

VOLUME 15 NO. 2
March — April 1952

John T. Egan

Journal of

MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk and Food Sanitarians, Inc.



Rice Weevil



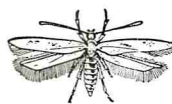
Buffalo Gnat



Fruit Fly



Silverfish



Angoumois Grain Moth

U.S.I.



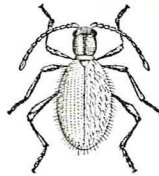
Drugstore Beetle



Mediterranean Flour Moth



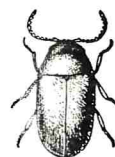
Polistes Wasp



Spider Beetle



Housefly



Cigarette Beetle



Dark Meal Worm

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Saboteurs like these are continually at work—devouring, spoiling and contaminating food and annoying workers—wherever food products are stored, processed or handled. But fast, effective, economical control of these and a wide variety of other insects is possible now with Pyrenone* insecticides.

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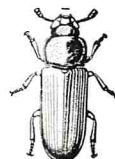
Cadelle



Cheese Skipper

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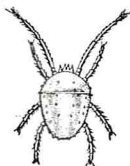
Pyrenone*



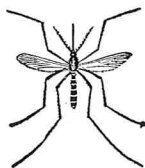
Rust-Red Flour Beetle



Confused Flour Beetle



Clover Mite



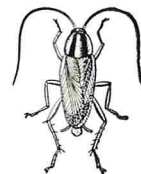
Mosquito



Bald-Faced Hornet

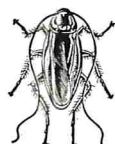


Saw-Toothed Grain Beetle

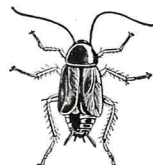


German Cockroach

U.S.I.



American Cockroach



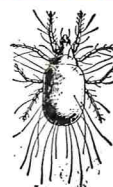
Oriental Cockroach



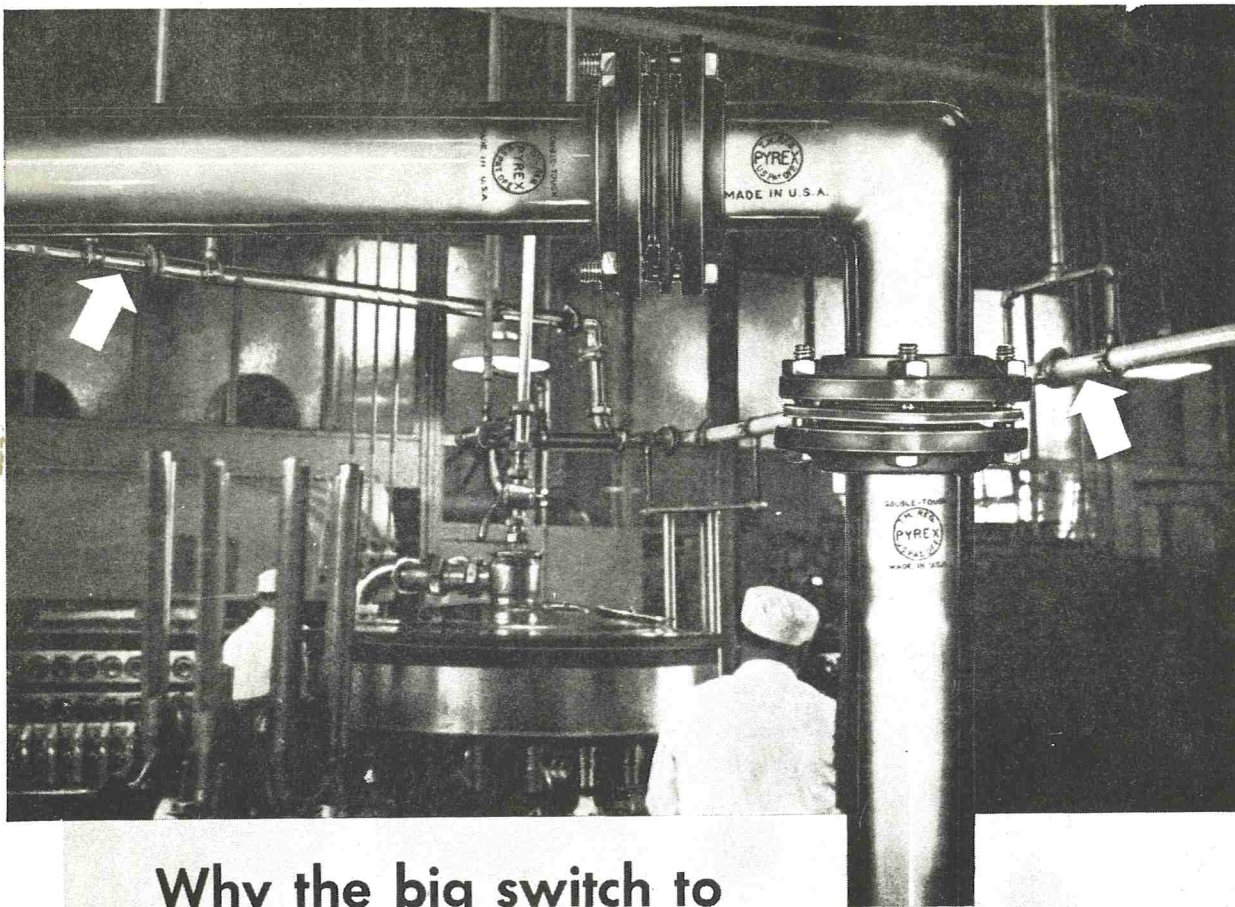
Granary Weevil



Chocolate Moth



Grain Mite

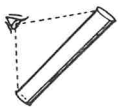


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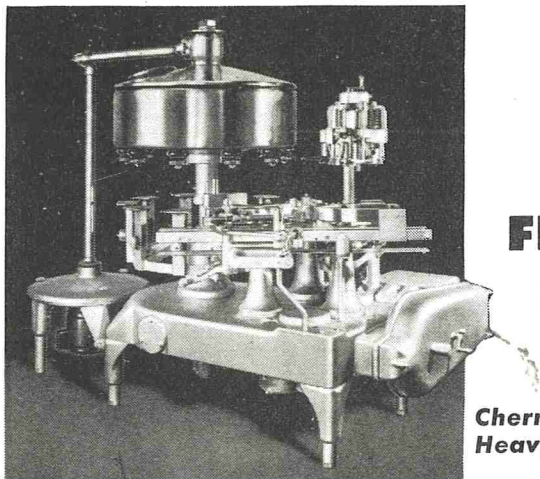


MEET THE

New

"MILWAUKEE" FILLER-CAPPERS!

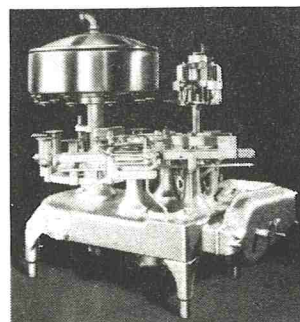
400



"Milwaukee 400" Gra-Vac Filler-Capper. 10-valve type shown; also available with 16 or 20 valves.

Cherry-Burrell's "Work-horse" Line for Heavy Duty, High Volume Production

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INCLUDING MILK AND FOOD SANITATION

Official Publication

International Association of Milk and Food Sanitarians, Inc.

VOL. 15

MARCH-APRIL 1952

NO. 2

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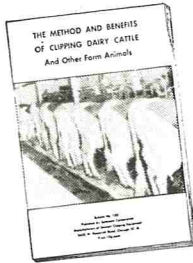
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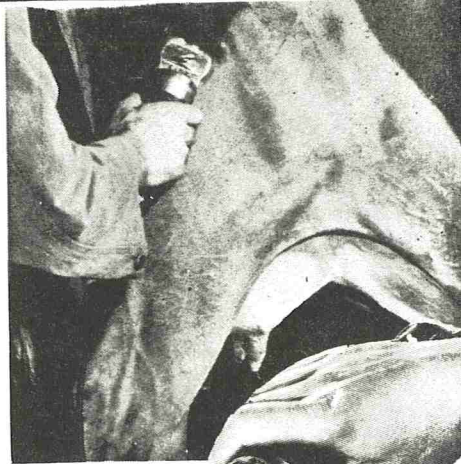
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Leading health authorities say: "A regular clipping program means more wholesome milk. It is an essential step in the production of quality dairy products." Emphasize the advantages of regular clipping. It reduces sediment, lowers bacteria, avoids contamination and increases profits from production of cleaner, higher quality milk.

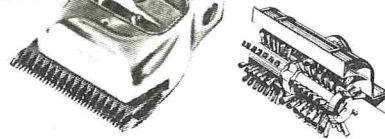


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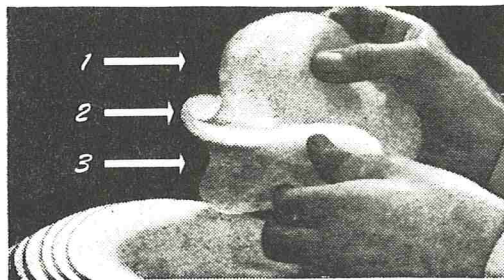
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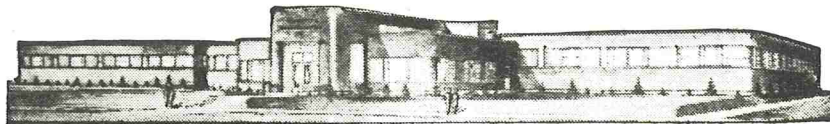
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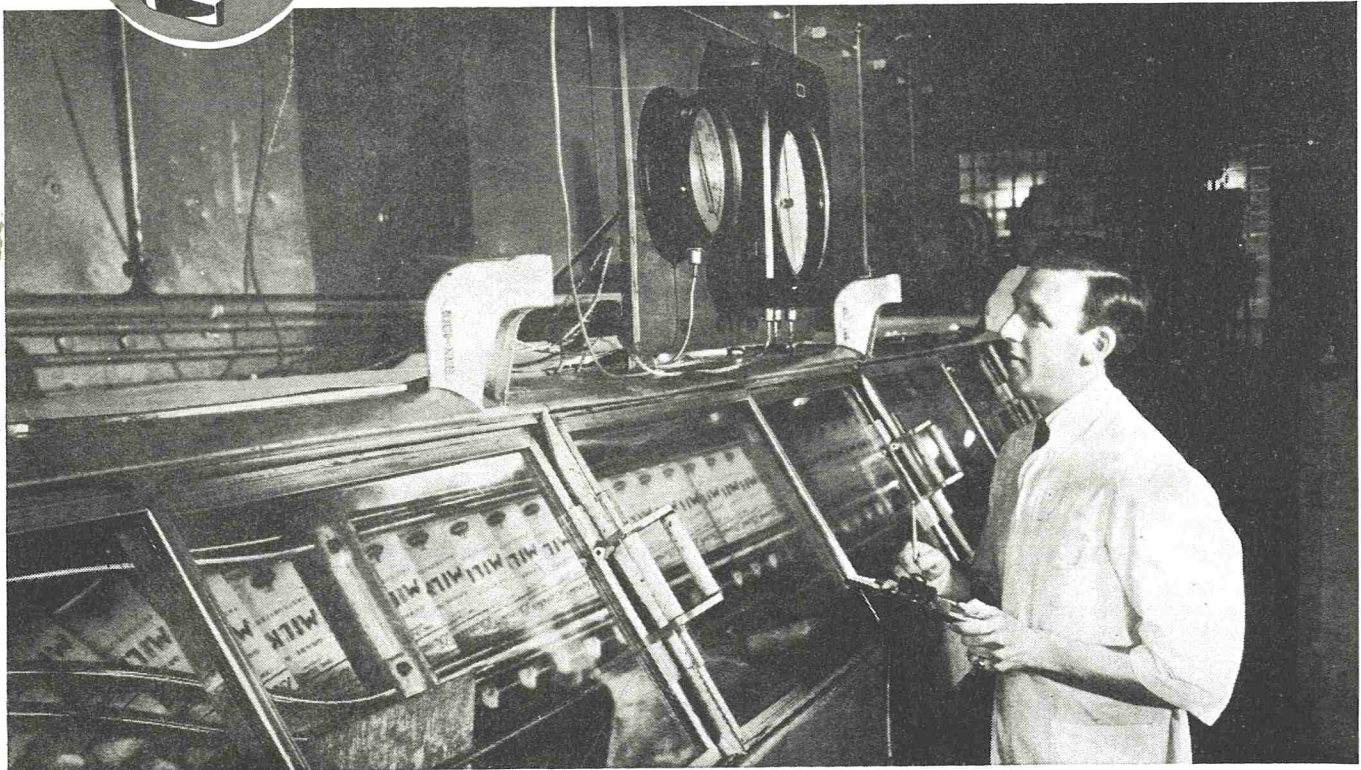
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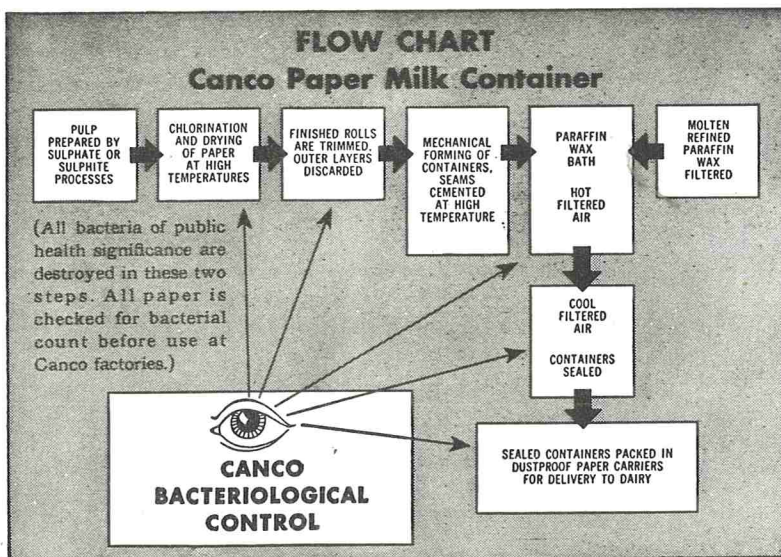
THROUGH THE EYEPIECE

(Crucial Points in Bacterial Control of Canco Milk Containers)



A bath in continuously filtered molten paraffin waterproofs every Canco paper milk container, and is one of the factors contributing to its sterility.¹ (See Flow

Chart below.) Each container is immersed in the bath, and then drained in an atmosphere of hot filtered air. The entire operation is mechanical.



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1. Bulletin 495, University of Illinois, 2-43
2. The Journal of the Texas Public Health Association, 2-50

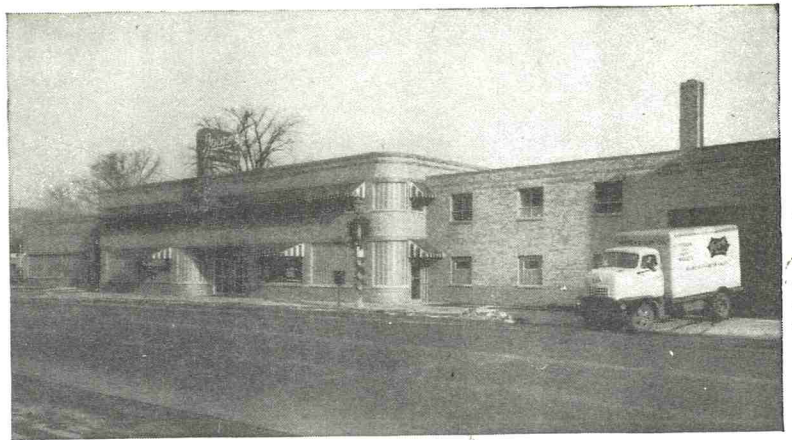
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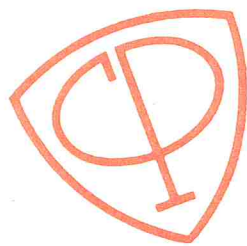
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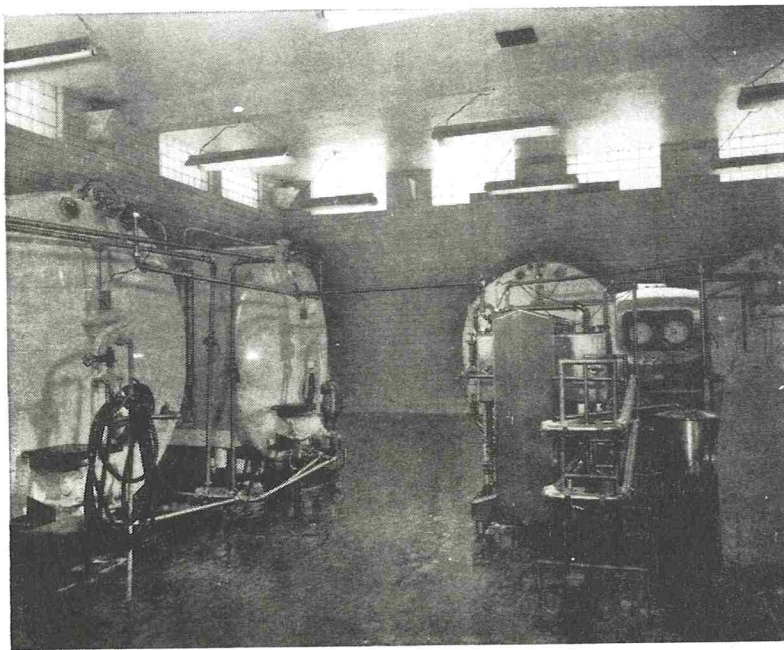
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Cold-Hold
STORAGE TANKS

IN A SYSTEM ENGINEERED FOR THE JOB



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Editorial Notes

AFFILIATION — AN AUTONOMOUS FEDERATION

WORKERS in a given field of food sanitation have learned by experience that they cannot get the best results unless they are in constant touch with current developments. They find that progress is so rapid, both in the rise of new problems as well as in methods and techniques for their solution, that they soon find themselves trailing along behind the procession unless they take great care and effort to acquaint themselves with the new developments.

Generally, this need is met to a large degree by the reading of the current literature. But in addition, more direct contact with workers in the field is needed. This is done by correspondence and occasional conference at some annual meeting where casual meetings between workers occur. Such contacts are helpful as far as they go but they lack the sustained objective motivation that comes from an organization of workers who are engaged in a common task. In an association of kindred minds and related interests, there is a definiteness of objectives that clearly formulates the problems and assembles the best means for illumination of the subject.

In addition, such an organization institutes a great stimulation and encouragement to the workers. It develops an *esprit de corps* in the given field. It provides a source of inspiration, that sparks advance as well as an appreciation. It provides a clearing house for the exchange of ideas. It also affords a means of presentation of papers.

Now the setting up of such a project is an expensive proposition. This becomes almost impossible if a publication is undertaken—and an active organization just cannot function without one. The expense of such an undertaking is bound to run higher than anticipated — and costs keep rising.

All of the above desirable objectives can be attained by workers in the field of food sanitation by affiliating with the International Association of Milk and Food Sanitarians, Inc. Constitutional provision is made for the organization of affiliates, as follows:

“. . . and also functioning organizations of milk and food sanitarians and milk technology societies, or closely related groups whose objectives are consonant with those of this Association may form an affiliated section of this Parent Association under conditions stipulated in the By-Laws

“Each affiliate section shall have the privilege of electing at least one representative who will be a member of this Council”

By such provision, the Affiliate operates autonomously. It functions as it pleases, and by virtue of its membership on the Council has its voice in shaping Association policies.

A section is available in the *Journal of Milk and Food Technology* for regular contributions from the Affiliate. It would carry the masthead of officers, official notices, news items, papers, pictures and correspondence. Other such material would be regularly accommodated. Its circulation of over 4,500 and its distribution to 57 foreign countries gives an immediate service which an independent organization could not get except through expensive effort over many years.

Further information can be obtained by writing to our Executive Secretary, Mr. H. L. Thomasson, Box 286, Shelbyville, Indiana.

J. H. Shrader

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WORKERS in a given field of food sanitation have learned by experience that they cannot get the best results unless they are in constant touch with current developments. They find that progress is so rapid, both in the rise of new problems as well as in methods and techniques for their solution, that they soon find themselves trailing along behind the procession unless they take great care and effort to acquaint themselves with the new developments.

Generally, this need is met to a large degree by the reading of the current literature. But in addition, more direct contact with workers in the field is needed. This is done by correspondence and occasional conference at some annual meeting where casual meetings between workers occur. Such contacts are helpful as far as they go but they lack the sustained objective motivation that comes from an organization of workers who are engaged in a common task. In an association of kindred minds and related interests, there is a definiteness of objectives that clearly formulates the problems and assembles the best means for illumination of the subject.

In addition, such an organization institutes a great stimulation and encouragement to the workers. It develops an *esprit de corps* in the given field. It provides a source of inspiration, that sparks advance as well as an appreciation. It provides a clearing house for the exchange of ideas. It also affords a means of presentation of papers.

Now the setting up of such a project is an expensive proposition. This becomes almost impossible if a publication is undertaken—and an active organization just cannot function without one. The expense of such an undertaking is bound to run higher than anticipated — and costs keep rising.

All of the above desirable objectives can be attained by workers in the field of food sanitation by affiliating with the International Association of Milk and Food Sanitarians, Inc. Constitutional provision is made for the organization of affiliates, as follows:

“. . . and also functioning organizations of milk and food sanitarians and milk technology societies, or closely related groups whose objectives are consonant with those of this Association may form an affiliated section of this Parent Association under conditions stipulated in the By-Laws

“Each affiliate section shall have the privilege of electing at least one representative who will be a member of this Council”

By such provision, the Affiliate operates autonomously. It functions as it pleases, and by virtue of its membership on the Council has its voice in shaping Association policies.

A section is available in the *Journal of Milk and Food Technology* for regular contributions from the Affiliate. It would carry the masthead of officers, official notices, news items, papers, pictures and correspondence. Other such material would be regularly accommodated. Its circulation of over 4,500 and its distribution to 57 foreign countries gives an immediate service which an independent organization could not get except through expensive effort over many years.

