutions of the products to be tested. Generally dilutions are carried out to 10^{-5} or 10^{-7}.

Enumeration of S. cremoris and/or S. lactis

Elliker's agar (Difco) or APT agar (Difco or BBL) work well for enumeration of the *S. cremoris* and *S. lactis* organisms. Better counts may be obtained with Elliker's agar, especially when 0.4% diammonium phosphate is added, as suggested by J. T. Barack in *Applied Microbiology* (1). Media suppliers sell the broth, to which 1.5% agar is added.

Plates may be incubated 48 hours at 32° C or four to five days at 21-22° C. The longer incubation period at the lower temperature generally yields slightly higher cell counts and is the preferred procedure, if time permits.

Enumeration of S. thermophilus

A 1975 French regulation shows the preferred agar medium for enumeration of the *S. thermophilus* is M17 agar, as described by Terzaghi and Sandine in *Applied Microbiology* (2).

That regulation requires that yogurt be sold within 21 days of manufacture and that it contain a minimum of 100 million viable culture organisms per gram at the time of sale. Yogurt is made with a combination culture of *S. thermophilus* and *L. bulgaricus*. The official procedure adopted in France specifies M17 agar for enumeration of the *S. thermophilus*. This medium is not commercially available and must be formulated in the laboratory. Plates should be incubated at 37 degrees C for two days.

Enumeration of L. bulgaricus and L. helveticus

The recommended agar medium for enumerating the *L. bulgaricus* or *L. helveticus* is Lactobacilli MRS broth (Difco) to which agar has been added. This is the agar the French regulation suggests for the lactobacilli, and the procedure suggested here is as specified in that regulation. This means the agar must be acidified to pH 5.4 and plates incubated anaerobically at 37 degrees C for three days.

Enumeration of L. acidophilus

Three commercially prepared media may be used to enumerate *L. acidophilus*.

The first is the MRS (Difco) medium, previously mentioned, following the same procedure as for *L. bulgaricus*, without adjustment of the pH to 5.4. Use is as specified by the media supplier.

The second is APT agar (Difco or BBL). Satisfactory enumeration is obtained with this agar by overlaying the inoculated plates with the same agar and incubating aerobically for two to three days at 37 degrees C.

The third procedure is to plate in a lactobacillus selective agar such as LBS agar (BBL) or Rogosa SL agar (Difco). Both agars have the same formulation. Here plates must be incubated in an atmosphere of carbon dioxide in order for visible colonies to form. Incubation time and temperature is the same as for the other procedures.

The highest counts are obtained with the MRS agar as it is completely non-inhibiting. The salt in APT may be slightly inhibitory to *L. acidophilus* and would result in slightly lower counts than with MRS. The procedure using the LBS selective medium yields the lowest counts because it is a selective medium. Selective media are slightly inhibitory since they are designed to suppress growth of other bacteria. This makes them slightly inhibitory to the organism being enumerated.

Enumeration of L. citrovorum

The agar medium preferred for enumeration of the *Leuconostoc citrovorum* is APT. Incubation is at 32 degrees C for two to three days.

Enumeration of S. diacetilactis

For enumeration of *S. diacetilactis*, Elliker's agar is recommended. Incubation is at 32 degrees C for two to three days.

Identification

Identification of cultured product organisms in some cases can be relatively complex, but simple procedures are adhered to as far as possible here. Knowing what types of organisms are used in the different cultured products, as previously outlined, is a handy starting point.

Two useful identification techniques are microscopic examination and growth temperature tests. If it is not known what organisms are present in a product, examine a methylene blue-stained smear under a microscope using an oil immersion objective. This examination shows if cocci, lactobacilli, or a mixture of both are present.

Growth temperature tests may be run by inoculating sterile skim milk with 1% of the product and incubating at selected temperatures. The temperatures to use can be 21 and 45-50 degrees C. If growth occurs at 21 degrees C but not at 45-50 degrees C, the organisms are only mesophilic. If growth occurs only at 45-50 degrees C, the organisms are only thermophilic. If growth occurs at both temperatures, both types are present.

Perhaps the most simple way to cover the subject of identification is to take two products which include at least seven and possibly all of the eight basic cultured product organisms. These two products are cultured buttermilk and yogurt.

Identifying organisms in cultured buttermilk

To identify the organisms in any product, the organisms must first be isolated. In cultured buttermilk one would expect to find *S. lactis* or *S. cremoris*, or a mixture of both together with flavor organisms, *S. diacetilactis* or *L. citrovorum*, more likely the latter. If these organisms are identified, half the organisms under consideration will have been named.

Since the flavor organisms ferment citrates, they may be isolated by plating the product in an agar medium containing a citrate. In such a medium clear zones appear around colonies of the flavor bacteria due to utilization of the citrate. N-L agar, developed by Nickels and Leesment and described by M. Y. Pack, et al, in the *Journal of Dairy Science* (3) is one such agar.

Colonies with clear zones on this agar may be picked into litmus milk to identify the organisms as *leuconostoc* or *diacetilactis*. The diacetilactis will reduce litmus and coagulate the milk. *Leuconostocs*, on the other hand, just slightly reduce litmus and do not coagulate the milk. This procedure is depicted by Foster, et al, in *Dairy Microbiology* (4).

The diacetilactis may be further identified in broths containing arginine. They produce ammonia from arginine, whereas *leuconostoc* do not. An arginine broth for this identification is described by Reddy, Vedamuthu and Reinbold in the *Journal of Milk and Food Technology*. (5).

This broth is put up in screw cap test tubes containing Durham gas tubes. The reactions of diacetilactis in this broth are first an acid condition (yellow color) followed by an alkaline condition (violet color), due to production of ammonia from arginine.

Also, gas would be collected in the tube from fermentation of citrate in the medium. Production of gas is the confirmatory reaction to look for since *S. lactis* will produce the same color changes in this broth.

Identification of the *S. cremoris* and *S. lactis* may be accomplished in a special agar medium. E. M. Mikolajcik described a broth for this purpose in the *Journal of Dairy Science* (6).

In this procedure, petri plates are poured with approximately 15 milliliters of the sterile agar medium and held for 24 hours at 32 degrees C to dry. The product being examined, buttermilk in this case, was diluted as for enumeration procedures to yield between 50 and 100 colonies on the plate. A volume, 0.1 milliliter, of the desired dilution was deposited carefully on the agar surface and spread with a small diameter glass rod. Plates were incubated 3-4 days at 32 degrees C under high humidity.

The cremoris colonies growing on this agar turn yellow, whereas the lactis colonies turn white or purple. The medium contains brom cresol purple indicator which is yellow under acidic conditions and purple under alkaline conditions.

The *S. cremoris* produces only acid on this agar, so those colonies are yellow and the medium turns yellow surrounding the colonies. The *S. lactis*, on the other hand, produces ammonia from the arginine in the medium, giving an alkaline reaction. Therefore these colonies remain white and may turn purple.

These strains may further be identified in the arginine broth described for identifying diacetilactis. In fact, since the product is cultured buttermilk, the white colonies must be screened in the broth for gas producers to determine if any of them are diacetilactis.

The diacetilactis organisms produce the same colony reaction as *S. lactis* on this agar. In the arginine broth the *S. cremoris* produces a yellow acidic reaction. The *S. lactis*, at the outset, produces a yellow acidic reaction which is followed by a violet-colored alkaline reaction through the production of ammonia from arginine. As stated previously, there will be gas in the Durham tube if the organism is a diacetilactis.

Identifying organisms in yogurt

As discussed earlier, a combination of *S. thermophilus* and *L. bulgaricus* or *L. helveticus* organisms are used in the production of yogurt.

To identify the various organisms in yogurt, the first thing done is to prepare a methylene blue-stained smear and examine it for streptococcus (coccus) and lactobacillus (rod) organisms under a microscope, using the oil immersion objective. Boty types should be found.

Next, two samples of sterile skim milk are inoculated. One should be incubated at 20-22 degrees C and the other at 45-50 degrees C for 16 hours. Growth should occur at the latter, but not the former, temperature. Growth is determined by the milk coagulation.

If the milk coagulates at 20-22 degrees C, the product contains mesophilic acid producers. On the assumption none are present, the coagulated 45-50 degree C sample should be examined microscopically. If the milk coagulated at that temperature and coccus here found under the microscope, they can be considered *S. thermophilus*. Lactobacilli should also be present.