Further information can be obtained by writing to our Executive Secretary, Mr. H. L. Thomasson, Box 286, Shelbyville, Indiana.

J. H. Shrader

THE FOOD LAW INSTITUTE

Experienced sanitarians know that their procedures rest on scientific knowledge. The question as to what constitutes insanitation or health hazard poses one set of diagnostic or analytical problems, and the procedure to interpret and correct the condition constitutes the application of additional scientific knowledge. These considerations have been so well recognized that our work has grown in intimate association with research and control laboratories. In fact, the enforcement personnel have practically always been selected from among the medical men, the chemists, the bacteriologists, engineers and others in the learned professions. This practice has resulted in great advances in our knowledge and consequently, in our effectiveness.

Experienced sanitarians recognize just as surely that their objectives are validated under the police powers of the community. They know that this power is interpreted and applied through the discretionary prerogatives of the enforcement officials. These opinions, in turn, rest on the authenticated ideas of competent scientific experts in the fields involved. Enlightened industry and the public cooperate willingly to facilitate applications of sanitation, but there are so many who refuse to cooperate that the program would be in jeopardy if means were not available to force compliance. Uniform and impartial enforcement is absolutely necessary in order that a sanitation program be made effective.

So, we realize that successful utilization and application of the principles of sanitation rests on scientific knowledge and legal authorization. The enforcement program is a dichotomy of science and law.

It is common knowledge that our scientific knowledge has grown by cooperative research. Its findings are recognized as standard and reliable over all the country. There is no such thing as regional scientific knowledge. But the situation is different in the legal area of the basis on which we operate. The legal aspects of our enforcement

procedure have grown up in a more or less hit or miss fashion. The multiplicity of our state and municipal laws, ordinances, and regulations attest the extent of this confusion. Confusion, in turn, declares that we really just don't know what is the most desirable legal basis on which we should work. In the past, this was excusable because we had nowhere to turn for direction. Every community had to work out its own salvation, so to speak. The burden of having to live and operate under such conflicting conditions became so intolerable that finally the U. S. Public Health Service came to the rescue, and inaugurated its program of standard forms of legal requirements—*empirically* ascertained.

What has been needed is some authoritative source of information that will serve us in the legal area as effectively as the scientists have served us in the technical area. On March 16, 1949, the Food Law Institute,* was organized. This is a non-profit, wholly public organization, and its officers receive no compensation.

It was created and is principally supported by leading manufacturers in the food industry, as a contribution by this industry to the national welfare. It was established constructively to develop the law of food, through basic research and education. Therefore it supplements The Nutrition Foundation, Inc., for the latter is also a public organization established by the food industry in 1941 constructively to develop the science of food, through the same means. They are both pioneer organizations playing a new role in food progress; and together they constitute a long-range program of fundamental public service by this industry, in its field. It is a program of enlightened industrial statesmanship in which the food industry duly recognizes its primary responsibility to the science and law on which it is founded; and also the essential need for their constructive development in the general interest.

Its organization and functioning are well described in the Second

Annual Report of its president, Charles Wesley Dunn. In brief, it has founder, sustaining, and public members who are elected by its board of trustees** *Founder* members are food and other interested manufacturers who financially support it by voluntary, public-spirited contributions (ranging mostly from \$1,000 to \$5,000 a year—particularly between \$2,000 and \$3,000). *Sustaining* members are others who financially contribute to it. *Public* members are individual or organized representatives of the public at large, who are interested in its purposes.

The Institute has two guiding objectives: *basic legal research* and *basic legal education*. This is for the constructive development of the food law, beneficial to the public welfare. The Institute has the approval of the American Bar Association, the Association of Food and Drug Officials of the United States, the Federal Security Administrator, the United States Commissioner of Food and Drugs, the Canadian Minister of National Health and Welfare, and the Permanent Secretary of the United Kingdom Ministry of Food (each of the last two administrators the Canadian and United Kingdom food laws respectively).

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*The institute has its offices in Suite 1004, and 608 Fifth Ave., New York 20, New York.

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It sponsors a research program in compilations and studies of the food law. Its first research book is a compilation of the official annual reports in the administration of the original 1906 Federal Food and Drugs Act and the succeeding 1938 Federal Food, Drug and Cosmetic Act, and all the reports from 1907 through 1949.² Numerous additional research books are in preparation or plan.

Equally important is its program of basic legal research and legal education. These are conducted by the sponsoring or research and teaching fellowships, regular courses in curricula, lectures and conferences conducted by leading law schools, among which are those of the George Washington University, New York University, Emory University, Leland Stanford, Tulane, Northwestern, McGill, Harvard, and Duke, and the Universities of California, Illinois, Minnesota, North Carolina, South Carolina, Southern California, and Washing-

In addition, it sponsors the *Food, Drug, and Cosmetic Law Journal*; it fosters public understanding and appreciation of the profound social and economic importance of the food law; it organizes public and industry meetings for the same educational purpose; and it promotes national and international uniformity of the food law.

Here is a centralized, already-functioning, authoritative, highly professional, public-spirited organization engaged in a field of work which we, as food sanitarians, know is valuable and necessary. It is a field in which the International Association of Milk and Food Sanitarians, Inc., has been making contributions ever since we became an organization.

Why not team up?

A public member is a public organization interested in the objectives of the Institute. It assumes no financial obligation to the Institute and no other responsibility toward it. In short: this membership is, in effect, simply a recognition that the Institute has approved objectives with which our Association desires to be connected in the public interest. Any member may resign from the Institute on written notice to it. Our organization is eligible because of its professional character, but election to membership is in the hands of the Board of Trustees of the Institute. We can participate in its program and bring the weight of our influence and perspectives in furthering these common objectives of research, education, and uniformity. The Institute needs what we can contribute. On the other hand, we need what the Institute can give us. We lose no freedom of action; we add to the weight of our public influence; we enhance the professional standing of food sanitarians.

Write us your reactions.

J. H. Shrader

²See book review, this Journal 13, 309 (Sept.-Oct. 1950)

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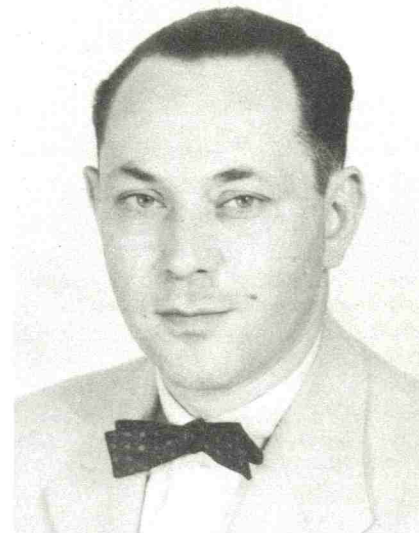
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*"WHIPPED CREAM DISPENSERS - THEIR PUBLIC HEALTH SIGNIFICANCE"

HAROLD WAINESS,

*Milk and Food Consultant, Public Health Service, Federal Security Agency
Region V, Chicago, Illinois*



Mr. Harold Wainess graduated from Purdue University with an A.M. degree in bacteriology. After working as a bacteriologist in several milk plants, he entered the U. S. Public Health Service in 1943 in the Milk and Food Branch, and since then has served in Oregon, Arizona, and now in the Chicago Regional Office. He has published several papers in the field of milk and food technology, the principal ones dealing with high temperature pasteurization and with loose cow housing.

The basic principles of aerating liquids under pressure was applied to the process of aerating or whipping cream. Industry practice as to composition and aeration of cream is presented. Over the years, basic interest in the process was functional with little interest devoted to certain important aspects of sanitation. The most common types of containers currently in use are described. The author has drawn many details from his extensive experience and interest in the public health problems associated with whipped cream dispensers.

IN ALMOST every country where milk and cream is plentiful, whipped cream is used, but nowhere is it used as freely as in the United States.

The art of whipping cream is very simple and very old. The only equipment needed is cold cream, a bowl, and a spoon. By beating the cream with the spoon, some air is trapped in the cream. This air, in the form of tiny bubbles about 1/64" in diameter, becomes coated with fat, with the result that the volume of whipped cream increases by 50 to 100 percent above the volume of liquid cream originally placed in the bowl. With some refinements in tools, such as egg beaters or electrically-driven food mixers instead of spoons, this method of whipping cream is still commonly used in the home, at many soda fountains, and in restaurants.

While it may produce a good product, the above has many disadvantages, among which are the following:

1. Small increase in volume or so-called percent overrun.
2. The product "bleeds out" when standing; therefore, it must be made up fresh for each use.
3. As practiced in public eating places, it is very insanitary.
4. It is expensive per unit volume served.

*Presented at the 37th Annual Meeting of the International Assn. of Milk and Food Sanitarians, October 14, 1950, Atlantic City, New Jersey.

As the demand for whipped cream increased over the years, improved methods of preparing, transporting, storing and dispensing have been sought.

PATENTED WHIPPING PROCEDURES

The process of aerating liquids under pressure, and particularly of carbonating beverages by charging them with carbon dioxide under pressure, has been known and practiced for over a hundred years. Hundreds of patents have been issued for pressure vessels, valves, dispensing nozzles, and other equipment for carbonating liquids. It was logical, therefore, to apply this known art to the process of aerating or whipping cream for which many patents were issued in the period 1930 to 1940.

One of the first published reports of this newer method was that of Getz, Smith, and Tracy¹ in 1936. They reported that: "Whipped cream is produced by aeration by dissolving large quantities of a soluble gas under pressure in liquid cream and then allowing the cream to flow out from under the gas pressure".

Subsequent research^{2,3,4,5}, has described newer applications of the above method with little basic change except the type of gas to be used.

In 1942 one concern acquired two patents, one covering a whipped cream dispenser (Patent No. 2,281,604), and the other covering the process of whipping cream with nitrous oxide gas in a pressure vessel (Patent No. 2,294,172). They marketed their whipped cream product through licensed processors who served the soda fountain and restaurant trade, and for some time enjoyed a monopoly under the protection of their process patent. About two years ago, however, a Federal court found this patent to be invalid, and since then many new methods of whipping and packaging cream have been introduced.

In commercial procedure today, the pasteurized cream (30 percent butterfat or higher), is mixed with sugar, vanilla flavoring, and a stabilizer such as dehydrated egg albumin, dehydrated egg yolk, sodium caseinate, gelatin, or skim milk powder. About 7 fluid ounces of this mix is poured into a 12-ounce pressure container and passed to the gasser, where it is charged with either 85 or 100 percent nitrous oxide and 15 percent carbon dioxide. The gassed cream is shaken violently for 10 to 30 seconds to hasten equilibrium between the cream and gas in the headspace and partly to clump the butterfat. Equilibrium pressures of 75 to 90 psi are usually obtained, producing an overrun of 250 percent, or a yield of 25 liquid ounce volumes of whipped cream from the original 7 ounces.

SANITARY CONSIDERATIONS

Until recently, the emphasis on equipment design was only functional, with little thought given to

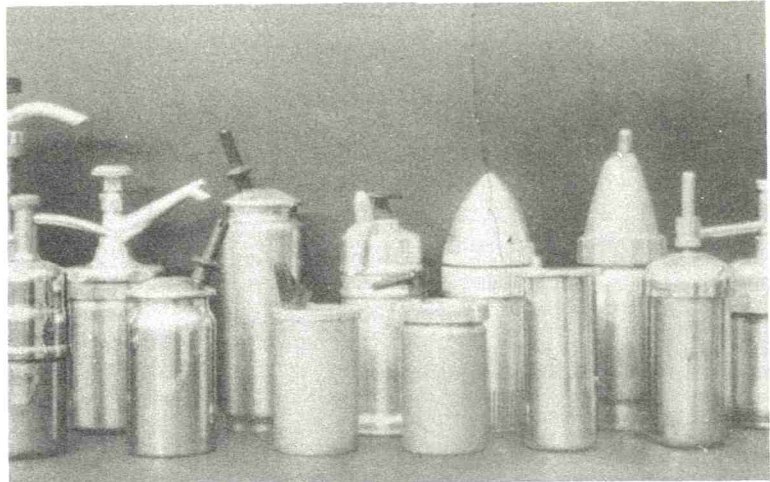
sanitation. As a result, there appeared on the market scores of so-called whipping cream dispensers with a conglomeration of uncleanable parts, blind corners, crevices, narrow tubes, tire valves, small V-threads, fat absorbing rubber porous and corrosive metals, springs, etc.

These dispensers were sold principally to soda fountains for filling and charging at the fountain. Needless to say, few, if any, met even the most elementary sanitary standards. When recharged, they seldom received more than a perfunctory warm water rinse, which was totally ineffective in removing cream from V-threads, tire valves, siphon tubes, and other bacterial traps. Because of the expensive construction and costly cleaning of its many small parts, few dairies ventured into the business of filling the containers at the plants and delivering them to the soda fountain user or the home.

While many soda fountains and restaurants were satisfied to make their own whipped cream, either by mechanical whipping, or by whipping with nitrous oxide gas under pressure, others found the work too involved and preferred to buy the whipped cream ready to serve.

The dangers involved in whipped cream sold to the public were made obvious in the report by Dahlberg and Kosikowsky⁶, who collected 39 samples for chemical and bacteriological analysis. They found that "the total bacterial counts and the coliform counts on the whipped creams were high, the majority of average total counts being in the millions per gram." Another interesting point brought out by their work was the absence of any correlation between flavor characteristics and bacterial or coliform counts.

It is interesting to note that several products with extremely low coliform counts had a poor flavor, whereas samples with total counts over ten million had excellent flavors. This is an answer to the many manufacturers who claim their products remain sweet and have an excellent flavor, although the containers are never completely dismantled for cleaning and bactericidal treatment.



Some Commonly Used Multi-Use Whipped Cream Containers

PLATE 1

TYPES OF CREAM DISPENSERS

Basically there are four types of cream dispensers:

1. The type that is filled, distributed, cleaned and given bactericidal treatment by the local dairy plant.
2. Another type similar to the above, is filled at the point of dispensing by the restaurant where cleaning and bactericidal treatment, when practiced, is also performed.
3. Containers, similar to the above, but containing a gas "bullet" for use both in restaurants and in the home.
4. The "throw away" or single service container, processed and distributed by the dairy plant.

Each type of container, of course, has its particular health problem. From a sanitation viewpoint, containers that are processed and cleaned at the dairy plant present the least aggravating public health problem, while those cleaned in restaurants are a hazard for which no practical antidote has as yet been devised. Plate 1 shows a number of commonly used multi-use containers. Note the variety of shapes, sizes, and methods of dispensing.

Automatic filling equipment is a reality. Adaptions can be made to standard fillers, or a specially built electronic filler can be purchased for this purpose.

The processing of containers at the dairy plant, to meet the requirements of the Milk Ordinance and Code Recommended by the

Public Health⁷ Service, requires the use of automatic capping equipment. To date, no system has been developed that completely meets the requirements of the Code, although there are a few experimental units in use, that, with some changes, can be made to do so. The basic problem lies in the difficulty of fitting the closure or cap to the containers in a mechanical manner. In all but one case the dispensing nozzle is placed on the container by hand.

In the multi-use container the problem of placing the large top on the container and locating the dispensing nozzle itself are problems still to be solved. One concern has devised a tamper-proof cap that cannot be removed without breaking the seal, but this cap is applied by hand. It has been recommended that extreme care be taken during the hand operations to minimize possible contamination and that all portions of the cap or dispenser, including gaskets and plastic covers, be kept in a bactericidal solution until applied.

SINGLE SERVICE CONTAINERS

As the expensive refillable guns could not very well be used by dairies to supply the housewife (which may be the largest market for whipped cream), attention has been directed to providing a cream dispenser inexpensive enough to be discarded when discharged. About three years ago several such "single

service" or "non-refillable" containers appeared on the market, thus offering the dairies a new outlet for cream and enabling them to venture into the business of packaging and distributing whipped cream in a big way.

In a single service container, one experimental apparatus places the dispensing nozzle in a large stainless-steel rotating bowl, in which they are rotated through a chute and placed on the container automatically. However, the method of placing the cap over the dispensing nozzle has not been improved beyond the hand operation.

In the fabrication of single service containers, a number of problems have appeared during the past few years. For example:

1. When toxic paints are used to coat the outside of the container, what method of painting can be used to eliminate the migration of the paint to the inside of the can?

2. What method of shipment shall be employed to safeguard the contents enroute from the fabricating plant to the dairy?

3. What treatment shall be given the can and the dispensing nozzle before filling.

The first problem has been solved by a change in the method of painting and by a recommendation that only non-toxic paints be used for the outside coating. Properly protected shipping containers, as dust-tight as possible, are in use today, with the results that bacteriological contamination of the cans is negligible and chemical bactericidal treatment of all portions of the can that come in contact with the cream is generally practiced before filling.

MULTI-USE CONTAINERS

In the multi-use containers, as will be evidenced from the photographs shown, there is a pronounced need for an educational program, directed at manufacturers, to discourage the use of threads, springs, minute nozzles and tire valves. The need for fabricating a completely demountable container for proper cleaning and bactericidal treatment has *not* yet been fully demonstrated to manufacturers, as evidenced by the many containers now on the market that cannot meet these requirements.

The cleaning and bactericidal

treatment of multi-use containers has not been entirely satisfactory. A number of rather ingenious devices has been submitted, but few of them actually operate in accordance with the Recommended Ordinance and Code.

A few acceptable containers use standard bottle washing equipment for cleaning and bactericidal treatment, which produces excellent results. The dispensing nozzles, and the gaskets in certain types can be washed easily by hand. The latter statement, however, is not true for containers with long siphon tubes or dispensing nozzles. Some mechanical means for cleaning the dispensing assembly must be used. One such machine now in use is divided into 8 tanks, representing separate steps in the cleaning and bactericidal process. The dispensing assemblies are fixed in position on an endless chain conveyor. The valves are first flushed with warm water by means of an air brush, and then all outside surfaces are mechanically brushed. The process is repeated, using detergent under 40 pounds pressure, followed by an application of live steam. The movements of this machine are correlated so that each valve contacts a specific tank throughout the process, and the temperature of all solutions are thermostatically controlled.

It should be pointed out that the basic concept of cleaning and bactericidally treating food containers without complete disassembly is contrary to existing good sanitation practices. It will be necessary to accumulate conclusive evidence of the validity of any method whereby complete disassembly is not practiced before it can be presented to the Public Health Service Advisory Board for consideration. Accumulating this evidence will of course take considerable time and effort on the part of interested industry and health departments.

Plates 2, 3, 4 and 5 show a number of containers in which the dispensing nozzle cannot be removed for cleaning; where the containers are not fabricated of a material that will resist corrosion; where dead ends and square corners are very prominent, and where portions of the container are not accessible to sight or touch even when dismantled.



PLATE 2

Plate 2. This is a container with an excellent exterior appearance, indicating very fine workmanship. This container is activated by placing the dispensing nozzle down, thus releasing a portion of the cream.



PLATE 3

Plate 3. A breakdown of the foregoing container discloses twelve parts, which must be cleaned each time. Note the springs, the small bore equipment and the many threaded areas in the milk zone.



PLATE 4

Plate 4. This is a container presenting rather poor exterior workmanship. Note the dispensing nozzle, which does not come apart and is difficult to clean.

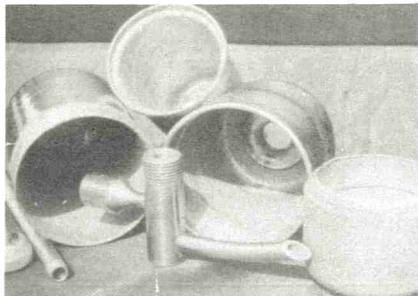


PLATE 5

Plate 5. A breakdown of this container indicates a lack of understanding of basic public health rules. Observe the easily corrodible type of material used in its fabrication. Threads in the milk zone make it difficult to clean the dispensing nozzle.

Plate 6, 7, 8, and 9 denote containers that basically meet sanitary construction requirements.



PLATE 6

Plate 6. This container is undoubtedly the oldest commercial type container that has been used on a large scale. The cream is dispensed by depressing the nozzle.

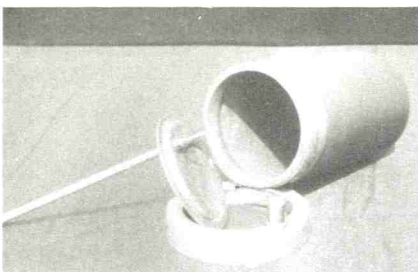


PLATE 7

Plate 7. The latest modification of the above container. The body is now made of stainless steel and is free draining. Note too, that the valve is still of the tire type, although the threads have been removed. This valve can be properly cleaned, provided it is completely dismantled.



PLATE 8

Plate 8. This is one of the newest dispensers and shows excellent workmanship. The outlet cap can be removed only by breaking so that tampering with the contents is impossible. The dispensing nozzle itself is delivered to the restaurant or soda fountain in a separate bag.

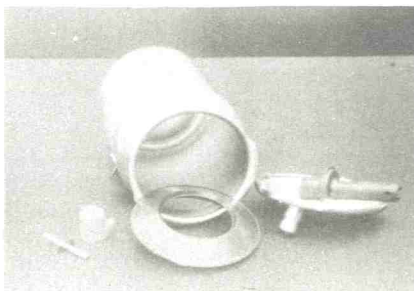


PLATE 9

Plate 9. A breakdown of this container reveals an understanding of sanitary construction. The dispensing valve can be cleaned easily. The container itself has proper radii throughout. The gasket is of the newest type and is relatively non-fat absorbent.

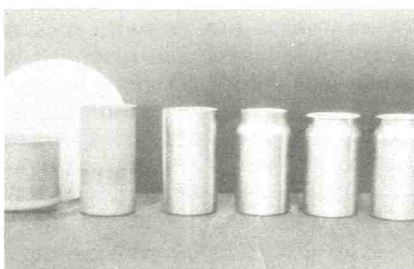


PLATE 10

Plate 10. It is of interest to observe the fabrication of an acceptable container. The container shown in plates 8 and 9 starts with the round blank, is drawn into a bowl, then into a cylindrical shape,

then annealed, necked, lipped, and finally polished inside and out. This method of fabrication has its advantages from a public health standpoint, since no welding or soldering is required, and sufficient radii are thus much easier to obtain.

SUMMARY

The process of whipping cream by introduction of a non-toxic gas has become widespread in the last three years.

Only a few of the containers in use today are designed for proper cleaning and bactericidal treatment.

None of the containers on the market at present meet the requirements of Item 20p of the Public Health Service Milk Ordinance and Code, which requires that the capping of milk and milk products be performed by approved mechanical equipment. Present methods of capping necessitate an unusual amount of handling of the contact surfaces and exposure of the products to air-borne contamination.

The problems posed are of public health significance in view of the excess handling involved. It is surprising that only a few manufacturers have taken steps to develop mechanical means of filling and capping containers, and that so little satisfactory equipment has been introduced to date.

The Advisory Board of the Public Health Service, Federal Security Agency, has not considered modifying the Ordinance to permit the filling and capping of these dispensers other than by approved mechanical equipment.

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MILK PROTEINS†

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THE IMPORTANCE of milk as a food and its availability have for a long time made milk proteins favorite proteins for investigation. In 1838, the great Dutch chemist, Mulder¹¹, who gave proteins their name, devised the method of separating casein by adding acid. It was considered to be a pure protein for almost a hundred years. Early work by Sebelien¹⁹ demonstrated the complexity of the proteins of milk whey, obtained after the removal of casein. A globulin fraction was obtained by saturating whey with magnesium sulfate, and lactalbumin was prepared from the supernatant after the removal of globulin by acidification. Wichmann²⁴ reported the crystallization of lactalbumin from salt solutions. Although others have reported the crystallization of lactalbumin, it is now generally conceded that the crystalline B-lactoglobulin prepared by Palmer¹⁴ constitutes the principal protein of the lactalbumin fraction. Osborne and his associates¹³ devised methods for separating individual milk proteins, and with Wells¹³ determined their purity by immunological means. Sorensen and Sorensen's²⁰ investigations on the albumin fraction of milk whey indicated that a large number of proteins with unique properties are present in small amounts.

Numerous empirical methods have been devised for separating and classifying milk proteins. Determination of nitrogen distribution of milk on the basis of the amount of protein separated by isoelectric precipitation, salt fractionation, and heat coagulation, has given comparative information. These studies showed that cow's milk contains about 3 percent casein and 0.7 percent other proteins.

† Borden Award Address, presented at Protein Symposium, Division of Biological Chemistry, A. C. S. Meeting, Boston, April 4, 1951.

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Because of the biological significance of milk as a food, it was to be expected that milk proteins would have unique characteristics that would differentiate them from other tissue proteins. As compared with other proteins, casein is remarkably stable. In solution it may be heated, or treated with organic solvents, specific denaturing agents such as urea and guanidine hydrochloride, and small amounts of acid or alkali without apparent change in properties. *In vitro*, however, casein is digested with the greatest ease by proteolytic enzymes. It is well known that the ease of digestion of some proteins is greatly increased by denaturation or cooking⁸, which appears to make a more accessible molecular structure by unfolding. Since casein cannot be denatured, it is frequently considered to be already denatured or to have an unfolded structure. Studies of physical properties of casein solutions such as viscosity and streaming birefringence are consistent with the idea that casein is a long molecule resembling denatured proteins.

To determine whether laboratory casein is in fact changed or denatured by the action of acid or alkali during its preparation, casein has been separated from milk at 2° by centrifugation at high velocities, according to the method of Ramsdell and Whittier¹⁸, who isolated casein in its natural state from milk for the first time. The separated casein was converted into sodium caseinate by dialysis against a solution of sodium chloride, thus avoiding any change in acidity during its preparation. Measurements of optical rotation were used for detecting and measuring denaturation of casein, as it is well known that the denaturation of a protein is accompanied by a large increase in its negative specific rotation. A value of $[a]^{25}_D$ of -101 was obtained for the specific rotation of casein solutions, at pH 6.9 prepared without acid or alkali; this value is identical with that given by casein solutions prepared by means of acid



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and alkali. The rotations of both these caseins were unchanged by heating in solution. A slight increase in the value for the specific rotation of each was obtained when they were treated with 5-molar guanidine hydrochloride. When the guanidine hydrochloride was removed, however, the values for specific rotation returned to their previous values, showing that the effect of guanidine hydrochloride was that of the solution rather than a denaturation of the casein. In contrast, B-lactoglobulin, occurring in milk to the extent of only 0.4 percent behaves as a typical tissue protein in that it denatures easily; its specific rotation is increased from a value of $[a]^{25}_D$ of -43 at pH 8.5 to a value of -80 by heat, and to a value of -114 by guani-

dine hydrochloride. These results suggest that casein occurs in milk in an unfolded configuration, which may be rapidly digested by proteolytic enzymes.

In undertaking a program of separating and purifying individual proteins of milk, it was important to determine whether the same proteins are always present in milk in the same relative amounts. The electrophoresis method of Tiselius was used for this study. The electrophoretic compositions of the proteins were determined on individual samples of milk obtained at regular intervals from four cows over their complete lactating cycles, including gestation. As shown in figure 1, there are four principal electrophoretic components in the proteins of skim milk. When casein was separated from whey by adjusting the pH to 4.7 and centrifuging, three of the electrophoretic components were found to be casein, amounting to about 80 percent of the total protein of milk. Since the proteins of whey amount to only 20 percent of the total protein of milk, it was desirable to separate them from casein before making electrophoretic determinations. The electrophoretic components of casein obtained from the milk of three cows were remarkably constant in area and mobilities throughout the lactating cycle. The electrophoretic components of some of the samples of casein from the fourth cow, however, varied, in that the α -casein component was split into two

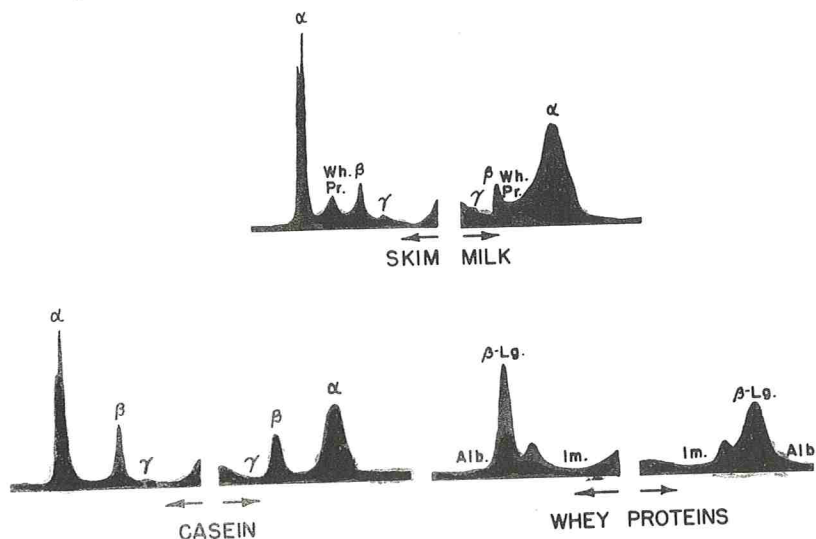


Fig. 1. Electrophoretic patterns of milk proteins in veronal buffer at a pH of 8.35 with an ionic strength of 0.1. Wh.

pr., whey protein; B-Lg., B-lactoglobulin; Im., Immune; Alb., Albumin.

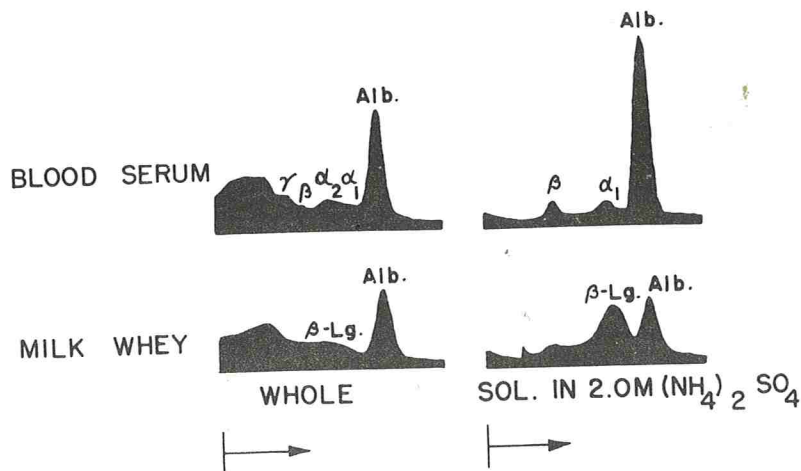


Fig. 2. Comparison of electrophoretic patterns of milk whey during the dry period (27 days before parturition) with the electrophoretic pattern of blood serum; veronal buffer, pH 8.35; ionic strength, 0.1. Alb., albumin; B-lac-

toglobulin. Blood serum mobilities: -3.1×10^{-5} (B-globulin); -5.2×10^{-5} (α_1 globulin); -6.8×10^{-5} (albumin). Milk whey mobilities: -2.8×10^{-5} (unidentified); -5.2×10^{-5} (B-lactoglobulin); -6.7×10^{-5} (albumin).

components. This is of interest in connection with the finding of Nitschmann and Lehmann¹² that the clotting of casein by rennet is associated with a split in the electrophoretic pattern of α -casein. Our results on the clotting of the separated components of casein showed that all the components of casein clot with rennet, and therefore a theory of clotting of casein based on the action of rennet on only one component is inadequate.

The relative amounts of the protein components of whey varied considerably more than did the components of casein during the lactating cycle. The amount of colo-

strum globulin or immune globulin in whey increased markedly, beginning at 70 days before parturition. Also, the fast-moving component of whey, with the mobility of serum albumin, increased markedly at the end of the lactating cycle. This albumin component of milk has been crystallized by Polis, Shmukler, and Custer¹⁶ from commercial mixed milk and shown to have the properties of blood serum albumin. Coulson and Stevens² demonstrated that this milk albumin is immunologically equivalent to blood serum albumin. As shown by the electrophoretic pattern, the whey fraction obtained from the cow's udders during the dry stage (about 27 days before parturition) contained a large amount of albumin. There is a marked similarity between the electrophoretic patterns of the whey proteins at this stage and those of the blood serum proteins (figure 2). The pH of the contents of the cow's udder at this stage is 7.4, the same as that of blood. On the day of the birth of the calf, however, the pH contents of the udder drop rapidly to the normal value of 6.6, presumably owing to the secretion of casein.

As shown by its electrophoretic pattern in figure 1, casein is a mixture of at least three components, which have been designated α -, β - and γ -casein in the order of their decreasing mobilities. The chemical separation of these components has been a difficult task. All the

evidence, based on reproduction of properties of the unfractionated casein by mixing the separated components, shows that casein is a mixture. The properties of the mixture, however, are different from the properties of the pure components and give comfort to those who have felt that casein is a homogeneous substance. Interaction between the components of casein is so pronounced that the properties of the individual components, such as solubility, are greatly modified when present in mixtures.

Three methods for separating the components of casein have been devised in our laboratory, and probably the success of each method is to a large extent due to finding conditions that minimize interaction between the components. The first of these methods was developed by Warner²³, who discovered that *a*- and *b*-casein could be separated by repeated reprecipitation from dilute solutions near the isoelectric point at 2°. Effective separations were obtained by this method. The method, however, is tedious, making the separation of the components in quantity difficult. The method by Hipp *et al.*⁵, based on solubility in 50 percent alcohol in dilute salt solutions at different pH values, has been successfully used in separating the components of casein in larger amounts. Recently it has been found that the casein components can be most easily separated by means of urea solution. The properties and compositions of the components of casein prepared by these three methods are the same, indicating that casein is a mixture of proteins and that these components are not decomposition products.

Although the three caseins have the same general properties, such as insolubility at the isoelectric point, and are closely associated, they differ markedly in amino acid composition, as shown by Gordon *et al.*³ in a complete amino acid analysis of these proteins. Calculations based on the amino acid content of these caseins reveal their relative polarity. *a*-casein contains 291 ionic groups and 965 nonpolar CH₂ groups per 10⁵ grams, whereas *b*-casein contains 219 ionic groups and 1567 nonpolar CH₂ groups per 10⁵ grams. If the ratio of ionic

groups to the nonpolar CH₂ groups may be considered as a measure of polarity, then these calculations based on the amino acid composition indicate that *a*-casein is about twice as polar as *b*-casein. This calculation does not take into consideration the nonionic polar groups, because there are about an equal number in *a*- and *b*-casein. Polarity calculations, based on the ratio of the solubility in 50 percent alcohol to the solubility in water, also indicate that *a*-casein is about twice as polar as *b*-casein (6), thus demonstrating a relation between the amino acid composition and the solubility of these caseins.

After casein, *b*-lactoglobulin is the next most abundant protein in milk, constituting about 12 percent of the total protein. Milk also contains numerous other proteins in small quantities, some of which are enzymes. The isolation of *b*-lactoglobulin in crystalline form by Palmer¹⁴ has furnished protein chemists with one of the most attractive proteins for investigation, in spite of the fact that it is electrophoretically inhomogeneous⁷. Although one of these components has been isolated in our laboratory¹⁷, no difference in composition has been detected between the electrophoretically pure component and unfractionated *b*-lactoglobulin. Remarkably large *b*-lactoglobulin crystals can be obtained with ease by crystallizing from dilute salt solutions. McMeekin and Warner⁹ determined directly the composition of *b*-lactoglobulin crystals suspended in water and concentrated ammonium sulfate solutions. The crystals were analyzed for water content by removing an individual crystal from the supernatant liquid. Surface liquid was removed by blotting, and the loss of water was determined by weight as a function of time. The water content of the crystal was obtained by subtracting the weight of the completely dried crystal from the weight of the crystal at the time of removal from the suspending liquid. The *b*-lactoglobulin crystals contained approximately 50 percent water rather than 20 percent, as given by the indirect method of Sorensen and Hoyrup²¹. Figure 3 illustrates the rate of loss of water by crystalline *b*-lactoglobulin when expos-

ed to the air. It was found that the rate of loss of water follows a first-order equation, being proportional to the logarithm of the water remaining in the crystal until about 70 percent of the water is lost. This indicates that the vapor pressure of the water in the crystal does not change until most of the water is lost.

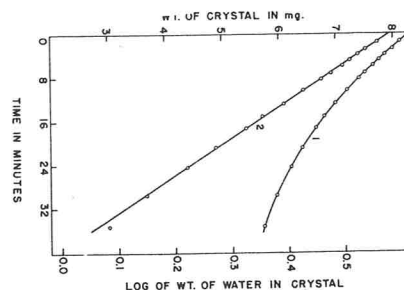


Fig. 3. Rate of loss of water by *b*-lactoglobulin crystal at room temperature. 1, loss in weight of crystal as a function of time; 2, logarithm of weight of water in the crystal shown in 1.

It was found also that ammonium sulfate went into *b*-lactoglobulin crystals, and on the basis of the water content of the crystal reached approximately 80 percent of the concentration of the suspending ammonium sulfate solution. In view of the results of Adair and Adair¹ based on density determinations, this finding was expected. The fact that salt diffuses into protein crystals accounts for the low results obtained for the water content of protein crystals by the method of Sorensen and Hoyrup.

To investigate the penetration of molecules into protein crystals, it is necessary to select conditions in which the protein crystal is relatively insoluble. *b*-lactoglobulin crystals are relatively insoluble in water and concentrations of ammonium sulfate greater than 2 molar. In more dilute solutions of ammonium sulfate, however, it is soluble. Consequently, sucrose, a nonelectrolyte in which *b*-lactoglobulin is relatively insoluble, was used to study the effect of concentration of the suspending medium on the composition of the protein crystal. The penetration of the protein crystal by sucrose was determined by density determinations on the crystal and by direct analysis. Figures 4 and 5 show the results. The density of the protein crystals was de-

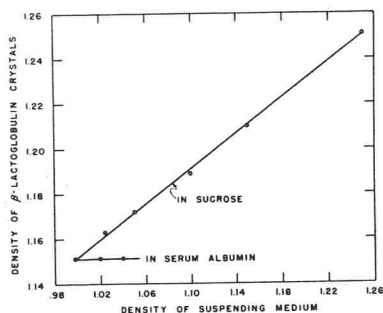


Fig. 4. Densities of β -lactoglobulin crystals equilibrated in sucrose and serum albumin solutions.

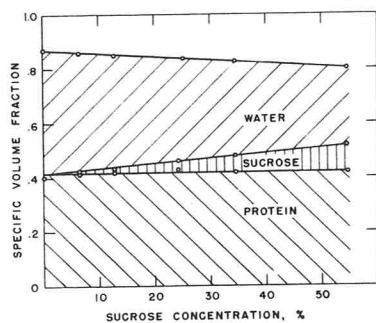


Fig. 5. Volume fractions of sucrose, protein, and water in crystals of β -lactoglobulin expressed as a function of concentration of sucrose in the suspending medium.

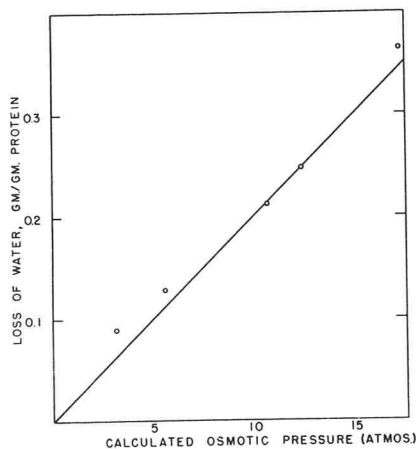


Fig. 6. Relationship between loss of water by β -lactoglobulin crystals and the osmotic pressure of the difference between sucrose in the crystal water and that in the suspending medium.

terminated in bromobenzene-zylene mixtures after equilibrating in the suspending medium. Figure 4 illustrates that the density of the protein crystal is proportional to the density of the sucrose suspending medium. When the suspending medium was a solution of serum

albumin, however, there was no increase in the density of the protein crystals. These results indicate that sucrose penetrates β -lactoglobulin crystals and that serum albumin, presumably because of its much larger size, does not.

The composition of the protein crystal is graphically illustrated in figure 5 as a function of sucrose concentration in the suspending medium. It may be seen that there is a reciprocal relationship between the amount of sucrose and water in the protein crystal. The total volume of crystal, however, decreases with increasing concentrations of sucrose owing to loss of water not replaced by sucrose. That the forces controlling the distribution of water and sucrose in the protein crystal are largely osmotic is indicated by the straight line relation obtained when the loss in water by the crystal is plotted against osmotic pressure of the difference between the sucrose in the crystal water and that in the suspending medium (figure 6).

There are exceptions to these results which indicate that osmotic forces govern the composition of protein crystals suspended in solutions of small molecules. Thus when β -lactoglobulin crystals are suspended in saturated solutions of lithium bromide or chloride, the concentration of salt is greater in the crystal when calculated on the basis of crystal water than in the suspending medium. This result indicates that these lithium salts combine with the protein in the crystal. Sorensen and Palmer²² have reported that the ammonium chloride content of β -lactoglobulin crystals suspended in dilute ammonium chloride is greater than in the suspending solution.

The water content of protein crystals has been considered to be of two kinds — bound and free¹⁵. The apparent "nonsolvent" water calculated from the difference in concentration of a reference substance in the water of the protein crystal and the suspending medium has been considered to be a measure of the bound water or hydration of the protein. Perutz¹⁵ reported a value of 0.3 gram of water per gram of protein for the hydration of hemoglobin in ammonium sulfate solutions. The results of calculations of "nonsolvent" water in

β -lactoglobulin crystals suspended in different concentrations of sucrose are shown in figure 7.

It is apparent from these results, based on large variations in sucrose concentration, that "nonsolvent" water values vary widely with concentration of sucrose and that there is no obvious basis for dividing the water of crystallization into two kinds. It appears plausible to relate the degree of hydration of protein crystals to the osmotic environment, in a manner similar to the relation of vapor-phase water absorption of proteins to vapor pressure. Thus, weakly polar groups such as the peptide bond may hold water loosely as suggested by Mellon *et al.*¹⁰. According to this view the hydration of a protein crystal varies with the osmotic environment. Previous studies on the "nonsolvent" water of protein crystals suspended in salt solutions have used such small changes in salt concentrations and vapor pressures that changes in hydration were not detected.

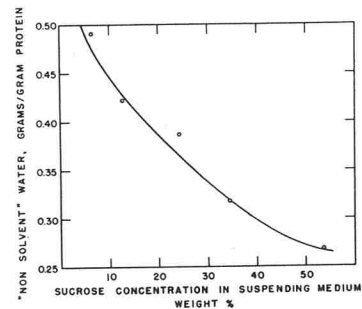


Fig. 7. Effect of sucrose concentration in the suspending medium on the "nonsolvent" water in β -lactoglobulin crystals.

When β -lactoglobulin crystals are equilibrated with water or a dilute salt solution, the solution tends to become more alkaline with time and show some indication of decomposition. This fact and other considerations led to a systematic study of the stability of β -lactoglobulin solutions as a function of pH and temperature. Groves *et al.*⁴ found that β -lactoglobulin denatures in relatively mild alkaline solutions and that the rate of denaturation increases rapidly with increase in alkalinity. Denaturation was followed by insolubility at the isoelectric point and by increase in optical rotation. When the loga-

rithm of the undenatured protein is plotted against time, a straight line is obtained, as shown in figure 8, indicating that denaturation is a unimolecular reaction. The rate of denaturation was proportional to the first power of the hydrogen ion concentration between pH 8-10, as may be calculated from figure 9. This results suggests that pH denaturation involves one group in the β -lactoglobulin molecule. The surprising result was obtained that the rate of denaturation of β -lactoglobulin is the same at 3° as at 25°. The rate of denaturation of proteins, like other chemical reactions, usually increases rapidly with temperature. Solutions of crystalline β -lactoglobulin containing 2 molecules of the detergent dodecyl sulfate combined with each molecule of β -lactoglobulin are much more stable to alkali than without the detergent (figure 9). The rate of denaturation of this protein derivative has a normal temperature coefficient, being much greater at 25° than at 3°.

These results on the origin, separation, composition and properties of the proteins of milk constitute a brief summary of some of our studies on protein structure, uses and behavior.