There are at least three characteristics for distinguishing between the *L. bulgaricus* and *L. helveticus*. The first is on the basis of granulation, which is detected under the microscope. The bulgaricus strains produce granules (dark blue spots) in the cell, whereas the helveticus do not.

A second way to tell them apart is on the basis of acid production in milk. The helveticus will develop acid in milk to a titratable acidity of approximately 2.7%, whereas the maximum for the bulgaricus will be approximately 1.7%. Before this test can be made, the lactobacillus must be isolated. This may be done in MRS agar acidified to pH 5.4.

A third identification can be maltose fermentation. The helveticus would ferment maltose, whereas the bulgaricus would not.

If there were a suspicion of the presence of *L. acidophilus* in yogurt, this could be determined by growth in milk and growth in presence of bile salts. This organism grows slowly in milk and produces acid to a maximum of approximately 0.8% titratable acidity. The acidophilus grows in the presence of bile salts, whereas the bulgaricus and helveticus do not. This can be determined by observing for growth in APT agar containing 0.15% oxgall.

Another distinguishable characteristic of the acidophilus is that there is no granulation in the cells. Therefore, if the organism is free of granulation and does not produce high acidity in milk, it would likely be an acidophilus organism.

Enumeration and identification of the eight most widely-used cultured product organisms should prove useful to those working the field of dairy sanitation.

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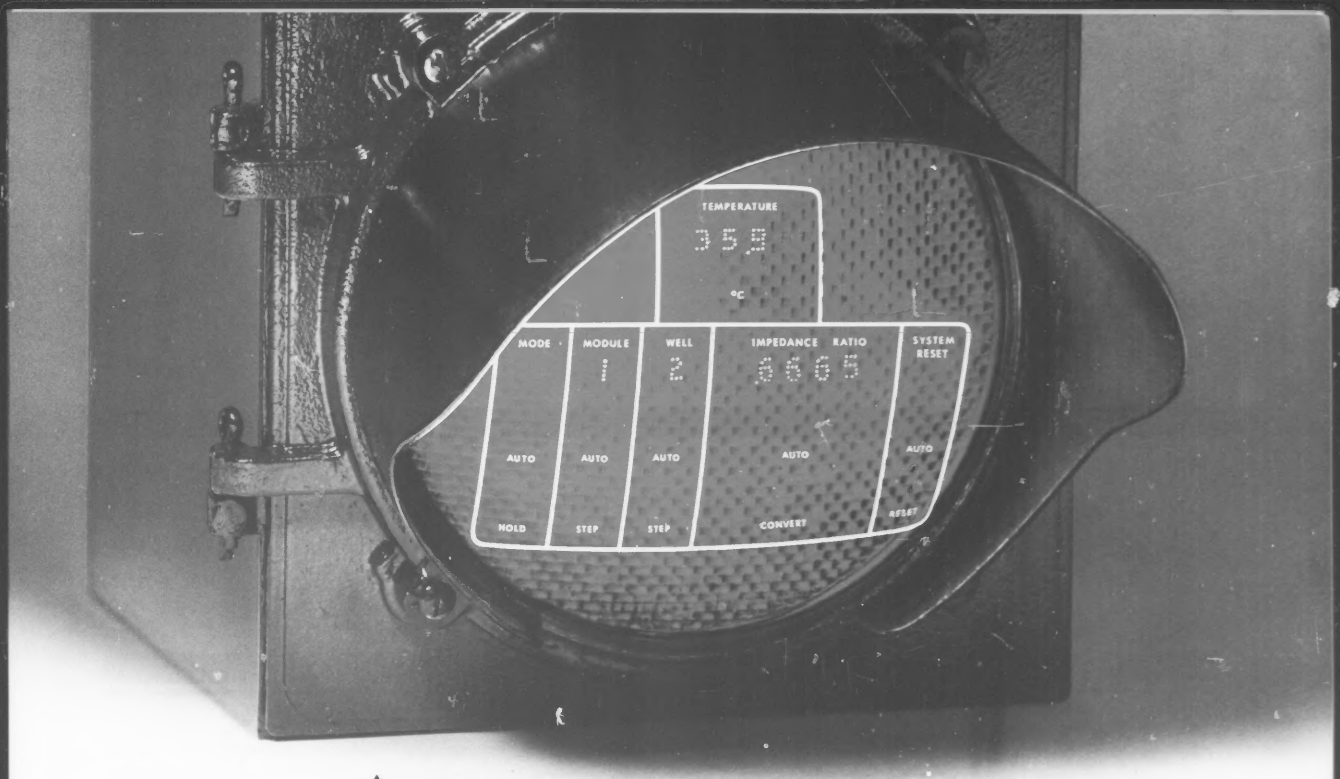

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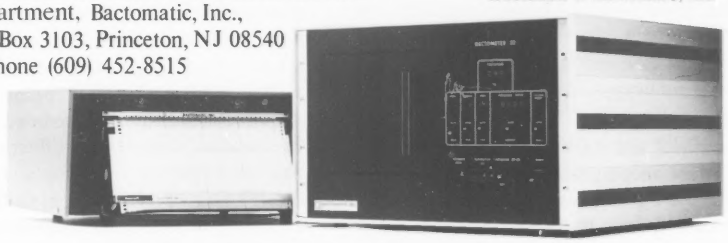

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TERRY MITCHELL

Babson Bros. Co., Oakbrook, IL.

Cleaning of CIP Systems

The requirements for automatic cleaning of CIP systems are discussed. The wash cycle should be ten minutes and adequate amounts of hot (160° F) water must be supplied. Water volume information should be supplied by the equipment manufacturer. The proper amount of detergent will insure adequate cleaning, and "scrubbing" action is provided through air injection. To insure proper drainage after the completion of each wash cycle the system must be sloped and have secondary drains. Equipment should be sanitized immediately before each milking. These steps will eliminate the accumulation of milk soils and resulting high bacteria counts.

Automatic cleaning of CIP systems requires that certain criteria be met for proper performance. Since the elements involved in manually cleaning a surface—brush, sudsing detergent, and "elbow grease"—are usually absent in CIP systems, a few other requirements must be met.

The requirements for CIP systems include:

- Time
- Temperature
- Volume
- Detergent Balance
- Velocity
- Drainage

TIME. The length of the wash cycle should be 6-10 minutes. This is often accomplished with an automatic washer. If the wash cycle greatly exceeds this time frame, water temperatures will drop to a level that may cause redeposition of soils.

TEMPERATURE. Adequate amounts of hot (160° F) water must be supplied. Ideally, wash temperatures should not drop below 120° F on the return side of the system. However, some detergent formulations will exhibit better cleaning performance and sequestering power than others at temperatures below 120° F.

VOLUME. Adequate water volume is essential in CIP systems. A table of equipment capacities should be available from the equipment manufacturer, and then the proper amount of water to be used should be calculated. A good rule of thumb is that the wash vat should never be emptied before return water reenters the vat. In addition, if maintenance of 120° F water is required, water volume can be increased. This will help maintain temperature at 120° F.

DETERGENT BALANCE. Proper amounts of detergent must be added to insure adequate cleaning. Recommendations of the detergent representative should be adhered to in order so that a proper cleaning concentration can be maintained. A water conditioner will remove the hardness ions such as calcium and magnesium, in the water through an ion exchange process. The resulting soft water will allow the phosphates in the detergent to perform more efficiently.

In addition to the hardness ions, iron can greatly reduce the detergent's effectiveness. In areas where iron concentrations exceed 1 ppm, additional detergent is required. Iron filters to remove iron from the raw water are available and cost effective in areas where iron exceeds 1 ppm.

VELOCITY. Proper physical action is a much in a cleaning system. Since the brush and "elbow grease" present in a manual cleaning operation are absent, "scrubbing" action must be provided through air injection. Alternate air admission at specific locations and timed intervals provide a slug of water which scrubs the surface. Length and diameter of milk line, plumbing

"Adherence to these classic steps in cleaning will aid in the production of quality milk. Divergence from these steps could result in the accumulation of milk soils and subsequent high bacteria counts."

design, and types of automated equipment greatly affect the amount of air which must be supplied. Electronic air injectors provide the capability of selecting length and frequency of air admission. The equipment dealer should provide the necessary adjustments to assure proper washing action.