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MICHIGAN ASSOCIATION OF SANITARIANS

The Annual Meeting of the Michigan Association of Sanitarians will be held in the evening of April 9, 1952 at Michigan State College, East Lansing. One of the guest speakers will be Mr. H. L. Thomasson, President of the International Association of Milk and Food Sanitarians, who will talk on the advantages of belonging to the Association.

The meeting will be held at the same time as Ninth Annual Dairy and Food Sanitarians School of Michigan State College. The school will be held April 8, 9, 10, and 11.

The program is as follows:

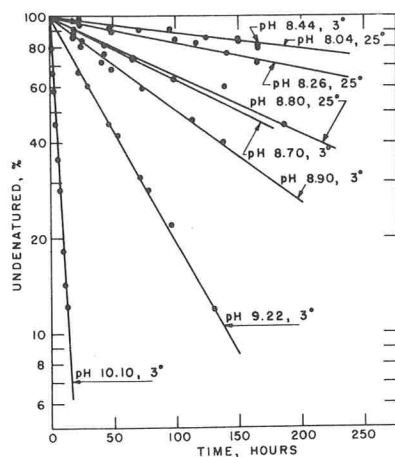


Fig. 8. Effect of pH on the velocity of denaturation of β -lactoglobulin in veronal buffer at 3 and 25°.

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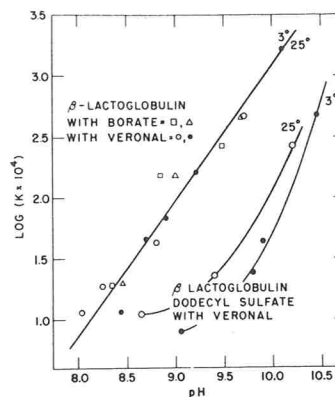


Fig. 9. Comparison of the effects of pH and temperature on the velocity constant of denaturation of β -lactoglobulin and β -lactoglobulin dodecyl sulfate. \square , borate at 25°; \triangle , borate at 3°; \circ , veronal at 25°; \bullet , veronal at 3°.

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ACTION OF ALKYL-DIMETHYL-BENZYL AMMONIUM CHLORIDE ON SOME ORGANISMS CAUSING BOVINE MASTITIS

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A commercial preparation of alkyl-dimethyl-benzyl was examined for its effectiveness in destruction of bacteria commonly associated with bovine mastitis. Cold aqueous solutions of this compound may have value as an added safeguard when used as a disinfecting rinse for dairy farm equipment against organisms of bovine mastitis if used following a carefully planned rinsing and washing procedure including boiling water. It cannot be depended upon to disinfect in conjunction with cold washing procedures.

SEARCH continues for more efficient chemicals for use by dairy farmers in maintenance of milk equipment at required standards of bacteriological safety. In certain operations such as care of milking machines, complete kill of those bacteria associated with bovine mastitis is important as an aid in preventing spread of this disease. This investigation was undertaken to determine the efficacy of a mixture of high molecular alkyl-dimethyl-benzyl ammonium chlorides as a disinfecting rinse in effecting 100 percent kill of three organisms commonly known to be associated with bovine mastitis and the suitability of this chemical for use in disinfecting milking machines. Claims of high phenol coefficient values have been made by manufacturers and distributors of these compounds. Inconsistent results using the official Association of Official Agricultural Chemists phenol coefficient method (1) tends to throw doubt on the validity of these claims. This has been noted by Klarmann and Wright (11) and Dunn (4, 5).

Organic matter influences activity of quaternary ammonium compounds. Methods of evaluating and studying this influence have been devised by numerous workers (Ruehle and Brewer 20; Stuart 22; Mallman and Hanes 14; McCulloch 15; Klarmann and Wright 10; DuBois 2; Nolte and James 17, 18; Mallman 13). Generally speaking all agreed that some inactivation took place which rendered the com-

ound less efficacious as a bactericide.

Investigations on use of quaternary ammonium compounds in the dairy industry have been scant and sometimes inconclusive. Krog and Marshall (12) found alkyl-dimethyl-benzyl ammonium chloride to be of definite value in reducing bacterial flora in pasteurizing plants when used following cleaning operations. Reduction of bacterial populations was thought due to removal during rinsing as well as to germicidal activity. Frayer (6) used several non-chlorine materials recommended for dairy use. Among these was alkyl-dimethyl-benzyl ammonium chloride which he declared effective against bacteria after 15 minutes exposure. His results showed large reduction in bacterial numbers but not total kill.

Dubois and Dibblee (3) have studied the influence of surface cationic germicides on the bacterial population of milk. When varying concentrations of germicide were added directly to milk samples at three different temperatures, no appreciable influence on bacterial counts of raw or pasteurized milk was noted. This was especially true of alkyl-dimethyl-benzyl ammonium chloride. They did note that when inhibition occurred, gram-positive, acid-producing microorganisms were more readily affected than gram-negative ones. Mueller, Seeley, and Larkin (16) showed that quaternary ammonium compounds were effective against such organisms as *Escherichia coli*, *Micrococcus pyogenes* var. *aureus*, thermophilic types of bacteria and the vegetative cells of *Bacillus cereus*. Efficiency of these compounds decreased when organic matter in the form of milk solids or cow manure was added. Metal parts of milking machines showed lower bacterial counts than rubber parts sanitized with the same concentration of quaternary ammonium compound.

Hughes and Edwards (8) investi-



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gated the effect of cetyl trimethyl ammonium bromide on *Streptococcus agalactiae* and found it to be effective in reduction of spread of infection when incorporated in a wax base and used as a salve on the living animal. Spurgeon, Elliker, Harper, and Froedge (21) conducted studies comparing the effect of quaternary ammonium compounds and hypochlorites on *Streptococcus agalactiae* present on teats and milking machines. There are no pronounced differences in the effectiveness of the two types of germicides. They found that the presence of milk on the milking machine nullified the action of residual germicide and that while germicides applied to teats did lower counts about 90 percent, enough bacteria remained to continue infection. When the number of organisms inoculated onto teat cups was low, successive dippings in the germicide at temperatures of 21° C. and 51° C. usually prevented recovery of *Streptococcus agalactiae*.

MATERIALS

Contaminated Carriers. *Micrococcus pyogenes* var. *aureus* 209, *Escherichia coli*, and *Streptococcus agalactiae* M2-31, commonly associated with bovine mastitis,

were used as test organisms.* The 24-hour growth from a slant of the test organism was washed off with sterile physiological saline. The suspension was standardized to give 50 percent light transmission by means of a Fisher AC model electrophotometer (4250 A° filter). The number of bacterial cells in 1 ml. was calculated by inoculating decimal dilutions in suitable broth and noting the endpoint of growth. This method indicated an approximate population of 10 million per milliliter for *M. pyogenes* var. *aureus* 209, 100 million per milliliter for *E. coli*, and 10 million for *S. agalactiae* M2-31. To 0.5 ml. of standardized suspension, 9.5 ml. of sterile whole milk were added. Milk was used as a diluent to stimulate as nearly as possible conditions that would be found on used dairy equipment.

Sterile stainless steel rods were immersed in the milk-organism suspension for 15 minutes. The rods were then removed, placed in large tubes containing gauze to absorb drainage, lightly plugged with cotton, placed in a Weiss-Spaulding anaerobic jar which was connected to a vacuum pump (Cenco Hyvac), and the top sealed. The jar was evacuated for 15 minutes during which time the film became dried on the rod. Repeated trials showed that the 3 organisms remain viable when treated in this manner.

Rinses. The dairy industry generally uses a series of 3 rinses and washes before treatment of equipment with a sanitizing agent. For these studies the following basic routine was adopted and studied as applied *in toto* or in part: (1) cold water rinse (room temperature), (2) a hot detergent wash (62.5°C.), (3) a boiling water rinse (100°C.), (4) a chemical sanitizing rinse at 20° C. and 23° C., and (5) a final cold water rinse. Distilled water was used for all cold and boiling water rinses. The detergent,

G.L.X. (Wyandotte)*, was diluted in the ratio of 1 ounce per gallon of water. Proper temperatures were maintained in a constant temperature water bath. Rinses and washes listed above were placed in sterile test tubes in 20 ml. amounts so that the contaminated area of the test rod was always completely immersed.

Culture Media *M. pyogenes* var. *aureus* 209 and *E. coli* contaminated rods were cultivated after medication in F.D.A. broth (20) and letheen broth (19). For culturing *S. agalactiae* M2-31, tryptose phosphate broth (Difco) and tryptose phosphate broth with lecithin and Tween 80 added were used. The lecithin and Tween 80 were added to the tryptose phosphate broth in the same manner as described by Quisno, Gibby, and Foter (19). These media were also used for subculturing any tube showing negative or doubtful results after 48 hours incubation at 37° C.

Medicant. Alkyl-dimethyl-benzyl ammonium chloride (10 percent active ingredient technical grade) † was the medicant employed. It conformed to the chemical specifications given for benzalkonium chloride in the U. S. Pharmacopoeia XIII, 1947 (24). Dilutions equivalent to 1 ounce in 4 gallons (1 : 5120); 1 ounce in 3 gallons (1 : 3840); 1 ounce in 2 gallons (1 : 2560); and 1 ounce in 1 gallon (1 : 1280) were used.

Hydrogen ion changes in diluted quaternary ammonium compound allowed to stand at room temperature have been noted by Stuart (22). Mineral content of water used for diluting the alkyl-dimethyl-benzyl ammonium chloride may effect pH changes and effect the efficiency of the compound (7). In order to eliminate the effect of metallic ions present in tap water and to minimize pH changes, the quaternary ammonium compound was diluted with distilled water and used immediately after dilution.

EXPERIMENTAL PROCEDURES AND RESULTS

General Procedures. The use-dilution recommended for dairy equipment was noted to be in the proportion of 1 ounce in 4 gallons of water. Additional dilutions were used as described above. The same volume of medicant was used for each exposure tube as was used for each rinse or wash (20 ml.). Exposure times of 5, 10, 20, 40, 60, and 100 seconds proved insufficient to secure a clear picture of germicidal activity, and final testing was done using 0, 1, 3, 5, and 10 minutes. Tubes containing medicant were immersed in the water bath at a level above the contents and allowed to remain at temperature for 15 to 30 minutes before exposing contaminated carriers.

A set of eight rods was exposed for each time interval. These, four at a time, were rinsed by moving to and fro in each of the pre-rinses for 5 seconds. They were immersed in the alkyl-dimethyl-benzyl ammonium chloride solution for the specified time, rinsed 5 seconds in the final rinse, and placed in individual tubes of medium: 4 in either F.D.A. or tryptose phosphate broth and a duplicate set in broth with "inactivator" added in order to designate between bactericidal and/or bacteriostatic activity. After 48 hours at 37°C, all negative and doubtful tubes were subcultured by placing 0.1 ml. of thoroughly mixed broth into a fresh tube of corresponding broth and reincubating an additional 48 hours. Positive tubes were checked by Gram's stain to determine the presence of the test organisms.

Five experiments were performed. The experiments were designated to determine the effect of (1) each dilution of alkyl-dimethyl-benzyl ammonium chloride alone on the test bacteria in dried milk films, (2) each dilution of benzalkonium chloride on the test bacteria following an initial cold water rinse and washing in cleaning solution, (3) the entire routine as defined above included the boiling water rinse, (4) a boiling water rinse alone and (5) residual amounts of the quaternary ammonium compound on contaminated rods stored overnight at room temperature (20°C. to 32° C.).

**Micrococcus pyogenes* var. *aureus* 209: from Food and Drug Administration, Washington, D. C.

Escherichia coli: from stock, University of Maryland, College Park, Md.

Streptococcus agalactiae M2-31: fresh isolate from mastitis case, from Livestock Sanitary Service, College Park, Md.

*G.L.X.—a "sudsing" cleaner which contains no soap; combination of alkalies and especially selected surface active agents; obtained from Wyandotte Chemical Corporation, Wyandotte, Michigan.

†Sample obtained from Winthrop Chemical Company, Industrial Division, 1450 Broadway, New York City.

TABLE 1
THE EFFECT OF ALKYL-DIMETHYL-BENZYL AMMONIUM CHLORIDE ON CARRIERS
IMPREGNATED WITH *Micrococcus pyogenes* var. *aureus* 209

Temp	Time in min.	Dilutions and media															
		1 : 5120		1 : 3840		1 : 2560		1 : 1280									
		F.D.A.*	Letheen†	F.D.A.	Letheen	F.D.A.	Letheen	F.D.A.	Letheen								
20C	0	+	+	+	+												
	1	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+	+
	3	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+
	5	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+
	10	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+
23C	0	+	+	+	+												
	1	-	+	-	-	+	+	+	+	-	-	-	-	+	+	+	+
	3	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+
	5	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+
	10	-	-	-	-	-	-	-	-	-	-	-	-	+	-	-	+

* F.D.A. broth used by Food and Drug Administration for the phenol coefficient test (20).

† Letheen broth devised by Quisno, Gibby and Foter (19).

+ Growth after 48 hours at 37°C. or negative results which were positive after an additional 48-hour subculture period.

- No growth after an initial incubation of 48 hours at 37°C. and after a 48-hour subculture period.

1. *Alkyl-dimethyl benzyl Ammonium Chloride Alone.* Metal rods impregnated with each of the 3 test organisms were exposed to the 4 dilutions of medicant at 20°C. and 23°C. for 0, 1, 3, 5, and 10 minutes. For each organism eight rods were exposed at each time interval and subcultured in quadruplicate in the two media stipulated.

Results. Table 1 shows the action of the quaternary ammonium compound on *M. pyogenes* var. *aureus* 209. At 20°C. there was apparent kill in the higher concentrations or longer exposure times when F.D.A. broth was used. When letheen broth was used to subculture the carriers growth appeared in all tubes. This would indicate that the apparent kill obtained when using F.D.A. broth was a bacteriostatic effect rather than a bactericidal ac-

tion. At 23°C. bactericidal action was exhibited only in the longer exposure periods and in the highest concentration (1 : 1280) when using letheen broth. Bacteriostatic action was noted in most instances.

When *E. coli* was the test organism, alkyl-dimethyl-benzyl ammonium chloride exhibited neither bactericidal nor bacteriostatic action at 20°C. or 23°C.

The effect of alkyl-dimethyl-benzyl ammonium chloride alone on *S. agalactiae* M2-31 is shown in table 2. At 23°C. the medicant generally exhibited greater bacteriostatic activity in all dilutions at all times than at 20°C. The highest concentration of medicant studied showed some bactericidal activity after 5 and 10 minutes as indicated by a complete kill of the organisms on half the carriers at 20°C. When the

temperature was raised to 23°C., all dilutions except 1 : 5120 exhibited some bactericidal activity when the carriers were exposed for 5 and 10 minutes but this activity was not great enough to assure disinfection of the test rods at any of the concentrations studied within 5 minutes or at dilutions higher than 1 : 2560 within 10 minutes.

2. *Alkyl-dimethyl-benzyl Ammonium Chloride Following Cleaning.* Contaminated carriers were exposed to all dilutions of the compound at 20°C. and 23°C. for periods of 0, 1, 3, 5, and 10 minutes following a 5-second rinse in water and another 5-second wash in G.L.X. A 5-second after-rinse of water was used. With each organism, eight rods were exposed at each time interval and subcultured in quadruplicate in the 2 media stipulated.

TABLE 2
THE EFFECT OF ALKYL-DIMETHYL-BENZYL AMMONIUM CHLORIDE ON
CARRIERS IMPREGNATED WITH *Streptococcus agalactiae* M2-31

Temp.	Time in min.	Dilutions and media															
		1 : 5120		1 : 3840		1 : 2560		1 : 1280									
		T.P.*	T.P.L.†	T.P.	T.P.L.	T.P.	T.P.L.	T.P.	T.P.L.								
20C	0	+	+	+	+												
	1	-	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+
	3	-	-	-	-	-	-	-	-	+	+	+	+	+	+	+	+
	5	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-
	10	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-
23C	0	+	+	+	+												
	1	-	-	-	-	+	+	+	+	-	-	-	-	+	+	+	+
	3	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+
	5	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+
	10	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+

* T.P.—tryptose phosphate broth, dehydrated (Difco).

† T.P.L.—tryptose phosphate-letheen broth.

+ Growth after 48 hours at 37°C. or negative results which were after an additional 48-hour subculture period.

- No growth after an initial incubation of 48 hours at 37°C. and after a 48-hour subculture period.

TABLE 3
THE EFFECT OF ALKYL-DIMETHYL-BENZYL AMMONIUM CHLORIDE ON
Micrococcus pyogenes var. *aureus* 209 FOLLOWING CLEANING
Dilutions and media

Temp.	Time in min.	1 : 5120		1 : 3840		1 : 2560		1 : 1280													
		F.D.A.*	Letheen†	F.D.A.	Letheen	F.D.A.	Letheen	F.D.A.	Letheen												
20C	0	+	+	+	+	-	-	-	-	+	+	+	+	+	-	-	-	+	+	+	+
	1	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	+	+	+	+
	3	-	-	-	-	-	-	-	-	+	+	+	+	-	-	-	-	+	+	+	+
	5	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	+	+	+	+
	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	+	+	+	+
23C	0	+	+	+	+	+	+	-	-	+	+	+	+	-	-	-	-	+	+	-	-
	1	+	+	-	-	-	-	-	-	+	+	-	+	-	-	-	-	-	+	+	-
	3	-	-	-	-	+	+	+	+	-	-	-	-	-	-	-	-	-	+	+	-
	5	+	-	-	-	+	+	+	+	-	-	-	-	+	+	-	+	-	-	-	-
	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

* F.D.A. broth used by Food and Drug Administration for the phenol coefficient test (20).

† Letheen broth devised by Quisno, Gibby and Foter (19).

+ Growth after 48 hours at 37°C. or negative results which were positive after an additional 48-hour subculture period.

- No growth after an initial incubation of 48 hours at 37°C. and after a 48-hour subculture period.

Results. Table 3 shows that, in general, bacteriostatic activity was exhibited with *M. pyogenes* var. *aureus* 209. Bactericidal activity was demonstrated for the longest exposure time of 10 minutes at both 20°C. and 23°C., but not at the shorter time intervals. However, at no dilution was this activity great enough to assure complete disinfection of all the carriers exposed.

E. coli and *S. agalactiae* M2-31 were not killed. Even at the highest concentration and longest exposures, the medicant appeared of no value at either 20°C. or 23°C.

3. Treatment with Alkyl-dimethyl-benzyl Ammonium Chloride and All Rinses. Metal rods impregnated with each of the three test organisms were exposed to all pre-treatments for intervals of 5 seconds and all 4 dilutions of medicant at 20°C.

and 23°C. for 0, 1, 3, 5, and 10 minutes followed by an after-rinse for 5 seconds in cold water. With each organism, eight rods were exposed and subcultured in quadruplicate in the two media stipulated.

Results. This treatment was apparently effective against *M. pyogenes* var. *aureus* 209 and *S. agalactiae* M2-31 in all dilutions and at all exposure times for both 20°C. and 23°C. The organisms survived however on a few carriers emphasizing the difficulty in securing complete disinfection of infected metal surfaces.

When *E. coli* was used (Table 4), less bacteriostatic and bactericidal activity was exhibited than with *M. pyogenes* var. *aureus* 209 and *S. agalactiae* M2-31. With this organism no clear-cut evidence of complete disinfection was secured.

When a 5-second boiling rinse

was introduced into the sanitizing procedure, the three test organisms were eliminated from more carriers at both temperatures at all dilutions and time intervals. It would appear therefore that the 5-second pre-rinse in boiling water was responsible in a large part for the killing observed.

4. Effect of Boiling Water Alone. A total of 16 contaminated rods for each of the three test organisms was exposed for 5 seconds to boiling water (100°C.). After exposure, each carrier was placed in a separate tube of broth medium suitable for the particular organism. Rinse waters were subcultured after exposure of the rods to determine whether viable micro-organisms had been removed mechanically.

Results. *M. pyogenes* var. *aureus* 209 was killed with 11 of 16 carriers, and with *E. coli* and *S. agalactiae* M2-31, kill was noted on 15

TABLE 4
THE EFFECT OF ALKYL-DIMETHYL-BENZYL AMMONIUM CHLORIDE ON
Escherichia coli WHEN ALL RINSES WERE USED
Dilutions and media

Temp.	Time in min.	1 : 5120		1 : 3840		1 : 2560		1 : 1280									
		F.D.A.*	Letheen†	F.D.A.	Letheen	F.D.A.	Letheen	F.D.A.	Letheen								
20C	0	+	+	+	+	-	-	-	-	+	+	+	+	+	+	+	+
	1	+	+	+	+	-	-	-	-	+	-	-	-	+	+	+	+
	3	-	-	-	-	-	-	+	-	-	-	-	-	+	+	-	-
	5	-	+	-	-	+	-	-	+	-	-	-	-	+	-	-	-
	10	-	-	-	-	+	+	-	-	-	-	-	-	+	+	+	-
23C	0	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	+
	1	-	-	-	-	+	+	+	+	+	+	+	+	+	+	+	+
	3	-	-	-	-	+	+	+	+	+	+	+	+	-	-	-	-
	5	-	-	-	-	-	-	+	+	+	+	+	+	-	-	-	-
	10	-	-	-	-	+	+	+	+	+	+	+	-	-	-	-	-

* F.D.A. broth used by Food and Drug Administration for the phenol coefficient test (20).

† Letheen broth devised by Quisno, Gibby and Foter (19).

+ Growth after 48 hours at 37°C. or negative results which were positive after an additional 48-hour subculture period.

- No growth after an initial incubation of 48 hours at 37°C. and after a 48-hour subculture period.

of 16 carriers. None of the tubes containing "used" rinse water samples showed growth in subculturing. Therefore, it could be assumed that living organisms were not mechanically removed in the water but were destroyed by the high temperature. Comparison of these results with those using the compound alone have shown that 20° C. cold rinses with dilutions of benzalkonium chloride of from 1 : 1,280 to 1 : 5,120 for 10 minutes were not as effective in eliminating the three test organisms as was a 5-second rinse in boiling water. At the slightly elevated temperature (23°C.), dilutions of 1 : 1,280 and 1 : 2,560 gave results at the 10-minute exposure interval which were approximately comparable to those secured with 5-seconds of boiling water.