DRAINAGE. The system must be adequately sloped; and secondary drains must be provided to assure proper drainage after completion of each cycle. Automatic washers should provide sufficient time intervals for complete drainage.

Here's a closer look at the classic steps in cleaning as applied to a CIP system:

- *Pre-wash Rinse* - A clear, clean potable tepid (95-110° F) water rinse is flushed through the system to remove the bulk of the gross soil. In addition, the surface of the equipment wall is warmed. Care must be exercised never to exceed 115° F because soils can actually be "baked" on the equipment wall. A recommended procedure is to dump the initial rinse water directly down the drain. This will prevent recirculation of the heavy soil, and it can be performed automatically with a diverter valve.
- *Wash Cycle* - A hot (160° F) solution of a chlorinated alkaline cleaner is circulated for 6-10 minutes. Chlorines will aid in soil removal by peptizing proteins while the high alkalinity (ph 10+) emulsifies fats in addition to the protein materials dispersed. Water temperature should be maintained above 120° F to prevent redeposition of milk soils.
- *Acid Rinse* - An acid rinse is applied at 95-110° F. Acid rinse products differ from acid cleaners in that they do not contain detergents or surfactants. Formerly, acid cleaners were used once or twice weekly to remove milkstone formation. Use of a daily acidification rinse eliminates the need for an alternate acid wash. The advantages of the daily acid rinse include:

1. Neutralization of chlorine residues. This prolongs rubber life of gaskets, O-rings, and inflations, and prevents corrosion of stainless steel.
2. Prevention of mineral deposition, water spotting and filming. This, in turn, prevents the formation of milkstone.
3. Reduction of equipment surface pH will further prevent bacterial growth. In addition, chlorine sanitizers will perform more efficiently at this lower pH range.

SANITIZE. Immediately before the next milking, the equipment should be sanitized. Liquid sodium hypochlorite is probably the most widely used, although powdered chlorine and iodine can also be used. Powdered chlorine may provide additional benefits since it is more stable. Unlike liquid sodium hypochlorite which loses its strength when exposed to sunlight and temperatures above 70° F, powdered chlorine will maintain its strength if kept covered and dry.

Adherence to these classic steps in cleaning will aid in the production of quality milk. Divergence from these steps could result in the accumulation of milk soils and subsequent high bacteria counts.

Instruct and encourage dairymen to follow good sanitation practices. Their ultimate profit depends on the production of a high quality product.

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SPOKANE'S THE ONE IN '81

Welcome to Spokane, the capital of the Inland Empire. We hope that you'll come to the 68th Annual Meeting of IAMFES, August 9-13, 1981 at the Sheraton-Spokane Hotel, Spokane, WA. During the meeting a variety of events are planned, ranging from an ice cream social to a Salmon Barbeque at Riverfront Park, site of the 1974 World's Fair.
We'll see you in Spokane!

1981 IAMFES ANNUAL MEETING

Advance Registration Form for the 68th Annual Meeting, August 9-13, 1981, Spokane, WA

Mail to: Donald L. Kilgore, Registration Chairman
IAMFES
Dairy and Food Division
North 222 Havana
Spokane, Washington 99202

Please check where applicable:

Affiliate Delegate	☐	Speaker	☐
Past President	☐	Affiliate Member	☐
Executive Board	☐	ADA Member	☐
30 yr. IAMFES Member	☐	HIEFSS Member	☐
		Non-member	☐

Make checks payable to: IAMFES 1981 Meeting Fund

Advance register and save – refundable (prior to June 30) if you don't attend

ADVANCE REGISTRATION FEE (prior to July 1)
(All in American currency)

	*Member**	*Spouse of Member*	*ADA HIEFSS*	*Student*
Registration	$22.50	$10.00	$27.50	no chg.
Banquet	17.50	17.50	17.50	17.50
Salmon Barbeque	6.00	6.00	6.00	6.00
Total	$46.00	$33.50	$52.00	$23.50

REGISTRATION FEE AT DOOR
(All in American currency)

	Member	*Spouse of Member*	*ADA HIEFSS*	*Student*	*Non Member*
Registration	$27.50	$13.00	$32.50	no chg.	$32.50
Banquet	20.00	20.00	20.00	20.00	20.00
Salmon Barbeque	7.50	7.50	7.50	7.50	7.50
Total	$55.00	$40.50	$60.00	$27.50	$60.00

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Reservations must be received by July 17, 1981.
The best arrival time is after 3:00 p.m.

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Name _____

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Mail directly to: Sheraton-Spokane Hotel
North 322 Spokane Falls Court; Spokane, WA 99201

NATIONAL MASTITIS COUNCIL
1981 SUMMER MEETING PROGRAM

August 13, 1981

Sheraton Hotel **Spokane, WA**

8:00 a.m. **REGISTRATION**
8:20 a.m. **GREETINGS** - Robert Dawson, President, National Mastitis Council, Babson Bros. Co. Oak Brook, IL.
8:30 a.m. **MILKING SYSTEMS ANALYSIS** - Don Thomas, Animal Science Dept. Utah State University, Logan, UT
9:00 a.m. **ANALYZING CALIFORNIA MILKING SYSTEMS** - Dick Eide, Cooperative Extension Service, Univ. of California, Fresno, CA
9:45 a.m. **BREAK**
10:00 a.m. **EVALUATION OF BACK FLUSHING MILKING MACHINES** - Robert Bushnell, Cooperative Extension Service, Univ. of California, Davis, CA
10:30 a.m. **PANEL** - Don Thomas, Dick Eide, Robert Bushnell
11:00 a.m. **NORTHWEST DAIRYMEN'S QUALITY PROGRAM** - Larry Haas, Quality Committee Chairman, Northwest Dairymen's Association, Elma, WA
11:30 a.m. **LUNCH BREAK**
1:00 p.m. **BACTERIAL ANALYSIS OF BULK TANK MILK RELATING TO HERD PROBLEMS** - Robert Bushnell
1:30 p.m. **MILK QUALITY BEGINS AT THE FARM** - Ron McKay, Commercial Dairyman, Ferndale, WA
2:00 p.m. **DIRECTION OF EPIDEMIOLOGIC APPROACHES AND HEALTH CARE DELIVERY IN UDDER HEALTH** - Allen Britten, Udder Health Service, Everson, WA
3:00 p.m. **PANEL** - Larry Haas, Robert Bushnell, Ron McKay, Allen Britten
3:30 p.m. **ADJOURNMENT**

Annual Meeting Update ...

Final plans have been announced for the IAMFES Annual Meeting, scheduled for Aug. 9-12, 1981, at the Sheraton-Spokane, Spokane, WA.

Social events at the meeting will include an Ice Cream Social Sunday night. A Salmon Barbecue is planned for Monday night at the Riverfront Park, site of the Expo '74 World's Fair. Tuesday night there will be a wine and cheese reception and Wednesday night will include the Annual Awards Banquet.

The Spouses' Program will include a cruise on Lake Coeur D'Alene, followed by a luncheon. A fashion show and makeup demonstration are also planned. The Ladies' Hospitality Room will be available on the top floor of the Sheraton-Spokane. In addition to planned events, downtown shopping is just three blocks from the hotel, with skywalks connecting the various stores.