5. *Residual Effect of Alkyl-dimethyl-benzyl Ammonium Chloride.* Sixteen rods for each organism were exposed for 1 minute to each dilution of the compound drained and stored in sterile containers overnight. The rods were then placed into a medium suitable for the particular organism and incubated 48 hours at 37°C. Four control rods were employed for each organism, using distilled water instead of the quaternary ammonium compound. The 1-minute time of exposure was chosen with the assumption that this would be the longest time any operator would use in practice.

Results. *E. coli* and *S. agalactiae* M2-31 were not killed by this treatment. In almost all cases, *M. pyogenes* var. *aureus* 209 was killed. This suggested that the amount of quaternary ammonium germicide absorbed by milk contaminated surfaces in a short exposure period of 1 minute was not great enough to assure a continued germicidal activity on the surface after removal from a sanitizing solution of this type of germicide.

DISCUSSION

An attempt was made to establish the efficacy of alkyl-dimethyl-benzyl ammonium chloride under conditions resembling as nearly as possible those found in the dairy. Whole milk plus microorganisms commonly associated with bovine mastitis was used to duplicate milk film that might exist on the surface of equipment. These conditions ap-

proximate those on the surface faces of dairy utensils over which the dairy farmer must exercise daily sanitary control.

The primary objective of this study was to determine if benzalkonium chloride when used as a germicidal rinse on dairy farm utensils could be relied upon to eliminate completely bacterial contamination of the type commonly associated with bovine mastitis, because any living bacteria remaining on milking machines constitute a potential hazard for the spread of this disease. Under the conditions of these studies, the compound under investigation was not found to be effective in accomplishing this objective. Several microorganisms frequently associated with bovine mastitis were used as indicators of the bactericidal effectiveness of alkyl-dimethyl-benzyl ammonium chloride and no substantial evidence was secured to indicate that this chemical possessed sufficient germicidal activity to eliminate completely such infective agents from dairy equipment. Ten-minute rinses with cold solutions of this chemical were not as effective in this respect as a 5-second rinse of boiling water. The obtaining of complete destruction of an infectious agent on a soiled surface in the absence of added heat is much more difficult than commonly supposed. Total kill was the main objective in this work since the test organisms were those often encountered in bovine mastitis and it would be unsafe to assume that a certain percentage reduction in their numbers removed the possibility of re-infection or transmission. In all fairness, however, it should be pointed out that these studies do not eliminate the possibility that other preparations or grades of benzalkonium chloride can be produced which would give the results desired at the concentrations studied. The resistance of the three test organisms used in milk films on metal carriers in the series of treatments used in these studies emphasize difficulties encountered by the dairy farmer and necessity for carefully planned and controlled procedures of cleaning and disinfecting milking machines to prevent spread of infections.

In ordinary farm practices a complete kill or removal of the en-

tire bacterial flora from pails, strainers, cans and coolers has not been required, and these studies do not eliminate the possibility that benzalkonium chloride may have some value in the maintenance of such utensils at the bacteriological standard necessary to satisfy local public health ordinances.

This data represents the action of the germicide under laboratory conditions. The results indicate that the quaternary ammonium compound does not effect 100 percent kill at either of the two operating temperatures in any of the four concentrations.

SUMMARY AND CONCLUSIONS

In these studies a commercial preparation of alkyl-dimethyl-ammonium chloride was examined for its effectiveness in destruction of bacteria commonly associated with bovine mastitis. Under the experimental conditions employed, the following conclusions seemed warranted:

Aqueous solutions of benzalkonium chloride at dilutions ranging from 1 : 1,280 to 1 : 5,120 on the basis of the quaternary ammonium salt were not effective in disinfecting surfaces of stainless steel carriers contaminated with milk films containing *Micrococcus pyogenes* var. *aureus* 209, *Escherichia coli* or *Streptococcus agalactiae* M2-31.

A 5-second boiling water rinse was more effective in destroying the three test organisms than a 10-minute rinse in cold (20°C.) solutions of benzalkonium chloride alone or following rinsing and cleaning procedures.

Residual quantities of quaternary ammonium compounds absorbed on infected metal surfaces and remaining after the disinfecting rinse may exert a germicidal effect during draining and drying with susceptible organisms such as *M. pyogenes* var. *aureus* 209, but are not germicidal for resistant bacterial types such as *E. coli* and *S. agalactiae* M2-31.

Aqueous solutions of benzalkonium chloride as presently manufactured and distributed cannot be relied upon to give cold disinfection of uncleaned dairy farm equipment surfaces contaminated with organisms commonly associated with bovine mastitis.

Cold aqueous solutions of benzalkonium chloride may have value as an added safeguard when used as a disinfecting rinse for dairy farm equipment against organisms of bovine mastitis if used following a carefully planned rinsing and washing procedure including boiling water. They cannot be depended upon to disinfect in conjunction with cold washing procedures.

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The authors wish to express grateful thanks to Mr. L. S. Stuart, Production Marketing Administration, U. S. Dept. of Agriculture, for aid in planning and reporting this data.

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MISSOURI ASSOCIATION OF MILK AND FOOD SANITARIANS

The annual meeting of the Missouri Association of Milk and Food Sanitarians will be held on April 21, 22, and 23rd. The success of the meeting last year set the pattern for this year's meeting. That is to say, the first day there will be a general assembly type meeting. The second day will be broken up into two sections: one on milk, one on food. The third day is another general assembly of both sections. There will be frequent rest periods on all three days and door prizes will be given throughout the meeting.

MEAD P. CREATH

The death of Mr. Mead P. Creath on December 27, 1951, at the Veteran's Hospital, Tupper Lake, N. Y., brought a feeling of sincere regret to his fellow-workers and his many friends in the field of milk and food sanitation throughout the country.

Mr. Creath served as district milk and food sanitarian for the New York State Department of Health for the past nine years. During this time he was a member of the

International Association of Milk and Food Sanitarians and the New York State Association of Milk Sanitarians. A native of Fitchburg, Indiana, Mr. Creath graduated from the University of Purdue, College of Agriculture. Well versed in his chosen profession and operator of his own creamery plant, and with an intense desire to serve, he accomplished much while maintaining a cordial and friendly relationship with his co-workers and business contacts.

A DISCUSSION OF SOME PRINCIPLES INVOLVED IN THE HEAT PROCESSING OF FOODS*†

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FROM time to time during the past quarter of a century I have studied and experimented with the resistance of bacteria to heat, and have "elucidated" on the subject to my classes in bacteriology. My actual experience in the food processing industry is limited. As I attempted to prepare this discussion for you, I was at a loss to know *why I ever accepted the invitation to this assignment.*

A practical, understandable approach will be attempted, using a minimum of mathematics and chemistry. The object of the heat processing of canned foods is to inactivate the enzymes and microorganisms in the food so as to prevent spoilage during storage. The information needed to determine the treatment, or process is:

1. The time and temperature required to kill the largest number commonly present of the most-difficult-to-kill organisms found in the food. The endospores of anaerobes have been accepted as the most difficult organisms to kill. *Clostridium botulinum* cultures and National Canners Association Culture No. 3679 have been accepted as the principal resistance test organisms.

2. The rate at which heat penetrates the food in the container used must be determined.

3. The pH of the food being processed must be known.

Knowing these three things: the time and temperature required to kill heat resistant anaerobic spores, the rate of heat penetration into the food, and the pH of the food—the processing time can be calculated.

Foods have been placed into two groups: First the *Acid foods*, having a pH below 4.5, such as common fruits and tomatoes and their

juices, sauerkraut and pickles. The acid food group is not a problem since anaerobic spores will not germinate and grow at a pH below 4.5; besides at this low pH they are rapidly killed by the temperature of boiling water or even lower. The second group is the *Low Acid foods*, having a pH above 4.5, such as most vegetables, milk, fish and marine products, and meats and meat products. The foods in this group present a far more difficult problem. In these foods unkillable anaerobic spores will germinate and grow and cause the spoilage of the food. Long Exposures at high temperatures are required to kill them.

A study of the thermal resistance of spores of *Clostridium botulinum* shows that at 5 minutes and 6 minutes heating at 240°F, the triplicate tubes, or *probably cans*, all showed growth and spoiled; at 8 minutes only one spoiled; while at nine minutes all were sterile. Three minutes additional heating made the difference between all spoiling and all keeping.

Thermal Resistance of 750,000,000
Spores per ml of *Cl. botulinum* in
Neutral Phosphate Buffer (pH 7.0)
at 240° F

Process time min.	Survival
5.0	+ + +
6.0	+ + +
7.0	+ + -
8.0	+ - -
9.0	- - -

In a study of the thermal resistance of National Canner's Association organisms 3679, we note the far greater resistance of this organisms. Here we find approximately 11 minutes heating at 240° F showing the difference between all spoiling and all keeping.

Thermal Resistance of 250,000 Spores
per ml of N.C.A. Organisms 3679 in
Neutral Phosphate Buffer (pH 7.0)
at 240° F

Process time min.	Survival
14' 18"	+ + +
17' 54"	+ + -
21' 24"	+ + -
25' 6"	- - -

The ratio between the velocity constants of a reaction at two different temperatures is called the temperature quotient (or coefficient). It is customary to record the temperature coefficient for temperature intervals of 10°C as Q_{10} . For many chemical reactions, Q_{10} has a value of two to three. Following this line of reasoning that Q_{10} does equal 3, bacteria would be killed 59,000 times as rapidly by an increase of 90°C; or put the other way, an increase in temperature of 90°C in processing time, would require only 1/59,000 as long to process it. Thermal death time studies on *Bacillus mesentericus* illustrate this point. In these data Q_{10} equals approximately 7. Raising the temperature from 100°C to 140°C shortens the killing time from 350 minutes to less than 10 seconds.

Thermal Death Time of *Bacillus mesentericus*

Temperature degrees C	Thermal death time minutes	Temperature degrees C	Thermal death time minutes
100	330-360	126	3
109-113	45+	127	2
113-116	25	130	1
122-123	10		

These give a value for Q_{10} of about 7. On this assumption the calculated values are:

100	350.0	130	1.0
110	50.0	140	0.14
120	7.1		

In a first order, or true monomolecular reaction, a single molecule or substance is undergoing change. In the heat processing of food it is assumed that the concentration of living bacterial endospores is the only thing whose concentration is changing. The logarithm of the concentration of living bacteria plotted against time gives approximately a straight line.

A Theoretical Case

Time	Survivors	Dying per unit time	Total dead
0	1,000,000	0	0
1	100,000	900,000 = 90%	900,000
2	10,000	90,000 = 90%	990,000
3	1,000	9,000 = 90%	999,000
4	100	900 = 90%	999,900
5	10	90 = 90%	999,990
6	1	9 = 90%	999,999

The principle involved is shown in the "Theoretical Case" table. In this theoretical case, the death rate is 90 percent for each time interval.

*No attempt has been made to give credit for the data used or to supply references. The attempt has been to illustrate and verify basic principles.

†Presented at the Thirty-seventh Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., Atlantic City, New Jersey, Oct. —, 1950.

An approximate constant percentage of the number of surviving bacteria are killed during an interval of time. The number killed during an interval of time becomes fewer and fewer.

The food processing time requires, also, a consideration of the heat penetration, which is commonly expressed as the heating and cooling curves. It is generally assumed some killing of endospores occurs while the temperature is above 160°F. The determination is made by direct mathematical calculations based on established formulas. The complete summation can be accomplished only by calculus. A mathematical explanation is believed out of order here.

by the number of bacteria to be killed, efficient washing with the right cleaner and effective rinsing really determine the processing time. Regardless of the kind of microorganisms to be killed, a smaller number can always be killed in a shorter time.

In summarizing the previous discussion, we have observed (1) that certain anaerobic spore-producing bacteria, in the numbers commonly found in foods are used as the heat resistance test organisms; (2) that the death of bacteria is, in a general way, an orderly and predictable process. From one-third to one-tenth as long a processing time is required for each 10°C increase in processing time; (3) that by the

atery. This work is reported in *Food Technology* for May 1950. Some quotations from their paper will speak for themselves. "Our work mostly with vegetables, indicates that food can be preserved with only mild heat treatment (212°F or lower, for a few minutes) in the presence of very small amounts of subtilin, an antibiotic elaborated by a certain strain of *Bacillus subtilis*." This is a common soil and air contaminant. "In general a brief heat treatment of vegetables is required to inactivate enzymes which would otherwise cause deterioration during subsequent storage. Such treatment also is sufficient to destroy yeasts and fungi and all non-spore-forming bacteria, some of which are resistant to subtilin. On the other hand those organisms which are resistant to heat such as clostridia and thermophiles, appear from our work to be extremely sensitive to subtilin, particularly with mild heat." (*B. stearothermophilus* is completely inhibited in nutrient dextrose broth by 0.004 ppm of subtilin. This suggests the possibility that flat sour spoilage in the canning industry might be eliminated by the addition of minute amounts of subtilin to the brine. *Cl. botulinum* (62A) spores heated for 5 min. (212°F) in a brain-heart infusion containing 0.5 ppm subtilin failed to grow within 7 months. The homologous strain of *B. subtilis* was completely inhibited in nutrient dextrose broth without heat treatment by 1 ppm anaerobically and by 5 ppm aerobically.) In the presence of the antibiotic, therefore, it is unnecessary to resort to the long cooking periods used in the canning industry."

"The possible physiological effects of continued use of foods containing added antibiotics require careful consideration. The following facts suggest that subtilin would be harmless (a) Subtilin is a polypeptide and is inactivated (presumably hydrolyzed) by proteolytic enzymes.^{1, 4, 6} (b) Experiments in progress indicate that 100 ppm in rat diets has not affected the growth or visibly affected the health in animals over a period of 175 days (personal communication from the Pharmacology Division of this Bureau.) (c) In a single ex-

Thermal Death Times of 150,000 Spores of Culture 1503, a Typical Thermophile, in Media of Different Hydrogen-Ion Concentrations (Bigelow and Esty)

Minutes required to destroy spores heated in

Temperatures degrees C	Corn juice pH=6.1	Pea juice pH=5.3	String- bean juice pH=5.0	Beet juice pH=4.7	Pumpkin juice pH=4.5
	120	17	12	7	6	4
110	180	150	65	30	35
100	1,140	970	300	180	180

The effect of low pH, or high acidity, is indicated in the table above. The type of vegetable should exert little influence, since all the test materials are juices. The difference in pH, at each temperature, is the major factor. It will be noted that about one-fourth as long a time is required to sterilize a pH 4.7 to pH 4.5 as is needed at pH 6.1. Let us not overlook the fact that pH is a logarithmic expression; and that a pH of 5.0 is ten times more acid than a pH of 6.0. Here we note the extreme difference in processing time required by the different low acid foods: corn juice—pH 6.1—17 minutes, pea juice—pH 5.3—12 minutes; string bean juice—pH 5.0—7 minutes with pumpkin juice—pH 4.5—4 minutes. These data further show that at the same pH, lowering the temperature 10°C requires from 4 to 12 times as long to sterilize.

In the cleaning of foods and food processing equipment, thorough physical cleanliness must be attained and maintained. The extreme importance of careful and complete rinsing with clean water is most important. Since the time, temperature, pH, concentration of cleaner used, etc. are all affected

application of mathematics to heating and cooling curves, the required processing time can be safely calculated; (4) that the pH of the food is very important in the determination of the processing time; (5) and that the number of microorganisms to be killed, if known, and the kinds of microorganisms to be killed determine the processing time.

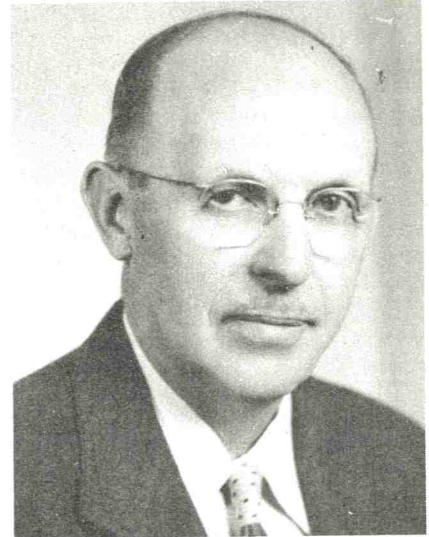
Other considerations seem to me to be of extreme importance. First, usually, the longer the processing time required, the lower the quality of the food produced. The trend is toward processing the container and the food separately, so as to use agitation and convection heat, thus shortening the processing time. Any means which gets quick heating to a very high temperature and rapid cooling is desirable. We must not forget the enormously increased rate of killing bacteria by higher temperatures.

Secondly, can we not combine with heat some agent to which anaerobic endospores are particularly sensitive? A very important step in this direction has been made by Andersen and Michener of the Western Regional Research Labor-

SURVIVAL OF SALMONELLA PULLORUM ON THE SKIN OF HUMAN BEINGS AND IN EGGS DURING STORAGE AND VARIOUS METHODS OF COOKING^{1,2}

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S. Pullorum causes a dysentery-like disease in human beings. It seemed desirable to know its survival time under the conditions indicated above. No recovery could be made from the skin of the back of the hand of a young woman 10 minutes after application (summer). It was recoverable after 45 but not after 60 minutes in the winter. It was recovered from eggs stored 8 months at 25° C and 5 months at 4° C. The usual methods of cooking did not destroy all pullorum bacilli in eggs. Scrambling and four-minute boiling were most effective.

THE ISOLATION of *Salmonella pullorum* from stools of patients suffering from gastroenteritis has been reported by Edwards and Bruner,¹ Felsenfeld and Young,² Mitchell, Garlock, and Broh-Kahn,³ and Judefind.⁴

Many workers have reported on the isolation of *S. pullorum* from tissues and eggs of poultry (Rettinger⁵, Hadley and Caldwell⁶, Runnells and Van Roekel^{7,8}, Mallmann⁹, Anderson¹⁰, Mallmann and Moore¹¹, Soloway and McFarlane¹²). For an extensive review of the literature on pullorum disease the reader is referred to Van Roekel¹³.

This work was done for the purpose of contributing to our knowledge concerning those characteristics of *S. pullorum* which may have public health significance.

SURVIVAL ON THE SKIN

Procedure. A 24-hour tryptose broth culture of *S. pullorum* was used. The experimental subjects were a young man and a young woman. The hands were thoroughly washed with soap and water and allowed to dry, after which 14 areas, 3 cm sq., were marked off on the back and the palm. The culture was

1. Condensed from M. S. degree thesis by Miss Cooper and senior term paper by Mr. Wallbank.

2. Journal Article 1188. From the Department of Bacteriology and Public Health, Michigan Agricultural Experiment Station, East Lansing, Michigan.

then shaken 25 times and the organisms (undiluted culture) swabbed into each area.

For controls, strips of index cards of uniform size were used. These were dipped into the broth culture and at appropriate time intervals dropped into 99 ml saline dilution blanks. Index cards proved to be superior to dry or moist filter paper, dry or moist pieces of wood, or small glass rods.

Swabs were taken from the hand at ½, 1, 2, 3, 5, 10, 15, 30, 45, 60, 75, 90, 105, and 120 minute intervals and dropped into saline dilution blanks. An index card control was dropped into a designated dilution blank each time a swab was dropped into a designated saline dilution blank and both were immediately shaken 25 times and again just before making the agar plates. Uniformity in swabbing, shaking of dilution tubes, time intervals, etc. was observed as closely as possible. The organism remained no longer than 15 minutes in the dilution tubes before pouring the plates. MacConkey's agar was used as plating medium and 1 ml of each dilution was used as inoculum. The plates were incubated at 37°C for 24 hours, and then the counts were made and recorded.

Results. The average count from 6 experiments, covering a period of 3 weeks during the summer and using the back of the hand of a young woman, showed a 98.9 percent reduction in recoverable living organism in 5 minutes. There was 100 percent reduction in 10 minutes. In the controls, a 99.4 percent reduction required 120 minutes.

Three experiments completed during the winter showed a 99.9 percent average reduction in 45 minutes. Twelve experiments were performed during a period of 19 days, using the palm of the hand of the same person. An average reduction of 99.9 percent of recoverable living organisms took place in 30

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minutes. A 99.3 percent reduction in the controls required 120 minutes. The results are recorded in tables 1, 2, and 3. Table 4 shows the results obtained by using the back of the hand of a young man, the experiments having been performed during the summer and fall.

Discussion. In these experiments *S. pullorum* survived longer on the back of the hand in the winter (45 minutes) than in the summer (5 minutes). More extensive experiments might reveal variations in survival due to individual differences in subjects.

On the skin of the palm of the hand the organism survived for 30 minutes both in the summer and winter. It is possible that sweat may have something to do with the difference between the palm and

the back of the hand with respect to bactericidal action. No doubt more desiccation took place on the skin of the back of the hand than on the skin of the palm, but desiccation alone can hardly account for the difference in the reduction in

number of viable organisms, as indicated by the relatively long survival on the strips of index cards. There was no significant increase in bactericidal effect during the menstrual cycle such as reported by Fisher¹⁴ and Cornbleet and Montgomery¹⁵.

monella typhimurium, *Salmonella enteritidis*, *Salmonella choleraesuis* and *Salmonella paratyphi*. Six sets of eggs were inoculated, each set with one of the six organisms; three of these sets were incubated at 25° C and the other three at 4° C. Two sets were examined approximately every two months.

Previous to inoculation each egg was tested for presence of *S. pullorum* by the withdrawal of approximately 1-ml samples of the yolk and white which were added to tetrathionate broth and incubated for a period of 12-24 hours at 37° C. They were then streaked out on S. S. and MacConkey agar plates. No organisms were encountered on these initial plates.

A 24-hour tryptose broth culture of each organism was used for the inoculations. Each egg was inoculated with approximately 0.01 ml of the culture and one half of the total number of eggs was incubated at 25°C and the other half at 4°C.