Continuing education credits for attending the IAMFES meeting have been announced by the American Dietetics Association at 11 hours, and the Hospital, Institution and Educational Food Service Society, 12 hours. The state of Ohio has awarded 14 hours for the

con't. p. 303

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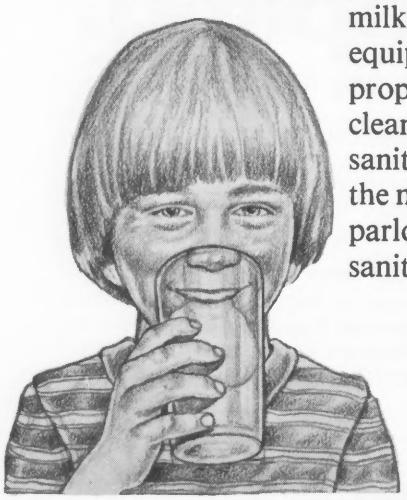

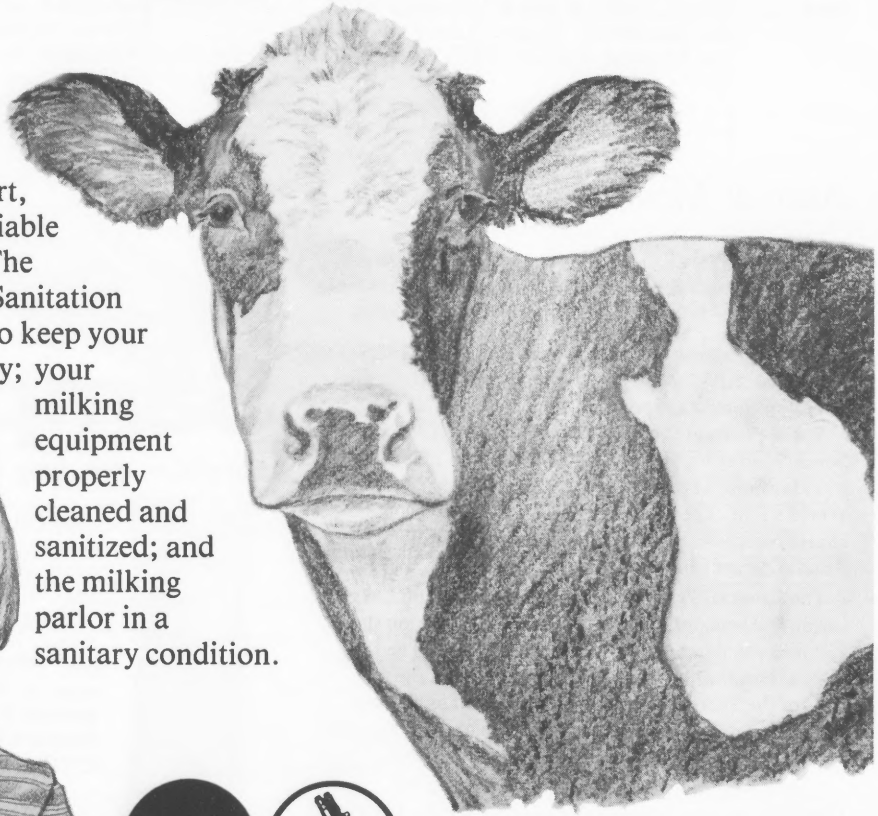

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Case Studies in Sanitation

This and future Case Studies in Sanitation *are written by Frank Raffaele, Vice President of Regulatory Compliance, American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.*

Case #17 - Rope in Bread

Carl Fletcher was a field investigator for the Department of Consumer Protection in the state of Connecticut. After graduating from College, Carl had the opportunity to take the Civil Service Exam and passed with flying colors. After spending a couple of years in another department, he was transferred to the food division as a field inspector. His primary responsibility included food plant inspections in a specific area of the state.

Carl really enjoyed his work and always maintained a good rapport with the personnel in the food establishments he inspected. The only part of the job he didn't like was the paper work involved when performing FDA inspections in food establishments shipping products out of the state.

On Monday, June 2, 1978, as Carl drove the 15 miles from his home in Hartford, he visualized the plants he would start inspecting that afternoon and figured that barring any real problems, he could probably do one per day and then get an early start on the weekend Friday afternoon.

Upon arrival at the office, he was immediately approached by his supervisor, James Bird, who informed Carl that during the weekend the department had received several complaints from area residents who had encountered what they described as "foul odors" from white and wheat breads produced by a bakery in Carl's area and one he had inspected many times.

In cases involving complaints such as this it was Carl's responsibility to visit the consumer, examine the evidence and submit it to the state lab for analysis and finally inspect the facility to determine the cause.

By 3:30 that afternoon, Carl had collected the samples and was amazed at the odor coming from each loaf. Physically, the product appeared normal, but one whiff inside the bag was sufficient to realize a definite problem existed. In filling out the request for laboratory analysis, Carl pointed out the last sale date on each loaf-which was June 3 and 4. Obviously the odor was not caused by a stale product.

On his way home, Carl stopped at several retail stores in an attempt to locate similar units from the same lot. He submitted those to the lab on the following day in accordance to standard operating procedures.

On Tuesday, June 3, Carl arrived at the production plant by 9:00 a.m. and was confronting plant management with the problem by no later than 9:15 a.m.

While Carl was conducting the inspection in the plant, a top level meeting of executives was being held in the corporate office. Since Thursday, May 29, the sales department had received numerous complaints from distributors stating that several of their variety products demonstrated off odors. These products appeared to be those manufactured on line #1 only. However, as the data was collected and examined, it became evident products produced on line #2 were also affected.

Back in the plant, it appeared to Carl that management personnel were exceptionally tight lipped and he could even sense a marked degree of tension in the air. After preliminary discussions, Carl set out on an audit of the facility and could find virtually nothing different - at least on the surface. This bakery had always been one of his cleanest shops. Sanitation and Quality Control were always well organized, well staffed and efficient. In Carl's mind finding the cause of this problem would not be easy and when he thought about it, he realized that he did not even know what it was he was looking for.

At the end of the day Carl left the plant manager with the completed state inspection form which, like others left in the past, contained nothing more than some very minor infractions of the GMP's. For the present, Carl felt confident that he had done his job but was uneasy with the realization that he had not found the problem.

In the board room, company executives felt confident they did know what was at the root of the problem: rope. However, the real problem for the plant was where to find someone who could confirm their suspicions and locate the source of the problem.

After a lengthy debate, Vice President of Operations, Jerry Deeker, decided to contact an outside consulting service. In the interim, Deeker concluded, "We will cease plant operations and embark on a massive clean-up operation."

The clean-up started the evening of Tuesday, June 3 and was in progress when representatives from the consulting agency arrived the following morning.

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Annual Meeting Update, *con't. from p. 297*

meeting, and Minnesota and Michigan have also been contacted for continuing education credits.

Members and friends of IAMFES attending the '81 Annual Meeting in Spokane will meet in a city celebrating its 100th birthday.

Spokane has earned a nation-wide reputation for its friendliness and hospitality. "Expo '74" started Spokane on its way to bigger things, among them being named an "All American City" in 1975.

Spokane's "Riverfront Park" adjoins the Sheraton-Spokane Hotel, and is a beautiful park. It's a short walk from the hotel and will give IAMFES meeting attendees an opportunity to enjoy summer band concerts, various historical exhibits and special ongoing activities, all being planned to celebrate the centennial.

The Spokesman-Review newspaper has donated a 165-page Spokane progress edition tabloid to be given to each person registering at the 1981 IAMFES international meeting. For further information on the social aspects of the Annual Meeting, or continuing education credits, please contact IAMFES, PO Box 701, Ames, IA 50010, 515-232-6699.

Case Studies in Sanitation, *con't. from p. 302*

Upon their arrival, the team of investigators immediately reviewed the facts with plant personnel and evaluated the spoiled product first hand.

Utilizing potato dextrose, whole culture plates along with swab and exposure plate techniques, the consultants conducted an extensive microanalysis of the entire production facility. In addition, investigators sampled some of the suspect raw materials and adulterated finished product attempting to locate and define the causal organism.

Following the sampling procedure in the plant a 24 to 48 hour incubation period revealed the following:

1. Adulterated slice of finished bread. . . . .10^3 Bacillus subtilis
2. Wheat Flakes (in raw material form). . . . .10^3 Bacillus subtilis
3. Reclaimed Bread Products and Crumbs. . . . .10^6 Bacillus subtilis
4. Bakers Yeast. . . . .0 Mold and 0 Rope count
5. Stagnant water inside liquifier line. . . . .10^6 Bacillus subtilis
6. Slicer Blade Guides (Line #1 slicer). . . . .TNTC Bacillus subtilis
7. Exposure plate inside line #1 proof box. . . . .0 Bacillus subtilis
8. Buildup inside jacket cover of line #1 mixer. . . . TNTC Bacillus subtilis

INTERPRETATION OF DATA

Microbiological data indicates the Rope problem can be traced directly to three major sources:

1. Wheat flakes appear to have an excessively high rope count.
2. Reclaimed bread scraps that are collected and recycled.
3. The bread crumb liquifier system.

NOTE: Bacillus subtilis is a large gram positive rod which is considered a "spore former." Bacteria that produce "spores" are always extremely resistant to heat. The 300° F plus generated inside the loaf of bread is sufficient to kill the organism itself, but the spore will survive only to regenerate in the finished product within 24 to 72 hours.

The fact that the organism produces spores also makes it extremely difficult to eliminate by the use of common, approved sanitizers since those available for the food industry are bacteriostatic and are not very effective against the spore.

The most dependable method of eliminating these spores is with the use of an autoclave where temperatures of 121° C are utilized at 15 lbs. pressure.

MAJOR IMPROVEMENTS NEEDED

1. Scrap bread and or cripple bread, especially that containing no preservatives, cannot be indiscriminately collected and allowed to "set around" to incubate. A program must be initiated whereby the product must be utilized within 3 to 6 hours or refrigerated at a temperature of 35° F to 40° F for extended periods.
2. It is recommended that the company contact the wheat flakes supplier and insist that steps be taken to reduce the rope score count in this critical raw material.
3. The bread crumb liquifier system must be immediately broken down and sanitized. The method of preference is a medical autoclave at 121° C at 15 lbs. pressure for a period of 1 hour. All pumps, valves and lines must be so treated. The liquifier proper must be filled with a 20 percent solution of chlorine and allowed to sit for a period of 3 to 5 days.
4. The plastic trays used to collect scrap bread should be discarded and replaced.
5. A more efficient system of sanitizing the trays and the liquifier system must be formalized and implemented.
6. Remove the stainless mixing bowl jacket covers. Remove all farinaceous material and deteriorated insulation. Sanitize using 20 percent chlorine and install new insulation, new cover gaskets and replace cover.
7. Swab tests should then be taken, on a weekly basis, of all critical areas described and appropriate action taken when high Bacillus counts are encountered.

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Kentucky Association Offers Varied Program

"The next decade promises greater change for this crowd than the previous decade." That was the message Dr. David Allen brought as keynote speaker for the Educational Conference of the Kentucky Association of Milk, Food and Environmental Sanitarians, Inc.

"Every activity that we're engaged in will be looked at with a fine-tooth comb. Even activities with merit may be cut in the current wave of government budget cuts," Allen explained. "It will be critical in the next decade to define what you do," he said. Among questions which must be asked, Allen said, is "What is the relationship of what you do daily with the public concerns? Relative priorities will be the guideline in determining where budget cuts will occur," he said. "Are the activities of your job protecting people from risks that are realistic today?" Allen asked. "For example, the machinery is in place to deal with TB and brucellosis, but those diseases are generally eradicated," Allen said. "The concerns for the 80's will include PCB's, asbestos in schools, and similar issues," Allen explained.

Addressing a very different subject, mastitis, Sid Beale of the Michigan Milk Producers Association noted, "90% of all mastitis is 'manmade'," through bad habits, machines, or management problems. "Subclinical mastitis really robs the farmer because he can't see it," Beale said. Clinical mastitis is obvious and much more likely to be treated. "Mastitis, in general, is really a management problem," he added.

"The Role of Fieldmen, Sanitarians and University Staff in Helping Dairymen Plan Dairy Facilities," was discussed by Dr. William Crist, University of Kentucky. Crist recommended getting plans from the company whose equipment is being purchased. He emphasized the importance of careful planning and design prior to the building of facilities.

Additional program sessions during the two-day meeting included "Animal Disease Eradication for Dairy Cattle," by Tom Maddox, State Veterinarian; "Selling Producers on Consumer Concept of Quality Milk," by Clarence Johnson, Capsule Laboratories; "Legal Aspects of Enforcement," by James Goldberg, Goldberg and Pedley, Attorneys; "Alternatives to Conventional Private Sewage Disposal Systems," by Carl Van Cleve, KY Division of Plumbing; and "Pest Control and Your Health," by Verlon Gasser, David Armstrong, and Muriel Blankenship, Kentucky Pest Control Association. In addition, there was "Emergency Planning Around Nuclear Reactors," by John McConnell, Federal Emergency Management Agency; "Psychology of Inspection," by Guy Brupbacher, Louisiana Food and Drug Control Unit; "Wise Use of Chemicals and Antibiotics," by Robert Harmon, University of Kentucky; "IMS-FDA Antibiotic Testing Regulations," by Jim Messer, FDA's Laboratory Quality Assurance; "Health Environmentalists and Their Interaction with the Public," a panel discussion by Irving Bell, KY Consumer Health Protection, William Pickett, Hardin Co. Health Dept., John Draper, Food Control Branch, and Jim Brashear, Kentucky River District Health Dept. The closing session by Edsel Moore, KY Consumer Product Safety Branch, offered ideas on "Amusement Ride Safety."

Left to right, front row: Eugene Catron, Leon Townsend, Walter Carter, James Brashear, Betty Kelly, and Bruce Langlois. Second row: Royce Wood, Ed Napier, Danny Jasper, Dale Marcum, and George Scott. Third row: Lyman Knierem, Ed Aylward, James Erwin, and Roger Barber.

Award winners at the 1981 Education Conference included, Outstanding Sanitarian, William Pickett, Administrator, Hardin County Health Dept.; Outstanding Fieldman Award, Charles Turner, Fieldman, Milk Marketing, Inc.; and Honorary Memberships, R. L. Cooper, Calloway Co. Health Dept.; Richard Foy, Milk Control Branch; Paul Hines, Louisville-Jefferson Co. Health Dept.; Reuben Morath, Northern District Health Dept.; John Rudolph, Paducah-McCracken Co. Health Dept.; and Fred Taylor, Louisville-Jefferson Co. Health Dept.

Officers who will serve the Kentucky Association for 1981 include: President, Dr. Bruce Langlois, University of Kentucky; President-Elect, James Brashear, Letcher Co. Health Dept.; Vice President, Betty Kelly, Franklin Co. Health Dept.; Past President, Leon Townsend, Milk Control Branch; and Secretary-Treasurer, Dale Marcum. Directors include: Western Region, J. W. Erwin; Midwestern Region, Royce Wood and Eugene Catron; North Central Region, Ed Napier, George Scott, Lyman Knierem, Garland VanZant, Ed Aylward, and William Crist; South Central Region, Danny Jasper; and Eastern Region, Walter Carter and Roger Barber.

Calendar

July 13-15---PRINCIPLES OF QUALITY ASSURANCE. Washington, DC. Course sponsored by American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

August 3-5---PESTICIDE RECERTIFICATION. Manhattan, KS. Sponsored by American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

Aug. 9-12---IAMFES ANNUAL MEETING. Sheraton-Spokane, Spokane, WA. Contact: IAMFES, PO Box 701, Ames, IA 50010, 515-232-6699.

Aug. 16-20---HOSPITAL, INSTITUTION & EDUCATIONAL FOOD SERVICE SOCIETY (HIEFSS), 21st ANNUAL MEETING. Hyatt Regency Houston Hotel, Houston, TX. Contact: Carolyn Isch, HIEFSS, 4410 West Roosevelt Road, Hillside, IL 60162, 312-449-2770.

Aug. 17-21---FOOD PROCESSORS ADVANCED MICROBIOLOGY SHORT COURSE. University of California, Davis. Contact: John C. Bruhn, Food Technologist, or Shirley Rexroat, Program Assistant, Dept. of Food Science & Technology, University of California, Davis, CA 95616, 916-752-2192.

Aug. 17-21---21st ANNUAL MEETING, HOSPITAL, INSTITUTION & EDUCATIONAL FOOD SERVICE SOCIETY. Houston, TX. Contact: HIEFSS, 4410 West Roosevelt Road, Hillside, IL 60162.

Aug. 30-Sept. 4---WORLD ASSOCIATION OF VETERINARY FOOD HYGIENISTS. Eighth Symposium. Theme: "Animal Health, Food Safety and the Consumer." Dublin, Ireland. Contact: The Secretariat, 8th WAVFH Symposium, 44 Northumberland Road, Ballsbridge, Dublin 4, Republic of Ireland.

Sept. 14-16---PESTICIDE RECERTIFICATION. Chicago, IL. Course sponsored by American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

Sept. 14-16---AMERICAN CULTURED DAIRY PRODUCTS INSTITUTE, Annual Meeting and Conference. Sheraton Royal Hotel, Kansas City, MO. For information: Dr. C. Bronson Lane, P.O. Box 7813, Orlando, FL 32854.

Sept. 14-18 --- MICROANALYTICAL SANITATION SERIES I (Basic Quantitative). Melbourne, FL. Course sponsored by American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121.

Sept. 15-17---FEMS SYMPOSIUM, "Significance of Indicator Organisms." Netherlands Congress Centre, Churchillplein 10, The Hague, 070-512851. For information: H. J. Beckers, Rijksinstituut voor de Volsgezondheid, Postbus 1,3720BA Bilthoven, The Netherlands.