Every two or three months a set of these eggs was examined by breaking one egg into a flask of tetrathionate broth and incubated at 37°C for 12-24 hours. Following incubation, a loopful of broth was streaked on S. S. and MacConkey agar. Colonies characteristic of salmonellae were picked and transplanted to motility medium, triple sugar iron agar (T. S. I.), and various fermentation broths: dextrose, lactose, maltose, mannite, sucrose, inositol, arabinose, xylose, and dulcitol. They were tested for indol production and stained with the Gram stain.

TABLE 1
Survival On the Back of the Hands*

Time (Min.)	SWAB FROM SKIN	
	Colony Counts	% Reduction
½	4149	—
1	2188	47.3
2	159	96.2
3	155	96.3
5	43	98.9
10	0	100.0

Time (Min.)	PAPER COLONY COUNTS	
	Colony Counts	% Reduction
½	5633	—
1	5037	10.6
2	4120	26.9
3	4062	27.9
5	3607	35.9
10	3109	44.8
15	1982	64.8
30	855	84.8
45	108	98.1
60	86	98.5
75	99	98.2
90	6	99.9
105	11	99.8
120	34	99.4

* An average taken from six experiments covering a three week period. Summer

TABLE 2
Survival On the Back of the Hand*

Time (Min.)	SWAB FROM SKIN	
	Colony Counts	% Reduction
½	21040	—
1	12717	39.5
2	8836	58.0
3	5617	73.3
5	1454	93.0
10	278	98.6
15	236	98.8
30	35	99.8
45	15	99.9
60	0	100.0

Time (Min.)	PAPER COLONY COUNTS	
	Colony Counts	% Reduction
½	26073	—
1	22298	14.4
2	17310	33.6
3	17000	34.7
5	13500	48.2
10	10400	60.1
15	9666	62.5
30	1785	93.1
45	1400	94.6
60	650	97.5
75	550	97.8
90	411	98.4
105	505	98.1
120	110	99.5

* An average taken from three experiments covering eight days. Winter

SURVIVAL IN EGGS DURING STORAGE

Procedure. Fresh eggs were inoculated November 11, 1947, with *S. pullorum* and, for comparison, with *Salmonella schottmulleri*, *Sal-*

TABLE 3
Survival On the Palm of the Hand*

Time (Min.)	SWAB FROM SKIN	
	Colony Counts	% Reduction
½	13459	—
1	11297	16.1
2	8325	38.2
3	4855	63.9
5	1060	92.1
10	339	97.5
15	244	98.2
30	2	99.9
45	0	100.0

Time (Min.)	PAPER COLONY COUNTS	
	Colony Counts	% Reduction
½	20410	—
1	19283	5.5
2	16742	17.9
3	15295	25.1
5	12870	36.9
10	10707	47.5
15	6589	67.7
30	1327	93.5
45	1357	93.4
60	353	98.3
75	82	99.6
90	117	99.4
105	174	99.2
120	136	99.3

* An average taken from twelve experiments covering 19 days. Summer and Winter

TABLE 4

Survival of *Salmonella Pullorum* on Human Skin and on Index Cards

Min.	Skin		Index Cards	
	Count	% Reduction	Count	% Reduction
	½	91,000	—	109,000
1	76,000	16.5	86,000	21.1
2	45,000	50.6	89,000	18.4
3	39,000	57.2	70,000	35.8
5	14,000	84.6	63,000	42.2
10	9,000	90.2	58,000	46.8
15	4,000	95.6	34,000	68.8
30	1,000	98.9	8,000	92.6
45	0	100.0	7,000	93.5
60	0	100.0	5,000	95.4
75	.....	.....	4,000	96.3
90	.....	.....	1,000	99.1
105	.....	.....	0	100.0
120	.....	.....	0	100.0

Representative data obtained during the fall and summer, 1948, by Mr. Wallbank

TABLE 5

Survival of Six *Salmonella* Species in Eggs over a Period of Twelve Months

Organisms	Temperature	1/8/48	2/28/48	5/5/48	8/11/48	11/16/48
<i>S. schottmulleri</i>	25° C	+	+	+	+	+
	4° C	+	+	+	+	-
<i>S. typhimurium</i>	25° C	+	+	+	-	+
	4° C	+	-	+	-	-
<i>S. enteritidis</i>	25° C	+	+	+	+	+
	4° C	+	+	-	+	-
<i>S. choleraesuis</i>	25° C	+	+	+	-	-
	4° C	+	+	+	+	-
<i>S. paratyphi</i>	25° C	+	+	+	+	+
	4° C	+	+	+	-	-
<i>S. pullorum</i>	25° C	+	+	+	+	-
	4° C	+	+	+	-	-

Results and Discussion. The results recorded in table 5 show that after three months incubation at 25°C and 4°C all the organisms were recovered with the exception of *S. typhimurium* which was recovered from eggs held at 25°C but not from those held at 4°C. At the end of six months all the organisms were isolated from both lots except *S. enteritidis* which was recovered only from the egg held at 4°C. Of the five salmonellae which were recovered after nine months, *S. schottmulleri* and *S. enteritidis* were the only two isolated from both lots. *S. paratyphi* and *S. pullorum* survived at 25°C while *S. choleraesuis* was not recovered after having been held for nine months at that temperature but was isolated from the egg at 4°C. At the end of

twelve months *S. schottmulleri*, *S. typhimurium*, *S. enteritidis* and *S. paratyphi* were found to have survived storage at 25°C.

SURVIVAL DURING VARIOUS METHODS OF COOKING

Rettger and Hull¹⁶ in 1916, demonstrated that soft boiling, codding, and frying of eggs do not necessarily render yolks free of viable bacteria.

This portion of our work was carried out for the purpose of collecting more data on this problem, making use of modern methods of isolation of *S. pullorum* on differential and selective media.

Procedure. With the exception of the media employed, our procedure was similar to that employed

by Rettger and Hull¹⁶. Three-hundredths of a ml of a 24-hour tryptose broth culture of *S. pullorum* was injected either into the yolk or white of 379 eggs which were then incubated at 37°C for three days.

A total of 214 eggs were boiled for varying lengths of time ranging from 1 to 4 minutes.

Eighty-three eggs were fried 1, 1.5, or 2 minutes. The eggs were fried either on one side or on both sides.

Only two periods, 1.5 and 2 minutes, were used in scrambling 29 eggs.

The cooking time for 53 poached eggs was 1 and 1.5 minutes.

Following boiling, frying, poaching, or scrambling, the eggs were placed into tetrathionate broth and incubated at 37°C for 12-24 hours. From the tetrathionate, *S. S.* agar plates were streaked with the egg material and incubated at 37°C for 24 hours. Typical colonies were picked and run through the usual identification procedure.

Results. In table 6 the data on boiling are summarized. Of the eggs with infected white, 11.1 percent showed kill after 1 minute, 31.5 percent after 2 minutes, 52.6 percent after 2.5 minutes, 75 percent after 3 minutes, 8.2 percent after 3.5 minutes, and 92.3 percent after 4 minutes of boiling. Similarly the percentages of eggs with infected yolks showing kill were: none after 1 minute, 7.1 after 2, 50 after 2.5, 64.2 after 3, 68.7 after 3.5, and 76 after 4 minutes of boiling.

Table 7 presents the data on the fried, scrambled, and poached eggs. All the eggs with infected white, fried on one or both sides, yielded *S. pullorum*. Of those fried on one side for 1.5 minutes, 48 percent showed kill, while 73.3 percent of those fried on both sides for 1.5 minutes showed kill. Of the eggs with infected yolks which were fried on one side for 1 minute, none showed kill; of those fried on one side for 1.5 minutes, 16.6 percent showed kill and of those fried on one side for 2 minutes, 50 percent showed kill; of those fried on both sides for 1 minute, none showed kill; of those fried 1.5 minutes on both sides, 71.4 percent showed kill.

Of the eggs with infected white, which were scrambled for 1.5 minutes, 81.8 percent showed kill, and

TABLE 6

Survival Time of *S. pullorum* in Egg Albumen and Yolk During Boiling

Egg Albumen			Egg Yolk		
Time in Minutes	No. of eggs with & without growth	Percentage of kill	Time in Minutes	No. of eggs with & without growth	Percentage of kill
1	16 + 2 -	11.1	1	12 + 0 -	0.0
2	13 + 6 -	31.5	2	13 + 1 -	7.1
2.5	9 + 10 -	52.6	2.5	7 + 7 -	50.0
3	5 + 15 -	75.0	3	5 + 9 -	64.2
3.5	2 + 15 -	88.2	3.5	5 + 11 -	68.7
4	2 + 24 -	92.3	4	6 + 19 -	76.0

Key: + = Growth
- = No growth

Total eggs 214
Total percent kill of organisms in both yolk and albumen in four minutes - 84.3

TABLE 7

Survival Time of *S. pullorum* in Fried, Scrambled, and Poached Eggs.

Prep. and time intervals	No. of eggs with or without growth	Pct. of kill
Fried (infected white) one side		
1 minute	3 + 0 -	0.0
1.5 minutes	13 + 12 -	48.0
Fried (infected white) both sides		
1 minute	3 + 0 -	0.0
1.5 minutes	4 + 11 -	73.3
Fried (infected yolk) one side		
1 minute	3 + 0 -	0.0
1.5 minutes	5 + 1 -	16.6
2 minutes	2 + 2 -	50.0
Fried (infected yolk) both sides		
1 minute	3 + 0 -	0.0
1.5 minutes	6 + 15 -	71.4
Scrambled (infected white)		
1.5 minutes	2 + 9 -	81.8
2 minutes	2 + 10 -	83.8
Scrambled (infected yolk)		
1.5 minutes	0 + 3 -	100.0
2 minutes	0 + 3 -	100.0
Poached (infected white)		
1 minute	7 + 10 -	58.8
1.5 minutes	0 + 9 -	100.0
Poached (infected yolk)		
1 minute	14 + 4 -	22.2
1.5 minutes	5 + 4 -	44.4

Key: + = Growth - = No growth

83.3 percent of those scrambled for 2 minutes showed kill. It is interesting to note that 100 percent of the eggs with infected yolks showed kill in both 1.5 and 2 minutes of scrambling.

Of the eggs with infected white which were poached for 1 minute, 58.8 percent showed kill while 100 percent of those poached for 1.5

minutes showed kill. Of the eggs with infected yolk, which were poached for 1 minute, 22.2 percent showed kill while those poached for 1.5 minutes, 44.4 percent showed kill.

Discussion. In general, as might be expected, the percentage of eggs with infected white which yielded viable *S. pullorum* after the various periods of cooking was lower than that of the eggs with infected yolk. This may be due to the yolk's fat content and the protection offered by the white.

It can be seen from these data that *S. pullorum* is not readily killed by the amount of heating usually employed in cooking eggs. Scrambling and boiling (4 minutes) appear to be most effective in rendering eggs as free as possible from *S. pullorum*, and, at the same time, leaving them in good edible condition.

Nowadays the percentage of pullorum infected eggs is very low, thanks to the pullorum disease control program which is in operation throughout the country. Nevertheless, there is a possibility that susceptible individuals, who eat foods which contain virulent strains of *S. pullorum* in sufficient numbers, may become ill. This is an important additional reason for intensifying our efforts to eradicate pullorum disease from our poultry rather than merely suppressing it by the use of sulfa drugs.

SUMMARY AND COMMENTS

The skin, as demonstrated by many workers, possesses a germicidal effect upon organisms. In these experiments, using *S. pullorum*, greater germicidal effect was demonstrated on the back of the hand than on the palm of the hand. Daily as well as individual differences of the skin must be considered in evaluating the data presented.

S. pullorum and *S. choleraesuis* in eggs were found to be viable after storage for a period of 9 months, the former at 25°C and the latter at 4°C. The survival time of four other salmonellae: *S. schottmulleri*, *S. enteritidis*, *S. typhimurium*, and *S. paratyphi* was shown to extend through a period of twelve months. The experiment indicates that salmonellae tend to survive longer at 25°C than at 4°C.

By ordinary methods of cooking: boiling, frying, poaching, and scrambling, *S. pullorum*, occasionally an inhabitant of eggs, is not always destroyed. The eggs showed a lower percentage of kill when the organism had been inoculated into the yolk than when inoculated into the white. It would appear from the results of these experiments that scrambled or four-minute boiled eggs would be the safest.

If *S. pullorum* should undergo further adaptation to the human host and gain greater virulence for man, it is obvious that the pullorum disease control program would assume more than purely economic importance.

It is conceivable that, in addition to infection being acquired through ingestion of contaminated eggs, the disease might be contracted through the handling of poultry meats containing *S. pullorum*, although, at present, the latter mode of infection seems to be of little or no importance.

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(continued on page 80)

PRESERVATION OF CHOCOLATE DRINK BY FREEZING

C. J. BABCOCK¹, and D. R. STROBEL¹, R. H. YAGER²,
and E. S. WINDHAM²

To determine the effectiveness of freezing as a preservative of chocolate drink, three commercial samples processed as follows were used: Sample 1.—Skimmilk through plate heater at 165-175°F and into vat, standardized to 1% butterfat and cocoa (20 lb. 100 gal.) powder with stabilizer and sugar (30 lb 100 gal) added. Held in vat 20 min. Sample 2.—Skimmilk heated in vat and 95 lb of chocolate syrup and 54 lb of sugar added 193 gal of skimmilk. Held at 160°F for 30 min. Sample 3.—590 gal of skimmilk heated to 90-110°F sugar (280 lb) and cocoa (90 lb) powder added and then standardized with 38% cream. Heated to 160°F for 30 min. The samples were checked for flavor, frozen at -10°F and stored at 0°F. Samples were removed from storage at monthly intervals for determination of flavor and sedimentation.

Data are presented showing analyses of the samples of chocolate drink prior to freezing, analyses of sections of the samples after freezing, degree of sedimentation, and the effects of methods of thawing on the degree of sedimentation. After 13 months of storage, samples of the three chocolate drinks showed no flavor deterioration, or sedimentation to an objectionable degree.

BABCOCK *et al.*^{1,2,3,4,5,6,7} reported a series of studies of frozen, homogenized milk. In these reports, various factors, such as freezing, storage and thawing temperatures, affecting the keeping quality and appearance of the thawed milk, were analyzed.

A search of the literature failed to reveal information regarding the keeping quality of frozen chocolate drink. Colvard and Roberts⁸, however, studied the effect of adding chocolate syrup on the protein stability of frozen concentrated milk. They reported that chocolate syrup retarded protein flocculation, in the concentrated milk for eight weeks after the control had become destabilized at -17.8°C (0°F). They attributed the stabilizing effect mainly to the sugar content of the chocolate syrup.

PROCEDURE

To determine the effectiveness of freezing as a preservative of chocolate drink, use was made of three commercial samples processed as follows:

Sample 1.—Skim milk through plate heater at 73°-79°C (165°-175° F) and into vat. Standardized to 1 percent but-

terfat and cocoa (20 lbs per 100 gallons) powder with stabilizer and sugar (30 lbs. per 100 gallons) added. Held in vat 20 minutes.

Sample 2.—Skim milk heated in vat. 95 lbs of chocolate syrup and 54 lbs of sugar added per 193 gallons of skim milk. Held at 71.1°C (160°F) for 30 minutes.

Sample 3.—590 gallons of skim milk heated to 32°-43°C (90°-110° F). Sugar (280 lbs) and cocoa (90 lbs) powder added. Standardized with 38 percent cream. Heated to 71.1° C (160° F) for 30 minutes.

The samples were examined for flavor and immediately frozen in the original containers at -23.3° C (-10° F) and moved into storage at -17.8° C (0°F). Samples were removed from storage at periodic intervals for the determination of flavor, sedimentation, effects of different methods of thawing on the degree of sedimentation, and the composition of sections of the samples after freezing.

The degree of sedimentation including chocolate was determined by pouring 50-ml portions from the pint samples, after thoroughly mixing, into conical tubes and centrifuging. This procedure was the same as that used for determining the solubility index of dry milks. To determine whether the solid constituents were more concentrated in the bottom section than the top section as found by Babcock *et al.*² in frozen homogenized milk, frozen pint samples were cut in half and the thawed sections analyzed. Flavor determinations were made, after the milk was completely thawed, by four experienced milk judges. Standard procedures for determination of fat, protein, and total solids contents were followed.

EXPERIMENTAL RESULTS

Table 1 shows the analyses of the samples prior to freezing.

Table 1.—Analyses of Three Samples of Chocolate Drink Showing the Fat, Protein, and Total Solids Content Prior to Freezing.

Sample No.	Fat	Protein	Total Solids
	Percent	Percent	Percent
1.	1.14	3.32	15.46
2.	2.62	3.11	15.84
3.	0.99	3.21	15.88



Mr. C. J. Babcock, in Charge Standards Section, Research Division Dairy Branch, P. M. A., with the Dept. of Agriculture 30 years, author of more than 80 technical publications, received B. Sc. Agr., Ohio State University 1916. Was discharged as a sergeant from Chemical Warfare Services, U. S. Army, World War I. During World War II, he served as Officer in Charge of Milk and Milk Products Inspection, Office of the Surgeon General, U. S. Army, and was awarded the Legion of Merit. He was relieved from active duty as Lt. Col. He is a member of the Advisory Board, Milk and Food Section, U. S. Public Health Service; a member of the Judging Committee, American Dairy Science Association; represents the Food and Nutrition Board, National Research Council, on its committee on Milk Production, Distribution and Quality. He is chairman, Committee on Milk Regulations and Ordinances, INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, and of the Technical Committee on Dairy Processing, Dairy Industries Society International.

To determine the effects of different methods of thawing on the degree of sedimentation, samples were thawed after removal from storage by four methods as follows: (1) Refrigerator temperature, 4°-6° C (40°-43°F), (2) Room temperature 20° C (68° F), (3) Refrigerator temperature and then stirred for 90 seconds with electric stirrer, (4) Thawed to 62°-63° C (144°-146° F) and cooled immedi-

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ately. Results are shown in table 2.

Babcock *et al.*^{1,2,3,4,5,6,7} found that frozen homogenized milk could be held at -17.8°C (0°F) for approximately three months without the development of objectionable sedimentation or flavor deterioration. The samples, therefore, were analyzed monthly during the first three months, three times during the fourth month, and twice during the fifth month to detect the development of the first objectionable conditions. Such conditions did not develop and after the fifth month the samples were analyzed approximately once a month for the remainder of the experiment.

Table 2 shows that the method of thawing affects the degree of sedimentation. Section C and Section D of table 2 indicates that when the samples were thawed at refrigerator temperature, $4^{\circ}\text{-}6^{\circ}\text{C}$ ($40^{\circ}\text{-}43^{\circ}\text{F}$) and then stirred 90 seconds or when they were thawed to $62^{\circ}\text{-}63^{\circ}\text{C}$ ($144^{\circ}\text{-}146^{\circ}\text{F}$) and cooled immediately, the degree of sedimentation remained comparatively constant for 380 days after freezing. Although Section A and Section B reveals relatively high degrees of sedimentation, it never reached the point of being objectionable in appearance when the thawed samples were shaken prior to sampling.

The flavor of each of the three samples 380 days after freezing was the same as the sample in its fresh state. At no time during the experiment was a change in flavor detected.

Analyses of the top and bottom halves of the samples three days after freezing and at approximately monthly intervals until 180 days after freezing were made to determine the fat, protein, and total solids contents of the two sections. The top and bottom sections of the samples showed a fat variation range from 0 to 0.02 percent; a protein variation range from 0.01 to 0.07 percent; and a total solids variation range from 0 to 0.17 percent. The small variations were not consistent since plus or minus variations were found in both top and bottom sections. This indicates that there is no significant shift of the solid components between the top and bottom halves of chocolate

Table 2.—Degree of Sedimentation as Affected by Time of Storage and Method of Thawing.

Sample No.	Number of days frozen														
	3	37	78	101	113	123	134	144	169	220	247	281	311	345	380
(A) Degree of sedimentation in ml when thawed at refrigerator temperature ($4^{\circ}\text{-}6^{\circ}\text{C}$)															
1	4.5	8.0	15.0	18.0	10.0	8.0	2.0	17.0	20.0	15.0	20.0	12.0	20.0	20.0	18.0
2	4.0	12.0	6.0	17.0	22.0	15.0	10.0	23.0	20.0	15.0	22.0	12.0	22.0	20.0	18.0
3	2.0	3.0	3.8	8.0	4.0	*	2.8	6.0	11.0	2.7	10.0	4.0	15.0	20.0	14.0
(B) Degree of sedimentation in ml when thawed at room temperature (20°C)															
1	1.7	4.0	4.0	6.0	8.0	15.0	16.0	17.0	23.0	15.0	20.0	20.0	23.0	19.0	20.0
2	3.0	4.0	7.0	15.0	25.0	25.0	24.0	23.0	22.0	15.0	24.0	22.0	22.0	18.0	18.0
3	1.8	1.6	2.7	5.0	4.5	*	8.0	9.0	9.0	2.7	7.0	4.0	15.0	19.0	15.0
(C) Degree of sedimentation in ml when thawed in refrigerator ($4^{\circ}\text{-}6^{\circ}\text{C}$) stirred 90 seconds															
1	1.6	1.4	1.3	1.1	1.2	1.3	1.2	1.2	1.4	1.3	1.5	1.4	1.4	1.1	1.4
2	1.4	1.4	1.3	1.0	1.8	1.2	1.2	1.1	1.2	1.4	1.2	1.2	1.1	1.1	1.2
3	1.8	1.6	1.6	1.4	1.0	*	1.6	1.3	1.5	1.5	1.4	1.6	1.3	1.1	1.5
(D) Degree of sedimentation in ml when thawed to $62^{\circ}\text{-}63^{\circ}\text{C}$ - cooled immediately															
1	3.5	1.4	0.8	1.0	1.5	1.4	1.4	1.3	2.0	1.8	1.8	0.8	1.3	0.8	1.4
2	1.5	1.2	1.1	1.2	1.5	1.3	1.1	1.6	2.1	1.3	2.0	0.8	0.9	0.9	1.1
3	1.9	1.0	1.5	1.3	1.0	*	1.9	1.3	1.4	1.7	1.6	1.4	1.4	1.2	1.5

*Leaky sample.

drink during freezing or while in storage.

SUMMARY

Samples of three commercial chocolate drinks did not deteriorate in flavor during 380 days of storage at -17.8°C (0°F).

The method of thawing the frozen samples affected the degree of sedimentation. Thawing samples at $4^{\circ}\text{-}6^{\circ}\text{C}$ ($40^{\circ}\text{-}43^{\circ}\text{F}$) and at 20°C (68°F) resulted in relatively high degrees of sedimentation but this sedimentation never reached the point of being objectionable. Samples thawed at $4^{\circ}\text{-}6^{\circ}\text{C}$ ($40^{\circ}\text{-}43^{\circ}\text{F}$) and then stirred 90 seconds with an electric stirrer or samples thawed to $62^{\circ}\text{-}63^{\circ}\text{C}$ ($144^{\circ}\text{-}146^{\circ}\text{F}$) followed by immediate cooling showed the least sedimentation. These samples revealed approximately the same degree of sedimentation 380 days after freezing as was found three days after freezing.

An analyses of the top and bottom halves of samples at approximately monthly intervals for 180 days showed no significant movement of the solid components between the two sections.

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TECHNICAL SCHOOL FOR PICKLE AND KRAUT PACKERS

*Abstracts of Papers given at
Michigan State College*

The Technical School of Pickle and Kraut Packers was held at the Kellogg Center at the Michigan State College, Lansing, Michigan, February 20 and 21, 1952. There were 237 persons registered from 23 different states and four provinces in Canada. Abstracts of the papers that are particularly interesting to food sanitarians follow:

THE PICKLE PICTURE FOR 1952

J. M. IRWIN

*President, National Pickle Packers
Association
Cleveland, Ohio*

The pickle industry is a young giant that has outgrown its clothes. The consumption of pickles has increased 115 per cent in the last 20 years. The primary reason why consumption has not gone beyond the 10 million bushel figure is not because of demand but partly because the yield in the past two or three years has not been sufficient to enable us to increase production in our plants

One of the major factors in this increase in consumption of pickles has been due to the better quality of pickles in the past few years. Quality is a very comprehensive term. It includes, among other things, the varieties of cucumbers, their shape, form, yes, even the warts on them; the method of salting; freshening and finally their manufacture. In making pickles we have learned the proper balance between salt, sugar and acid. We have also learned a great deal about spicing pickles so as to get a smooth, pleasant flavor rather than a sharp, biting taste. Our Association also has been a leader in sanitation since we have written and adopted sanitary codes for both salting stations and manufacturing plants. This has made us clean up and keep clean which has likewise contributed to the quality of the pickles.

I should like to take this occasion to state that many of these things have been taught us right here in these Technical Schools which have been held since 1929 at Michigan State College. To the many men of this and other colleges we want you to know that we deeply appreciate your time and efforts on our behalf and thank you.

Simultaneously, we must concentrate on our manufacturing methods, first to improve the quality and, second, to get mass production. If we can get a good raw product at low cost and make it into a delightful high quality product on a mass production basis, nothing can stop us. We shall reach that 20 million bushel goal in less than 20 years.

THE LATEST DEVELOPMENTS IN CHEMICAL DISINFECTANTS AND HOW TO USE THEM TO BEST ADVANTAGE

DR. W. L. MALLMANN

The development of new chemical sanitizing agents continues at a rapid pace. Most of the new products announced fail in practical application, however, a few succeed each year. The most reliable are still the well known hypochlorites although the quaternary products are finding wide acceptance. The detergent-sanitizers, the products that simultaneously clean and sanitize, are also finding acceptance. These products fill a definite need but they have limited uses and are very susceptible to misuse. The value of all sanitizers is limited to the degree of preparation of the surface for sanitization.

WHAT AN INSPECTOR LOOKS FOR WHEN INSPECTING A FOOD PLANT

MYLES NELSON

. . . . In the inspection of a canning or preserving plant, the inspector looks for compliance with all the laws and requirements. First, the inspector tries to determine the attitude of the person in charge and of the key personnel. By attitude it is meant the ideas, actions and methods used in operating the plant, and whether they carry out good canning and preserving methods and practices or just talk a good game. As the inspector checks through the plant, what he sees together with his impressions formed through conversation with the key men, gives him an idea as to what to look for in checking to see that all regulations are complied with.

In making a sanitary inspection of this type of plant, the inspector looks first at the floors of all rooms used in the manufacture of canned and preserved foods to see that they are water tight and pitched to drains that will carry off the waste into sewers. Where sewage outlets cannot be obtained, septic tanks, cess pools or other adequate facilities for disposal must be provided, as stated in the law and regulations.

All buildings used for the manufacture of food products must be kept clean, properly lighted and ventilated. Ceilings must be of sufficient height to permit ample clearance of all work or any suspended shafting, piping, hangers, etc.

All tables, pails, pans, trays, utensils, conveyors, machines, or any other equipment used in the processing of food shall be cleaned with steam and water at the close of each day, and as much oftener as is necessary to prevent souring or other unsanitary conditions.

An ample supply of steam and water is necessary to keep the factory clean. Only potable water shall be used in making the syrup or brine or for washing any equipment coming into contact with the food.

All windows, doors or other openings in the factory rooms where articles of food are being prepared or are exposed, must be screened so that flies and other insects are excluded.

The inspector looks for the maintenance of proper and sufficient sanitary lavatories and toilets for both male and female employees, and that proper clothing and head coverings are provided.

Fundamental sanitation is a matter of good housekeeping. Having well drained floors, and other facilities at his disposal, it then becomes the duty of the management to keep the building and equipment clean at all times. Cleanliness is essential in every food plant and every employee should be taught its value and should be trained in every clean-up job. He should be responsible to a supervisor, who in turn should be responsible for the over-all cleanliness of the plant and for its operations. This is what I referred to in the opening remarks when I stated that one of the first objectives the inspector tries to accomplish is in finding out the attitude of the key man or supervisor.

It is a generally recognized fact that where conditions are kept to the highest point of sanitation and cleanliness, the employees will do their part to keep it that way. But, if persons in charge of the housekeeping are lax, then employees will take no interest and will make very little effort to keep things clean and sanitary.

Premises and surroundings should be kept clean and neat. I know nothing that detracts more from the appearance of a plant than to have old pieces of machinery and equipment out in the yard which immediately creates a cluttered and untidy appearance. In such a case, the inspector sometimes in jest, remarks to the person in charge of the unsightly condition and advises the manager that if he wants to complete a picture of absolute disorder, he might add an old thrashing machine or two, an old binder or some obsolete equipment. This generally produces a quick clean-up job. It has been our experience that a clean, neat, well-kept establishment is the best advertisement a plant can have.

Some of the things an inspector looks for in making a sanitary inspection are whether the plant is in an area where a rodent problem can be expected, whether cannery waste or other waste is dumped close to the plant so as to constitute an insanitary nuisance and become a breeding place for flies or other vermin.

The building itself is a matter of concern, whether the storage rooms for sugar, salt, spices, and any other supplies are adequate to protect the products from contamination. The problem of proper handling and storage of the raw product to be canned or preserved is an important item which the inspectors watch for as well as quality of the product. Many instances have shown us bad practices of improper handling and storage where the raw product becomes moldy or partially decomposed before it is ever started to be processed. Inspectors work with management to help in better timing, to

see that the raw product is processed on time, when fresh, as it is brought in by the grower, thus eliminating some of the poor practices common in some phases of the industry.

There are many things the inspector looks for, too many to go into detail, for each plant is a different case in itself and has different problems, although these basic items mentioned are common to all

There are many ways canned or preserved food products can be adulterated, a few of which I will mention, where it is necessary for the food inspector to take steps under the law, to correct.

1. The adding of too much water or other liquid to fill up the container and an insufficient amount of the actual product.

2. The use of defective, decomposed, or unwholesome raw products in the finished product.

3. The use of chemicals which are not approved, or the use of contaminated supplies, such as sugar, salt or spices.

4. Contamination by insects, rodents or in any other way.

5. The use of preservatives when not declared on the label, or color or artificial flavor.

6. If it is processed in such a manner, or ingredients are used which would cause the product to be poisonous or injurious to health.

The inspector also looks for misbranded food articles both at the plant where manufactured and at the place of sale, such as a warehouse or the grocery store.

1. An article of food is misbranded if it is an imitation of, or is offered for sale under the name of another article.

2. If it is labeled, or branded so as to deceive or mislead the purchaser, or if the contents of the package as originally put up shall have been removed in whole or in part and other contents shall have been placed in such package.

3. If in package form, every package, box, bottle, basket or other container does not bear the true net weight, excluding the wrapper or container.

I have stated some of the things an inspector looks for when inspecting a food plant, also some of the ways of adulterating and misbranding. The inspector welcomes and expects cooperation from management in meeting the problems in the plants and in the majority of cases management welcomes inspectors.

CAUSE AND POSSIBLE CONTROLS FOR CUCUMBER SPOT ROT

DR. DONALD J. DEZEEUW

The fungus causing cucumber "spot rot", *Cladosporium cucumerinum*, is botanically akin to some of the common aerial molds. The spores may be spread by wind, rain drops or contact by pickers and cultivating tools and overwinters in dead plant material in nearby areas.

The optimum conditions for infection in young cucumber tissues, such as new leaves, terminals, blossoms and young fruit, are quite similar to those for potato and tomato late blight. In general, a night temperature of about 60 to 70 degrees and moisture such as rains or dews are required for infection. Control of the disease by chemical means has proved difficult because of the necessity of protecting all succulent tissues with a suitable fungicide during all infection stages—the disease cannot be eradicated when once established. If we consider that the cucumber reaches picking size in five days, as is often the case, the spray or dust schedule needs to be at least that frequent. Copper bearing fungicides give partial control in some of the college trials when used on a 7 to 10 day schedule but an economical commercial control has not been achieved to date. Sanitation of the fields and nearby areas from which spores may come, adequate air drainage to keep the vines dry, and thorough fungicide coverage at frequent intervals are advised until resistant pickling cucumbers are available. The fungicides will give additional protection from downy mildew should that disease become epidemic in Michigan. A spot resistant pickling cucumber developed by Dr. J. C. Walker and staff at the Wisconsin station is expected to be available in the near future and with Dr. Walker's permission is discussed in detail. Dr. Arthur Isbit of the Department of Horticulture will describe the Michigan program for breeding "spot rot" resistant cucumbers now being carried on in the departments of Horticulture and Botany and Plant Pathology.

CUCUMBER DISEASE PICTURE IN 1951

EDWARD A. ANDREWS

SPOT ROT

Observations during the past two years indicate that the spot rot fungus is widely distributed in Michigan. If so, the disease can be expected wherever cool nights and wet weather occur. Spot rot was widely scattered throughout the state during 1950 and in 1951 it became generally destructive except in the "Thumb" area.

Warm nights and dry weather will prevent the disease. Many growers have observed that a "hot spell" will almost eliminate the disease from a heavily infected field. Spraying, though inadequate in research plots, has appeared effective in some commercial fields. Spraying or dusting is the only available protection against potentially destructive diseases like downy mildew.

MOSAIC

Recent work at Wisconsin indicates that wild hosts of cucumber mosaic are probably less important as a source of infection for our cultivated cucumbers than previously assumed. More must be known about the vector and its control.

CONSIDERATIONS TO BE MADE BEFORE USING PEST CONTROL MATERIALS

DR. L. G. MERRILL, JR.

Following the development and commercial appearance of DDT as an insecticide in the early 1940's a great host of new highly effective insecticides has appeared. Paralleling the development of insecticides, other agricultural chemicals such as fungicides, rodenticides, weed killers and hormones have appeared in great number. The number of new pest control materials presenting themselves is not decreasing but actually is increasing. Therefore, there is no reason to believe that within the next 10 years, materials used at the present time, will not be replaced by some yet undeveloped chemicals.

Naturally, the sudden appearance of these materials has caused many problems. Among the problems which confront the scientist and the grower are these: 1. Plant injury. As has been long recognized certain groups of plants are susceptible to injury by some of these new insecticides. DDT itself has been shown to better experience to cause considerable damage to foliage of various members of the cucumber family. 2. Residue problems. Since we know that the recent development of insecticides are effective against many types of insects it is also reasonable to assume that they are quite poisonous and harmful to man and other domestic animals. This has proven to be the case and the use of certain insecticides is strongly retarded by public health considerations. 3. Off-flavoring or tainting. There has been considerable publicity given to the fact that at least one chemical insecticide is known to impart off-flavor to various vegetable crops. This is a serious consideration, particularly so to canners and other food processors. 4. Soil residues. It is not too well known, but undue accumulations of the new insecticides in the soil is under serious study by many workers. Illustrations to be shown in the talk will give concrete examples of what large soil residues of the new poisons can do to plant growth. 5. Adverse effect on soil organisms. This phase of problems encountered in using new insecticides has not been too well developed. Apparently, the growth of some beneficial soil organisms is seriously affected by the activity of certain chemicals.

What we are trying to do with the new pest control materials is to screen out unsuitable chemicals which cannot be used except under extreme precautions, and to recommend tested and proven agents which may be employed to the best advantage. We are also studying the longevity of residues to see how long before the harvest it is safe to use various chemicals. Another factor which enters here is to adjust the dosage of the chemical so as to avoid heavy residues at harvest. One further thing along this line, is the development of new equipment and new methods of applying these materials.

These, and other considerations, are presented to show some of the problems confronting Experiment Station workers who are trying to conscientiously recommend the use of chemical pest control measures.

HEAT PENETRATION IN FRESH PACK PICKLES

W. B. ESSELEN, I. S. FAGERSON
I. J. PFLUG, AND E. E. ANDERSON

The rate of heat penetration in whole fresh pack pickles in quart jars is subject to considerable variation in different jars whereas the rate of heating of fresh pack sliced pickles was much more uniform. The rate of heat penetration in fresh pack pickles was essentially the same under tank and spray pasteurizing procedures.

CHEMICAL AND PHYSICAL FACTORS CAUSING BLEACHING OF PICKLES

F. W. FABIAN AND LEON EISENSTAT

A series of experiments was conducted for the purpose of determining the factors responsible for the bleaching of pickles. Work was confined entirely to salt stock and to processed dill pickles.

Throughout these experiments it was observed that salt stock pickles did not bleach as readily as did desalted pickles, and that pickles in jars retained their color far longer than pickles out of jars.

Experimental work using diffused light, direct sunlight, infrared light, and ultraviolet light yielded this information. Direct sunlight was the most potent bleaching agent of all the factors tested. Infrared rays, like the complete spectrum of direct sunlight, brought about bleaching in almost every pickle jar tested, and even penetrated the glass jar to remove the color of the pickles inside. Ultraviolet light was responsible for bleaching under certain conditions, and was negative at other times.

There were only a few other test factors which brought about a loss of color. Eight grain vinegar, in the experiments conducted, showed a slight bleaching effect. The influence of alum was somewhat more pronounced, especially when the pickles were soaked in an aqueous solution from one to four days.

There was no apparent relation between bleaching and hydrogen ion concentration, for color losses occurred with equal facility at every pH from two through eight, whether salt stock or desalted pickles were tested.

Storage of pickles enhanced bleaching when the pickles in jars were stored in the diffused light of the laboratory over a period of a month-and-a-half.

The use of calcium chloride, zinc acetate, and potassium dihydrogen phosphate caused marked bleaching of pickles; cuprous, magnesium, and ferric salts were negative in action.

Neither differences in temperatures, nor differences in salt concentrations produced changes in pickle color. Spice oils and oleoresin of turmeric were equally ineffective.

The hypothesis that pickle bleaching was an enzyme activity was thoroughly explored. Pickles were heated in and out of jars to temperatures ranging from 65° to 100°C and from periods of one to thirty minutes in order to inactivate their enzymes. The pickles so treated were then exposed to direct sunlight. In not one case was any relation between enzyme inactivation, or heat treatment, and the inhibition of bleaching apparent.

The belief that bleaching might be oxidative in character was tested in a number of ways. Oxidizing and reducing agents were employed; only the chemical bleaching agents removed pickle color. Oxygen gas was introduced into jars of pickles, but these jars did not exhibit any activity different from the controls. In other experiments, air was removed from the jars, and the inert gas, nitrogen, substituted. In some cases, in addition to evacuation, antioxidants were added to eliminate any residual oxygen present. Still another method used was to exhaust the air by boiling after which the jars were quickly closed. On exposure of all these jars to direct sunlight no resulting inhibition of bleaching occurred.

The combined heat treatment (to inactivate enzymes), evacuation of air, and substitution of nitrogen did not show any certain evidence, either, that retardation of bleaching in pickles had been effected.

While a few factors which bring about loss of pickle color have been brought to light, it is obvious that the underlying cause of pickle bleaching still remains obscure.

COMMON MISTAKES MADE IN SALTING SAUERKRAUT

DR. CARL S. PEDERSEN

The production of sauerkraut is a fermentation process involving several types of bacteria. These ordinarily grow in a definite sequence, each type of organism causing certain chemical changes necessary to the production of a high grade kraut. In the early fermentation, lactic acid, acetic acid, alcohol and carbon dioxide are produced, but in the later fermentation lactic acid is the major product.

The variable factors which affect the kraut fermentation are quality of the cabbage, amount of salt, temperature of fermentation, air and cleanliness. Good kraut cannot be made from poor cabbage. Salt is essential in that it is the substance which draws the water from the plant cells to produce brine. It is, furthermore, important because of the part it plays in controlling the microorganisms in the fermentation. A temperature that is too high favors the action of certain bacteria over others while fermentation does not proceed as it should at too low a temperature. The bacteria that ferment kraut prefer to grow in the absence of air while

spoilage types of microorganisms are favored by the presence of air. Vitamin C is destroyed more rapidly in the presence of air. Cleanliness of equipment is essential to the production of a high quality kraut. This means not only that the plant be clean, but also that all microorganisms have been removed from equipment that may upset a natural fermentation. With proper control of these factors, a high grade sauerkraut should be produced by any natural fermentation.

BREEDING BETTER CABBAGE VARIETIES FOR KRAUT MAKING

HARM DREWES

The breeding of *Fusarium Yellow*s resistant cabbage varieties has proven to be of the greatest importance to the kraut making industry.

Dr. J. C. Walker and his co-workers at Wisconsin are responsible for many varieties, such as Wisconsin Hollander, introduced in 1916; Wisconsin All Seasons in 1921; Marion Market and Globe, so-called "early Kraut" types, in 1927; Wisconsin Ball Head in 1935 and the Improved Wisconsin Ball Head in 1946. The Improved Wisconsin All Seasons, introduced in 1947, is also resistant to mosaic.

Wisconsin Cabbage Seed Co. introduced Resistant Flat Dutch in 1942; Wisconsin Copenhagen (early Kraut) in 1950.

Ferry-Morse Seed Co. introduced for 1952 Resistant Glory, a yellows resistant Glory of Enkhuizen type.

Non-resistant varieties used are such as Danish Ball Head; Penn State Ball Head; Ferry's Hollander; Oakview Ball Head; Glory of Enkhuizen and the surplus of practically any fresh market cabbage variety.

Cornell and Penn State are also working on yellows resistance.

CABBAGE AND CUCUMBER INSECTS

DR. L. G. MERRILL, JR.

... Control measures are most effective when they are applied before the infestation becomes widespread. Therefore, examine your crops often to determine their presence. Pay particular attention to the under sides of leaves and the growing tips. Plants growing along ditch banks or roads often become infested before the rest of the field.

Early application of a pesticide to infested crops usually means a smaller crop loss and a saving in the final cost of control. Where crops are year after year infested by a particular pest a preventive control program is best. With most cucumber growers, the cucumber beetles come under this category. Every year these pests attack the germinating cucumber plants, even working down into the soil to attack the seedling. Therefore, control measures for this pest should be automatically applied as a part of the cultural practice.

Aphids or plant lice are serious pests of both cucumbers and cabbage. While the cabbage aphid does not attack cucumbers and the melon aphid does not attack cabbage, the biology of aphids is enough the same that control measures and examinations to determine the presence of these pests are the same.

The avoiding of insect pests in the packing houses is often a difficult problem. Screening or exclusion of flies is an absolute requirement. Sanitation is also important. The use of residual insecticides and day by day use of pyrethrin sprays will aid in fly control. However, screening and sanitation are the basic fundamental considerations in this problem.

DETERIORATION OF SAUERKRAUT DURING FERMENTATION, PROCESSING AND STORING

DR. CARL S. PEDERSON

Sauerkraut is subject to deterioration in various ways, the main ones being excessive growth of undesirable bacteria and yeasts or chemical changes causing darkening of color and development of foreign flavor.

Dark kraut is usually poor in quality and low in ascorbic acid. The degree of darkening seems to vary with the season and is related to the temperature and age of the kraut. There may be a possible relationship in the intermediate products of fermentation, such as pyruvic acid, aldehydes, phosphorylated derivatives, and proteins, all of which are chemically active.

The color, flavor, and ascorbic acid content have been determined upon different lots of kraut under controlled conditions of fermentation, processing, and storage. Color measurements were determined with the Hunter Color Difference meter upon kraut in cans and glass, processed and stored under normal conditions and in simulated storages. Kraut in cans, after water-cooking and packing in cases for storage, may remain at temperatures well above 90°F for several days and as a result may deteriorate. Kraut cooled to 70° and stored for 3 months showed little change in color. Greater changes occurred in kraut stored at 111° for 3 days or at 100° for 30 days than in kraut stored at 90° for 90 days. Darkening was more pronounced in glass than in tin.

It is suggested that greater attention be directed toward temperature of fermenting kraut with the idea that the warmer tanks of kraut be canned before those at cooler temperatures. In other words, the kraut that is fermenting faster should be canned first. Care should be exercised in over-processing kraut so as to retain the best characteristics in the kraut and the best appearance in the can.

After processing, kraut should be water- and air-cooled as rapidly as possible to avoid the deterioration that so often occurs during storage.

ENZYMES AND OFF-FLAVORS IN FRESH PACK PICKLES

M. LABEE, W. B. ESSELEN, AND E. E. ANDERSON

The possible relationship in the enzyme peroxidase to the development of stale flavors in pasteurized fresh pack pickles has been investigated. The development of such off-flavors is retarded or prevented if the pickles are pasteurized sufficiently to destroy or reduce their peroxidase activity to a low level. The peroxidase enzyme in fresh pack pickles is of greater thermal resistance than are spoilage organisms normally encountered.