Sept. 15-17---INTRODUCTION TO FOOD LAW AND REGULATIONS, Chicago, IL. Course sponsored by American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121.

Sept. 15-17---"SIGNIFICANCE OF INDICATOR ORGANISMS," Symposium sponsored by Food Microbiology Section, Netherlands Society for Microbiology. The Hague, Netherlands. Contact: H. J. Beckers, Meeting Secretary, Rijksinstituut voor de Volksgenzondheid, Postbus 1, 3720 BA Bilthoven, The Netherlands.

Sept. 16-18---NEW YORK STATE ASSOCIATION OF MILK AND FOOD SANITARIANS, Annual Conference. Hotel Syracuse, Syracuse, NY. Contact: D. K. Bandler, 11 Stocking Hall, Cornell University, Ithaca, NY 14853.

Sept. 21-25---CONFERENCE OF THE CANADIAN INSTITUTE OF PUBLIC HEALTH INSPECTORS, Ontario Branch. For information: L. A. Lychowyd, Canadian Institute of Public Health Inspectors, Ontario Branch, Inc.

Sept. 22-24---RESEARCH CONFERENCE, FOOD PROTEINS. Sponsored by Faculty of Dairy Science, University College, Cork, Ireland. Contact: Seamus Condon, Dean, Dairy Science Faculty, University College, Cork, Ireland.

Oct. 1-2---WISCONSIN LABORATORY ASSOCIATION, Annual Meeting. Holiday Inn, Eau Claire, WI 54701. For information: Dr. P. C. Vasavada, Chairman, Program Committee, Wisconsin Laboratory Association, P.O. Box 2433, Appleton, WI 54913.

Oct. 4-7---EASTERN FOOD SCIENCE AND TECHNOLOGY CONFERENCE. Conference theme: "The Strategies of Product Development." Host Farms Motel, Lancaster, PA. Conference sponsored by the following regional sections of IFT: Central New York, Maryland, New York, Northeast, Nutmeg, Philadelphia, Pittsburgh, Washington, DC. Contact: Toni Ruth Manning, Conference Chairman, McCormick & Company, 11350 McCormick Road, Hunt Valley, MD 21031, 301-667-7243 for more information.

Oct. 4-9---65th Annual Session, INTERNATIONAL DAIRY FEDERATION, Torremolinos, Spain. For information and registration: Harold Wainess, Secretary, United States of America National Committee of the International Dairy Federation (USNAC), 464 Central Ave., Northfield, IL 60093.

Oct. 7-8---NEBRASKA DAIRY INDUSTRIES ASSOCIATION, 27th Annual Convention Regency West Motel, I-680 and Pacific Street, Omaha, NE. Contact: T. A. Evans, Executive Secretary, 116 Filley Hall, East Campus, University of Nebraska-Lincoln, Lincoln, NE 68583.

Oct. 14-15---NEBRASKA DAIRY INDUSTRIES ASSOCIATION, Annual Convention. Omaha, NE. For information: T. A. Evans, 116 Filley Hall, East Campus, University of Nebraska-Lincoln, Lincoln, NE 68583.

Oct. 19-21---CANADIAN SANITATION SEMINAR. Course sponsored by American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

Oct. 21-22---NORTH CENTRAL CHEESE INDUSTRIES, Annual Conference. Earl Brown Center, University of Minnesota, St. Paul. For information: E. A. Zottola, Secretary-Treasurer, North Central Cheese Industries Association, P.O. Box 80113, St. Paul, MN 55108.

Oct. 22-24---GUM CHEMISTRY AND TECHNOLOGY IN THE FOOD INDUSTRY, Denver, CO. Course sponsored by American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121.

Nov. 15-19---FOOD AND DAIRY EXPO '81, Dairy and Food Industries Supply Association. World Congress Center, Atlanta, GA Contact: Fred Greiner, DFISA, 5530 Wisconsin Ave., Room 1050, Washington, DC 20015.

Nov. 16-19---ADVANCED FOOD MICROBIOLOGY. Manhattan, KS. Course sponsored by American Institute of Baking, 1213 Bakers Way, Manhattan, KS 66502.

Jan. 7-9, 1982---ANALYTICAL AND QUALITY - CONTROL TECHNIQUES, Manhattan, KS. Course sponsored by American Association of Cereal Chemists, 3340 Pilot Knob Road, St. Paul, MN 55121.

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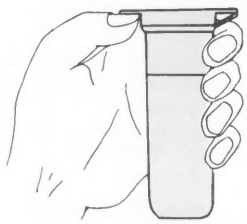

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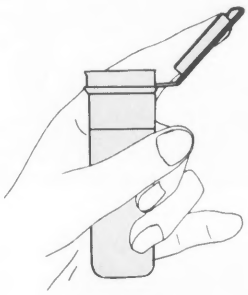

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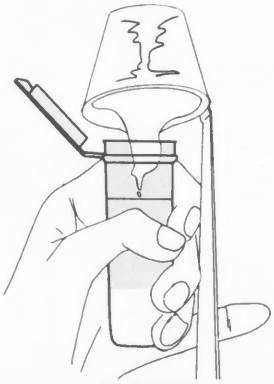

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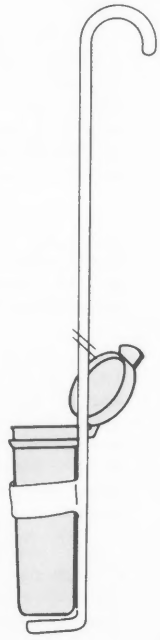

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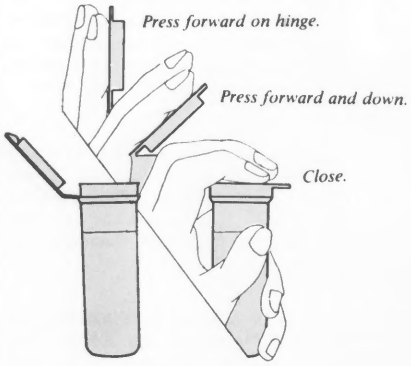

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JFP Abstracts

Abstracts of papers in the July Journal of Food Protection

Effects of Fat Content on the Microstructure of Domiati-Type Cheese, T. J. Kerr, C. J. Washam, A. L. Evans and R. L. Todd, Department of Microbiology, Department of Animal and Dairy Science, Institute of Ecology and Department of Agronomy, University of Georgia, Athens, Georgia 30602

J. Food Prot. 44:496-499

Domiati-type cheese was manufactured from skim milk and milk fortified to contain 6.1% milkfat. At the time of hooping and at 8 weeks of ripening in brine, samples were removed and prepared for scanning electron microscopy. Photomicrographs revealed differences in the internal and external microstructure of the two types of cheese, which became more evident during ripening. The microstructure of the high-fat cheese exhibited the greatest morphological alterations. Addition of a mixed culture to the vat milk did not appear to give rise to any additional changes in microstructure although the presence of microbial cells was readily evident and a more intense flavor developed in the finished cheese.

Hazard Analyses, in Reference to *Bacillus cereus*, of Boiled and Fried Rice in Cantonese-Style Restaurants, Frank L. Bryan, Charles A. Bartleson and Norma Christopherson, U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control, Atlanta, Georgia, 30333, and Washington Department of Social and Health Services, Olympia, Washington, 98504, and Seattle, Washington, 98104

J. Food Prot. 44:500-512

Hazard analyses were conducted in six Cantonese-style restaurants to evaluate the amount of *Bacillus cereus* in rice and the water activity and the temperatures of rice at each stage of processing. Each of 16 samples of raw, polished rice contained *B. cereus*. The water activity of cooked rice ranged from 0.912 to 0.980, and was related to the stage of the processing and storage practice. Rice reached temperatures that exceeded 93 C (200 F) during cooking. Cooked rice held in steam tables was maintained at temperatures that should preclude growth of *B. cereus*. Whenever cooked rice was kept at room temperature for a few hours, the temperatures became such that considerable growth of *B. cereus* could have occurred. Rice in layers less than 9 cm (3.5 in.) thick cooled rather rapidly; layers thicker than 9 cm (3.5 in.) cooled more slowly. During frying and refrying, temperatures exceeded 74 C (165 F). *B. cereus* was frequently isolated from rice at various stages of preparation and storage, but in numbers fewer than 10^3 per g. This organism was also isolated from rice storage pans. Recommendations for preventing problems that could be caused by *B. cereus* as a result of preparation and storage practices are to (*a*) cook only small batches of rice at intervals during the day, (*b*) hold cooked rice at or above 55 C (131 F), (*c*) cool cooked rice in shallow pans in layers less than 9-cm (3.5 in.) thick and (*d*) fry rice so that every grain is certain to reach a temperature of at least 74 C (165 F).

Exposure Time of Warm Leftovers to Temperatures Suitable for Microbial Growth in a Home-Type Refrigerator, Richard R. Ryno and Marion W. Leftwich, David Grant United States Air Force Medical Center, Travis Air Force Base, California 94535 and Department of Life Sciences, College of Marin, Kentfield, California

J. Food Prot. 44:513-515

A home-type refrigerator was used to determine the time of exposure of foods of varying solids content to temperatures suitable for microbial growth. The foods were handled using standard recommended public health procedures. Samples were tested with and without supplementary air circulation. The total time in the temperature range of 140 F to 45 F varied from 13 h to over 22 h. Supplementary air circulation had little benefit in reducing cooling times when used indirectly, i.e., when directed away from the test foods at the bottom of the refrigeration compartment. However, when the supplementary air was directed on the test foods from a distance of 4 inches, the cooling time was reduced by approximately one-half. The time of food exposure to a temperature range most favorable to microbial growth (100 F to 70 F) exceeded 5 h without supplementary direct air circulation, but was reduced to less than 2 1/2 h with direct forced air supplementary circulation. Alternate techniques to reduce the temperature of foods to supplement mechanical refrigeration are also discussed.

Stability and Complexation of Cyanidin-3-Glucoside and Raspberry Juice Extract in the Presence of Selected Cations, D. G. Coffey, F. M. Clydesdale, F. J. Francis, and R. A. Damon Jr., Department of Food Science and Nutrition, University of Massachusetts, Massachusetts Agricultural Experiment Station, Amherst, Massachusetts 01003

J. Food Prot. 44:516-523

The stability and color of purified cyanidin-3-glucoside and raspberry juice extract in the presence of selected metal ions was investigated. Production of metal-anthocyanin complexes was suggested by changes in color of the samples as shown by L, a, and hue angle values. Complex formation was indicated by

HPLC in raspberry juice samples treated with Sn^{++} but not in samples of purified cyanidin-3-glucoside. According to the colorimetric values, complex formation occurs with cyanidin-3-glucoside and Al^{+++} at pH 2.0 and 3.0 and with Sn^{++} at pH 4.0 and 3.0. Similar complex formation occurs with these metals and raspberry juice extract at the same respective pH values.

Preparation and Immunological Properties of a Brilliant Blue-Protein Conjugate, Athanasia Liakopoulou, Arnost B. Vilim and Dennis V. C. Awang, Drug Research Laboratories, National Health and Welfare Canada, Ottawa, Ontario, Canada K1A 0L2

J. Food Prot. 44:524-526

Brilliant Blue F.C.F. (BB), after purification to remove high molecular weight, blue-colored contaminants present in commercial preparations, was conjugated to bovine serum albumin (BSA). Phosphorus oxychloride was used to transform the sulfonate groups of BB to sulfonyl chloride groups; the product of this reaction was then allowed to react further with the protein. The conjugate thus prepared was purified by Sephadex G-25 column chromatography and found to contain 7 moles of BB per mole of BSA. Immunological studies in the rat indicated that neither IgE nor IgG_a antibodies to BB could be detected in the sera of immunized animals. This would tend to suggest that BB possesses a low degree of allergenicity. However, the possibility that some individuals under appropriate circumstances could respond with allergic manifestations to BB cannot be dismissed.

Fate of *Salmonella newport* and *Salmonella typhimurium* Inoculated into Summer Sausage, B. A. Masters, J. L. Oblinger, S. J. Goodfellow, J. N. Bacus and W. L. Brown, American Bacteriological and Chemical Research Corporation, Gainesville, Florida 32601 and Food Science and Human Nutrition Department, University of Florida, Gainesville, Florida 32611

J. Food Prot. 44:527-530

Various fermentation schedules and finishing temperatures used in the summer sausage industry were investigated for their ability to eliminate *Salmonella newport* or *Salmonella typhimurium* inoculated into raw ingredients during the formulation phase of production. Summer sausage was produced with and without the aid of a starter culture. Use of the starter culture, a *Lactobacillus plantarum* strain, provided for a more rapid fermentation and subsequent decrease in pH. Elimination of *Salmonella* was dependent upon the initial contamination level, serotype involved, rate of fermentation and processing temperature.

Growth Effect of Sorbate and Selected Antioxidants on Toxigenic Strains of *Staphylococcus aureus,* C. Lahellec, D. Y. C. Fung and F. E. Cunningham, Department of Animal Sciences and Industry, Kansas State University, Manhattan, Kansas 66506

J. Food Prot. 44:531-534

Effect of potassium sorbate with and without added antioxidants on *Staphylococcus aureus* 196, S-6, 137 and 326 in a liquid system was evaluated. We found (*a*) potassium sorbate a 1, 3, and 5% levels in combination with BHA, BHT, PG (50 and 100 ppm) exerted greater bactericidal and bacteriostatic effects on *S. aureus* strains at pH 5 than at pH 7; at pH 6 the effect was more pronounced at 3 and 5% compared with 1% sorbate, (*b*) TBHQ was highly inhibitory to *S. aureus* strains with or without the addition of sorbate, (*c*) in combination with sorbate, BHA exerted greater bactericidal effects compared with BHT and PG, (*d*) higher concentration of antioxidants exerted more bactericidal and bacteriostatic effects on test organisms, (*e*) *S. aureus* S-6 was more resistant than 196, 326, and 137 in the presence of sorbate and antioxidants and (*f*) shake cultures of *S. aureus* grew better than static cultures in the presence of sorbate and BHA.

Microbiology of Meats in a Hypobaric Environment, L. Restaino and W. M. Hill, Armour Research Center, 15101 N. Scottsdale Road, Scottsdale, Arizona 85260

J. Food Prot. 44:535-538

Growth of total bacteria on fresh meat and heat-processed commodities was analyzed at refrigerated hypobaric and conventional cooler storage. When using the time required for bacterial levels to reach one million/in.^{2} as the estimate of the shelf life, the refrigerated hypobaric storage system substantially extended the shelf-life of broiler chickens, pork loins, bone-in heat-processed hams, and lamb and beef carcasses, as compared to storage in conventional coolers. The dominant microorganism isolated from the surface of the bone-in heat-processed hams stored in hypobaric and conventional coolers was a *Streptococcus* which was resistant to the heat process and tolerant to salt and sodium nitrite. For the fresh meat products, *Pseudomonas* was the dominant microorganism isolated from these products stored in either hypobaric or conventional coolers.

Initial Chilling Rate Effects on Bacterial Growth on Hot-Boned Beef, Daniel Y. C. Fung, Curtis L. Kastner, Chia-Yen Lee, Melvin C. Hunt, Michael E. Dikeman and Donald H. Kropf, Department of Animal Sciences and Industry, Kansas State University, Manhattan, Kansas 66506

J. Food Prot. 44:539-544

We studied the chilling rate of hot-boned beef required to control bacterial growth during storage and display. Hot-boned cuts were chilled to 21 C by 3, 5, 9, and 12 h after their removal

from the carcass. Cuts were vacuum-stored at 2.2 C for 14 or 21 d, then displayed at 2.2 C for 3 days under natural fluorescent lighting. Initial bacterial loads of hot-boned cuts were low (Log 0-3 CFU/cm²). Conventionally chilled beef (48 h at 2.2 C) and hot-boned cuts chilled to 21 C by 3, 5, and 9 h had lower bacterial counts and more desirable color and odor than hot-boned cuts chilled slower (12 h to 21 C). In general, indicator organisms and potential pathogens (coliforms, fecal coliforms, coagulase-positive *Staphylococcus aureus*, *Clostridium perfringens*, and fecal streptococci) were more numerous for cuts with slower chilling rates (9 and 12 h to 21 C) than for cuts chilled faster (3 and 5 h to 21 C and conventionally chilled beef). No *Salmonella* were detected. Hot-boned beef cuts are in good bacteriological condition (no potential health hazards) for storage if chilled to 21 C in 3 to 9 h.

Microbiology of Hot-Boned and Electrostimulated Meat, A. W. Kotula, Meat Science Research Laboratory, Science and Education Administration, USDA, Beltsville Agricultural Research Center, Beltsville, Maryland 20705

J. Food Prot. 44:545-549

Boning of unchilled beef carcasses offers potential savings in energy, labor, safety, yield, and when coupled with electrical stimulation, provides tender beef with good water-holding capacity. Breaking of unrefrigerated beef carcasses into primals, subprimals and manufactured meat products, such as ground beef, provides the potential for increased levels of spoilage and pathogenic bacteria to contaminate the meat surfaces. Research carried out to characterize the influence of hot-boning and electrical stimulation on the microbial levels on beef carcasses, primals, ground beef and meat from other species showed that hot-boning of carcasses of any species need not cause inordinate increases of any groups of microorganisms on or in the resultant meat. The electrical stimulation treatment cannot be clearly shown to be responsible for improved microbial counts but the treatment did not cause an increase in counts. Present microbiological data do not preclude use of electrical stimulation coupled to hot-boning.

Surface Microenvironment and Penetration of Bacteria into Meat, R. B. Maxcy, Department of Food Science and Technology, University of Nebraska, Lincoln, Nebraska 68583

J. Food Prot. 44:550-552

Surface contamination in the form of discrete colony-forming units is the main source of bacteria associated with meat spoilage. The fate of these bacteria is determined by the microenvironment at the meat-atmosphere interface, where the constraints determine the nature of a developing microflora. Nutrients, water availability and nutrient diffusion are prominent factors influencing microbial activity. While surface growth is most commonly recognized through enumeration studies based on removal of microorganisms, the less-studied phenomenon of movement of bacteria may be of considerable significance. In model systems, *Serratia marcescens* moves rapidly in intact meat as well as in compacted comminuted meat. The invasion process may depend on specific enzymes rather than the general class of collagenases. Need for more knowledge about factors that control surface microenvironment of meat is apparent.

Quality Assurance: National and International, Thomas W. Holzinger, Corporate Quality Assurance and Compliance, Dairy & International (Food), Borden, Inc., 990 Kingsmill Parkway, Columbus, Ohio 43229

J. Food Prot. 44:553-555

In this age of instant communication, product quality complaints or adverse publicity originating from any point on the globe can have potentially world-wide repercussions and devastating effects on any firm operating on an international basis. For this reason, effective Quality Assurance must ensure that all products made by a firm throughout the world are safe, wholesome and in compliance with company quality standards and all applicable regulatory requirements. Borden, which operates food and dairy plants in more than 22 countries and markets its products in more than 100 countries, is committed to establish in all non-U.S. food and dairy plants the same standards of product safety and quality required of domestic plants. To achieve adherence to this company policy on a world-wide basis, Corporate Quality Assurance put into effect a comprehensive program entailing a formula approval procedure, quality and process control procedures, a process deviation reporting and evaluating system, plant sanitation inspections, product compliance audits and an effective communication system.

You Are What You Eat, Nancy Braithwaite Topp, St. Mary's Hospital Medical Center, 707 South Mills Street, Madison, Wisconsin 53715

J. Food Prot. 44:556-559

The world's population has two major food problems. One relates to the lack of quantity of the world's food supply and the other relates to the quality of the diet selection. Guidelines are given for wise food selections. There has been a major debate since the Senate's Committee on Nutrition and Human Needs announced the dietary goals for the United States. It supports a low cholesterol, low saturated-high polyunsaturated and high fiber diet for all healthy Americans. This discussion shares the recent stance of the Food and Nutrition Board of the National Academy of Sciences. It encourages further research before hardline decision are made. It reserves major diet modifications for individuals with adnormal clinical findings.

Recipe Hazard Analysis - RHAS - A Systematic Approach to Analyzing Potential Hazards in a Recipe for Food Preparation/Preservation, Edmund A. Zottola and Isabel D. Wolf, Department Food Science and Nutrition, University of Minnesota, St. Paul, Minnesota 55108

J. Food Prot. 44:560-564

A systematic approach to analyzing food preservation - food preparation recipes for potential hazards is presented. The method is based on the Hazard Analysis Critical Control Point (HACCP) concept developed by the food processing industry for identifying potential hazards in processing. The Recipe Hazard Analysis System (RHAS) is used to identify potential hazards in several recipes. Worksheets and the method of analysis are given.

Resolutions Deadline is August 1

The Business Meeting at the IAMFES Annual Meeting will include presentation of resolutions. While many resolutions can be taken care of at that meeting, some resolutions require advance discussion or research. Persons who have such resolutions should send them to the Chairman of the Resolutions Committee, William Kempa, Public Health Inspection Dept. Ryerson Polytechnic Institute, 50 Gould St., Toronto, Ont., Canada 406-595-5154. Resolutions should be submitted before August 1.

Position Available

The position of IAMFES Associate Executive Secretary/Editor will be available December 1, 1981. The position includes responsibility as Editor of *Dairy and Food Sanitation,* and Associate Managing Editor of the *Journal of Food Protection,* as well as some management responsibilities with the Association. Candidates should have a degree and experience in journalism and management or marketing. The application deadline is October 1. Send resume to IAMFES, PO Box 701, Ames, IA 50010.

SOMEONE YOU SHOULD KNOW IN THE DAIRY INDUSTRY

Gerald Prim, Banker

Gerald Prim is President of the Sulphur Springs State Bank in Sulphur Springs, Texas. His bank has been a prime mover in the development of the dairy industry in Hopkins County–consistently one of the top producing dairy counties in the nation. Since starting in the banking business in 1924, he has seen total bank assets grow from $350-thousand to more than $55-million. A large portion of the bank's lending goes to agriculture, and more than half of all agricultural loans in Hopkins County are dairy related.

"Dairying is an important interest for our bank. The percentage of our growth has been right in tune with the percentage of dairying in the county. The reason is that we make loans on cattle, equipment and land if it fits into the total improvement of the farming operation.

"If a person is going to buy equipment, we look at his operation to see if he can afford to pay for it out of his operating capital. If the loan won't work to help a person, sometimes the best service we can provide is saying no to the loan.

Working Relationship Is Important

"You look at a person from the standpoint of how long you'll be dealing with them. If you help them, you'll have a long term relationship. We depend on our customers to send us business because they have been treated fairly. You can't buy that sort of advertising, you have to earn it. I don't believe in buttering a person up. When I say we appreciate their business, I mean it.

"When a person comes in for a loan, it's hard to tell them they're headed in the wrong direction, but I feel you can disagree without being disagreeable. If you, as a banker, have the proper relationship with a customer, both parties will feel they have been treated fairly.

Knowing The Customer's Business

"To make an intelligent decision on a loan request, you have to know the things which make a difference on the operation. For a number of years I milked and fed cows each day while working full-time at the bank. Although I did this to help pay rent, it gave me a good idea of how a dairy needs to operate. This, plus years of looking at applications for farming loans, helps give you a feel for loans which will help a person out.

"One of the reasons Hopkins County is so successful in agriculture is that the former president of this bank, my father, George Prim, saw that milking cows could return more than cotton farming, which was the prevalent form of agriculture at that time.

"He saw that cotton often led to a loan for seeds and fertilizer being paid off and the farmer breaking even. On the other hand, in the 1930's, a dairyman could return five dollars per-cow per-month and make a steady income. As a result, Hopkins County went from producing around 40,000 bales of cotton a year in the 20's, to about 140 bales today. Many of those people who were just breaking even became profitable dairymen, and at least part of the reason is that a banker cared enough about his customers to learn their business. The bank has grown dramatically over the years because our customers have become more prosperous. Our interest in helping our customers succeed comes from knowing about their business.

The Dairyman's Part

"Being a good manager is important to running a dairy operation. Often we find the wife has a better feel for handling money than the dairymen. When a dairy couple works together planning their business, they have a headstart on managing their growth.

"Proper handling of finances requires the important things, the things returning money to the farm, are taken care of first. Payments on animals, land, and the feed bill are made before buying something less important to the farm. When important things are taken care of, people feel comfortable buying something for themselves because they've earned it.

"This, coupled with hard work, gives just about everyone the chance to succeed. Proper financial management will help good dairymen make it because they know the value of tightening the belt when needed."