FLAVOR PANELS AND FLAVOR JUDGING METHODS AND THEIR VALUE IN DEVELOPING NEW PRODUCTS

DR. E. H. HAMANN

Flavoring of cucumber pickles has largely changed from the use of dried herbs and spices to essential oils and spice extractions. Advantages gained by this change. A discussion of methods used in flavoring and the influence of processing methods on flavoring techniques. A discussion on and an investigation of solubilizers for essential oils and soluble dry spice mixtures. Spice extractives versus spice oils as practical and economical flavors.

FACTORS CAUSING CLOUDINESS IN PICKLES

F. W. FABIAN AND M. N. KRAFT

Cloudiness in pickle brines and liquors on the finished product is an important problem in the pickle industry since the housewife has been educated to associate cloudiness with spoilage.

Bacteriological, chemical and physical factors were studied on the dill and sweet type of pickles made from fresh and salt stock cucumbers. Samples of cloudy commercial pasteurized dills were examined bacteriologically and found to have undergone a lactic acid fermentation. Isolation and study of the predominant bacteria showed them to be *Lactobacillus* of the species *plantarum* and *fermenti*. It is well established that proper pasteurization at 165°F for 15 minutes is sufficient to kill all yeast and bacteria, except spore forming bacteria,

which gradually die out.

Vegetable gum emulsions were shown to cause turbidity in dill brines due to the action of temperature, electrolytes, and the instability of the gum emulsions in hard waters. A Molish test on the precipitates showed them to be carbohydrate in nature.

Salt bases such as C.O.S. and Tween 20 and 80 which act as essential oil carriers were shown to cause little or no cloudiness in dill brines.

The addition of whole spices to dill brines caused cloudiness. Of the three kinds of mustard seed tested, Montana, Oriental, and Superior, in tap and distilled water, the Montana mustard seed gave considerably more gelatinous precipitate than the other two did. However, in fresh pasteurized dill brine there was no difference in the amount of precipitate formed. The gelatinous precipitate gave a positive Millon and xanthoproteic test which indicated that it was protein in nature.

Tests made with distilled and hard water indicated that the various minerals present, as cations and anions in hard water, increased the cloudiness in the presence of acid and salt.

Alum caused cloudiness in dill pickle brines. Alum was precipitated in dill pickle brines at a pH as high as 5.5, with the greatest precipitation at pH 6, and of course above this pH.

Tests on sweet brines or liquors indicated that various sweet brines may also be cloudy as judged by the photometer, but often the particles remain suspended and therefore, are not seen in the small jars. Fresh pasteurized and processed dill brines as well as sweet pickle liquors should have a photometer reading of 80 or above (under the conditions of these experiments) to be acceptable.

GENERAL CONCLUSIONS

There are many factors which cause cloudiness. Chemically it may involve pH, electrolytes, iso-electric points, anions, cations, which acting together or separately may cause cloudiness.

Physically heat causes cloudiness in certain brines by coagulation and precipitation of certain substances such as proteins.

Bacteriologically cloudiness may be due to the growth of certain acid tolerant bacteria.

SWEETOSE AS A PICKLE SWEETNER

F. W. FABIAN AND HILLIARD PIVNIC

At present there are three kinds of sweeteners used for sweetening pickles, sucrose, cerelose (or dextrose) and Sweetose. Sweetose is enzyme-converted corn syrup into a sweeter product sold under the trade name of "Sweetose."

Different kinds of sweet pickles were made from Sweetose and different combinations of Sweetose and sucrose. Standard formulas were used in making all the different products. The products were then subjected to a consumers taste panel consisting of students living in the barracks on the Campus at Michigan State College. There were 294 tasters ranging from 25 to 27 years of age from 28 states and foreign countries. These data were collected and analyzed statistically. The results are as follows:

In low Baume sweet pickles 15 percent of the sucrose may be replaced with Sweetose without any effect on consumer acceptance.

Standard Baume sweet pickles can be made with 15 percent of the sweetener as Sweetose when the acetic acid content is decreased by about one grain acid. This small decrease in acid content might in some cases necessitate pasteurization of the finished products to insure against spoilage in some factories.

High Baume pickles may be made with 50 percent of the sweetener present as Sweetose but any greater amount of substitution might lead to a low acceptance of the product.

Fresh cucumber pickles of the bread and butter type made with 25 percent Sweetose substituted for sucrose were not as acceptable as those made entirely with sucrose.

WHAT IS THE BEST TYPE OF FLOOR FOR PICKLE AND KRAUT FACTORIES?

P. D. JACOBS

P. D. Jacobs:

Experience with an acid-proof asphalt mastic floor, installed in a pickle plant thirty years ago, demonstrates the high suitability of this type of floor. The floor has held up well under continuous production traffic for this span of years. Concrete floors, subjected to the same exposure of pickle brines and syrups, rapidly erode away due to chemical action. Asphalt floors in this pickle plant are regarded as unsurpassed for durability and resiliency as well as for their waterproof, sanitary, and non-absorbent qualities. Floors are laid without joints and are sufficiently elastic to withstand unequal strains without checking or cracking. Floors are installed hot (approximately 450°F) and can be installed over any type of substantial floor, such as new or worn wood, concrete, or brick. Floors can be put into use day following installation. Depending upon floor service requirements, these asphalt floors can be installed in thicknesses ranging from $\frac{3}{4}$ " to 2".

Wilbur Cobb:

We have experienced very satisfactory results with Fulton 1870 brand materials to protect concrete floors from erosion

due to brines, vinegars, sugars and spices. This acid-proof asphalt mastic floor material is manufactured by the Fulton Asphalt Co., Chicago. The material is laid hot on a clean concrete floor in two layers $\frac{3}{4}$ " thick. The mastic can be used satisfactorily in room temperatures above 45°F. It can be used with material handling equipment with hard rubber tires 22" diameter and 4" width under 2300 lbs./wheel or 9" diameter and 5" width under 1750 lbs.

A METHOD FOR TESTING CUCUMBER SALT-STOCK BRINE FOR SOFTENING ACTIVITY

THOMAS A. BELL, JOHN L. ETHELLS
AND IVAN D. JONES

A pectolytic enzyme has been found in commercial cucumber salt-stock brines which compares in chemical behavior to polygalacturonase (PG). The presence of this enzyme has been determined in cucumber brines obtained from various sections of the country and has been correlated with softening of the salt-stock. A sensitive method for detecting this softening agent is described and recommended for use by technical men in the food industry. It should be of value in a saving of salt-stock by having an early forecast of softening.

GRADING PICKLES

ROBERT D. WHEATON

The quality analysis of pickles presents a rather difficult problem. Different people may judge quality of the same product in entirely different ways. Hence, in order to make a complete quality evaluation of a product, many factors must be taken into consideration.

A few years back, Dr. F. W. Fabian was faced with the problem of evaluating quality of pickles and pickle products that were sent to him by various manufacturers throughout the world. At that

time he set up a quality analysis sheet that took into consideration the various factors that he as well as others used in a quality evaluation of a product. Since that time, he has revised and re-edited this sheet many times until it has now reached the form that has been placed in your hands.

As you can readily see, many factors are taken into consideration. Consideration has been given to cover all factors of quality used by various government agencies involved in the control of food production. For instance, proper sediment analysis takes into consideration the Federal Food, Drug and Cosmetic Act. By rating texture, uniformity of size, color and absence of defects it is found how the product might score when evaluated by the Production and Marketing Administration of the U. S. Department of Agriculture. In addition, when the sheet has been completely filled out, one can readily determine whether or not his product will meet military specifications.

In addition to the above mentioned factors, several other important characteristics are taken into considerations. These also have a definite bearing on quality. The most important of these is flavor. There is no flavor in a freshened salt stock pickle. The flavor in the finished pickle product is determined by what the manufacture adds in the way of vinegar, salt, sugar, and spices. This flavor factor has a great deal to do with determining consumer acceptance of your product. An analysis of flavor is made with special stress being put on the harmony of acidity, salinity, sweetness, and spicing.

Recommended fill of container and minimum drained weight are noted. Although these two factors are not used in scoring the product. The Department of Agriculture sets up standards that they recommend the product meet.

Since we do not have the facilities here to completely demonstrate the methods used, I will describe the procedure that is followed in filling out this sheet.

SURVIVAL OF SALMONELLA ON SKIN AND IN EGGS

(continued from page 73)

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ILLINOIS ASSOCIATION OF MILK AND FOOD SANITATION

The Annual Spring Conference will be held this year on Monday, June 2, 1952, at the Oak Park Arms Hotel, Oak Park, Illinois.

President Meany has announced the appointment of the following committees:

PROGRAM COMMITTEE

D. E. Harms, Chairman
Harry Cohen D. G. Hildreth
W. J. Corbett J. M. Nichols
J. C. Flake Dr. S. R. Poulter

3-A SANITARY STANDARDS COMMITTEE
S. M. Rogers, Chairman P. G. Larsen
E. G. Huffer Dr. P. H. Tracy

CONSTITUTION REVISION COMMITTEE

C. A. Abele, Chairman
C. V. Christiansen P. E. Riley
E. H. Parfitt L. H. Weiner

NOMINATING COMMITTEE

F. J. Keller, Chairman
S. J. Conway D. B. Morton

MILK and FOOD SANITATION

PUBLIC RELATIONS*

J. L. ROBERTSON, JR.

Sanitary Engineer Director — Public Health Service
Federal Security Agency, Washington 25, D. C.

Public relations is a patent and integral part of industry's and health department's daily affairs. Representatives of both must understand and practice good public relations to accomplish business and sanitation objectives. Every experience and action results in good or bad public relations. The Sanitarian should plan and strive for good public relations, based on an understanding of industry's problems and community needs. This approach should result in prevention by guidance through education rather than correction by enforcement through police action. Practical steps are suggested.

PUBLIC RELATIONS is a major part of the public health worker's business. If we are to be successful in reaching our objectives we must develop an understanding of public relations. Public relations sells milk for the dairy industry. Public relations sells health for the health agencies. One of the dairy industry's best friends is the health department, which strongly advocates quality milk and encourages milk consumption. Of course, it is necessary first to have a quality product. This applies to both the dairyman and the sanitarian.

WHAT IS PUBLIC RELATIONS?

If I may slightly misquote the wag, I shall say, "God gave us our relations, but we may choose our friends." Public relations is the exception that proves the rule. We can choose our public relations! In fact, we do this whether we intend to or not. We can be proud of our relations or ashamed of them; they can be helpful to us or they can be a handicap; they are good, they are bad, they are indifferent, just as we make them.

In seeking a definition of public relations, we will receive a variety of answers. Boiled down, they can be concentrated into a few words, packed with significance — public relations is human relations. The practice of public relations is the practice of the Golden Rule. David M. Church, quotes one authority as

* Delivered before the Virginia Association of Milk Sanitarians Sixth Annual Conference at Natural Bridge, Virginia, March 22-23, 1951.

saying, "very simply, public relations is nothing more than putting the Golden Rule into effect — doing unto others as you would be done by. To which someone has added the suggestion, 'But do it first.'" This in effect admonishes us to go 51 percent of the way.

We might add at this point, "that charity begins at home."

Professor Harwood L. Childs,² Princeton University, tells us "Public relations is simply a name for those activities and relations of ours that are public and which have social significance."

The consensus of several eminent national health leaders taking part in a recent symposium on "Health Education and Public Relations,"³ is that good public relations invites public appreciation and support of health programs; on the other hand, health education seeks personal understanding and practice of good health conduct by the individual.

I should like to quote from the symposium: Mayhew Derryberry³ tells us, "In the field of public health, public relations refers to winning good will for an organization or for one of its programs; health education aims to facilitate learning about health and health problems and motivating good individual and group health practices."

Lucy S. Morgan³ says, . . . "Public relations, human relations, and health education are a trilogy which cannot be compartmentalized or separated in a health program designed for the people and by the people and of the community."

Dorothy B. Nyswander³ points out, ". . . the health department and the community are dependent upon one another for their mutual welfare, and a program of public relations will be effective in strengthening the ties between them."

HOW IS THE SANITARIAN CONCERNED WITH PUBLIC RELATIONS?

By and large, there are two ways of conducting sanitation programs:



Mr. J. L. Robertson, Jr., graduated from the North Carolina State College with BS in CE, 1925. He entered the U. S. Public Health Service, July 1925, and served through the several grades to become Sanitary Engineer Director in 1948. Assignments varied in general sanitation with special work in interstate carrier sanitation, shellfish sanitation and mosquito and malaria control; both applied research and field control programs.

He served throughout greater part of United States and in Hawaii, and has had international experience in Mexico and Guatemala, during World War II.

Recent assignments are: Chief, Engineer Branch, Federal Employee Health Division, and latest assignment, Regional Engineer, FSA, Region III consisting of North Carolina, Virginia, District of Columbia, West Virginia, Maryland, Virgin Islands and Puerto Rico.

one is the enforcement of regulations or the employment of police methods; the other is guidance through education or the sharing of information. The choice lies with the health worker concerned. The sanitarian's interest and knowledge of public relations will determine his approach to the problem. Some criteria which we may use as guide lines are: Are we really welcome in our workaday contacts? Have we bettered each situation we have met? Have we stabilized it? Have we used an "adult" approach?

Good public relations creates a situation in which the dairyman is receptive to meeting regulations even when he is subject to correction. Recently, I saw this principle illustrated when I was in the office of a sanitarian supervisor. An irate manager telephoned about an inspection which had been made of

his establishment; the field sanitarian who had made the inspection had demanded compliance with the regulations in an arbitrary manner, had threatened closure, had not bothered to explain. The supervisor, in whose office I sat, listened politely, made a considerable effort to explain the regulations and the sanitary reason therefor, and asked what he, the manager, would suggest be done. The manager made acceptable suggestions and invited the supervisor to come to the establishment to inspect the changes when they were completed. Thus, two examples of public relations had been demonstrated before my eyes in the short course of a few minutes: the police approach and the educational approach.

People do things better and more willingly when they understand and want to cooperate than when they are forced arbitrarily to comply with regulations.

WHY SHOULD WE SEEK GOOD PUBLIC RELATIONS?

Today's sanitarian possesses a goodly amount of technical information. Research is constantly adding to the sum total of his knowledge. He knows a great many scientific facts about a great many things that have an impact on the hygiene of man's environment. He has the tools further to recognize and solve new sanitation problems; problems which grow more complex day by day. He can be proud of his accomplishments and have confidence in his ability to meet tomorrow's scientific unknowns.

On the other hand we have a great many unsolved, unrecognized problems in the field of public relations — human relations. Our urgent need is some means of putting our health knowledge to use in the community as a part of its daily life. We need to think in terms of social "know how" as contrasted with *technical* "know how." It is important for us to learn how to communicate with our neighbor; to communicate with him in the sense of making ourselves understood. It is equally important that we should not be misunderstood, for it isn't what we say that matters but what people think we say.

Good public relations enables us better to gain sanitation objectives

and to make real contributions to the community welfare. Through understanding, the support of the public is assured. When it is informed, the community, through the health department, is more responsive to changing local, national, and world conditions. Civil defense is an outstanding example of the need for informed community action.

Mutual aid in civil defense, community action in civil defense, are brought about through good public relations; the Federal government cooperates with the state government, the state government cooperates with the cities and counties, one community cooperates with another. Little or none of this action could be planned or put into effect if the program in all its aspects were not brought before the public — and public support obtained through public relations conducted on a logical rather than on an emotional basis.

The national defense situation is such that manpower may become in critical short supply before very long. Sanitarians may have to spread themselves extremely thin on the home front and, in addition, accept new responsibilities. We must be prepared to meet any emergency. Through good public relations — understanding amongst ourselves, the public, and industry — we can successfully meet these needs. We may have to invent new practices to obtain understanding, initiative, and action on the part of the citizen. Conditions may dictate that only a minimum of health department manpower can participate in sanitation programs. We may have to inaugurate a practice of self-policing in industry. Coordination of activities with other public services may prove necessary. We must learn to work together. The efficiency of our combined efforts largely will be determined by our understanding of each others interest and by mutual confidence, brought about by good public relations.

WHEN IS PUBLIC RELATIONS GOOD OR BAD?

Big business trains its executives in human relations — public relations — because surveys show that people are interested first, in their

health and the health of their loved ones, and second, in human relations — that is, getting along with people, doing business together, meeting socially.

An outstanding example of good public relations is the relationship which exists between Marshall Field's department store in Chicago and its public. It was Field who coined the slogan, "The customer is always right." The customer today takes for granted the many services which are available and which have been built up through the years. This great merchandizing establishment has become part and parcel of the civic life of the Windy City. The same may be said of Wanamaker's in Philadelphia and many stores in other large cities. These commercial establishments have become institutions.

Even though there may be frictions here and there, the public relations of many great national utilities and manufacturing companies are of the best. Consider for a moment the public's confidence in the American Telephone and Telegraph Company, in General Motors, in General Electric. This confidence was not something manufactured by machines, but rather fashioned through service and good public relations.

Not all public relations are good. Wright and Christian record²: "The public relations of the National Electric Light Association in the late twenties and early thirties still smells unpleasantly in the public nostrils. After a thoroughgoing investigation, the Federal Trade Commission in 1934 . . . reached the conclusion that 'measured by quantity, extent, and cost, this was probably the greatest peacetime propaganda campaign ever conducted by private interests in the country'."

Why did the campaign miscarry? Professor Harwood Childs comments: "In the first place, the association did not approach the public sincerely and directly for the purpose of enlightening it, but by indirection and use of financial pressure sought to control it. In the second place, and by far the most important reason, the industry tried to sell itself before its house was in order. Instead of trying to find out whether public disfavor had any real basis in fact, and seeking, so

far as it was possible to do so, to correct abuses where they existed, the propaganda resources of the industry were mobilized to white-wash them."

I am sure many of you remember the evil smell of bad public relations which emanated from some political machines from time to time.

HOW CAN THE SANITARIAN PRACTICE GOOD PUBLIC RELATIONS?

Our public relations will be good or bad according to our day-to-day actions. Public relations can't be turned off or on like an electric light. We cannot have a public relations week; necessarily, there are 52 of them each year. What we think, what we do, what we say, how we react to our daily contacts, the pamphlets we hand out, the radio talks we make, the posters we tack up, the exhibits we show, all, in sum total, determine the quality of our public relations.

Public relations is not static, it changes with the times.

We should know the various publics with whom we deal, their reactions, their likes and dislikes, their moods. The tidewater Virginian is a different individual from the Blue Ridge mountaineer. The farmer who produces milk on his farm in the country has interests and outlook on life different from those of the distributor who delivers the milk in the city.

In our public relations with industry we must make an honest effort to recognize its interest, understand its problems, appreciate its efforts. In this connection, we should keep in mind that there is a difference between appreciation and flattery; we should never dispense cheap praise. We can get people to do things. We can appeal to the better side of human nature. We can stimulate action by providing a motive; whether that of monetary reward or that of pride of civic service.

In the enforcement of regulations we should keep in mind that people don't blame themselves for their mistakes or misdeeds. "Two Gun" Crawley wrote, as the police closed in on him, "Under my coat is a

wearry heart, but a kind one — one that would do nobody any harm." A short time before Crawley wrote this he had killed a policeman in cold blood in an unprovoked attack.

Sharp criticism and rebukes arouse resentment and non-cooperation; while "a soft answer turneth away wrath." Compliance through coercion cannot possibly assure compliance during the absence of the inspector. The property holder, the business man, the government official, should welcome the sanitarian's visit. Happy is the sanitarian whose counsel is sought!

A word of warning: Let us not confuse public relations with publicity. Beware of the "press agent" approach. Let us not confuse public relations with propaganda—that is, progaganda in the evil connotation of the word. Publicity has its proper function. There is good and bad propaganda. It is good propaganda to show that good health results from proper sanitation practices. On the other hand it is bad propaganda to dispense "scare" material. Public relations should be used to help mold public opinion, never to varnish incompetence, whitewash mistakes, or paint frightening situations.

Dr. Vlado A. Getting,⁴ Commissioner, Massachusetts Department of Public Health, suggests the preparation of a "... manual of procedures for public relations with respect to proper telephone department, correspondence standards, management of visitors, home visits, and other everyday activities of each of the various professional and clerical staff members."

The National Publicity Council¹ proposes the creation of a Public Relations Committee, a small able group working together according to a sound plan. The report concludes:

"1. A Public Relations Committee can be useful:

If it is given representation in the top policy-making group.

If it is a working committee, and not merely a listing of names on a letterhead.

If it has a chairman who is well informed in the field, a leader, and able to recruit assistance.

If there is a definite program of work to be done and the where-withal to carry on that work.

If there are sound working relations between the committee and the agency's paid staff.

2. A Public Relations Committee should be formed only:

If the agency is willing to give it a voice in policy matters.

If the committee is given the opportunity to determine what public opinion is.

If the agency is willing to correct its activities to meet public attitude. If membership on the committee can be assured from those who have the necessary knowledge, the time to give the effort, and the willingness to give of that talent and time."

Finally, we should know our public relations; make full use of them; have them work for us rather than against us. Let us give our community an opportunity to become cognizant of its health objectives; encourage our community to take leadership in the solution of its health problems. Remember, however, that we must be "sold" on our business ourselves before we can effectively "sell" it to someone else.

In closing, may I point out that a demonstration is invaluable. All of us must go through a learning process. We should seek out opportunity to practice good public relations. We can demonstrate that an informed and friendly public need not be *spurred* into action — the application of the *spurs* is unnecessary. Concerted community action needs only understanding and guidance.

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NEW ENGLAND GREEN PASTURES PROGRAM

By S. G. JUDD

Commissioner of Agriculture, Montpelier, Vermont

The New England states have inaugurated a yearly contest in comparative ratings in the improvement of pastures and roughage crops. Governmental agencies and commercial firms are cooperating, and the judging is handled under the direction of county agents. The prizes are awarded at colorful exercises held on Governors' Day.

IN 1947 at an observance of the close of a successful pasture improvement contest in New Hampshire, Governor Charles Dale wagered a new hat to the governor of any New England state that would exceed New Hampshire in the ratings in a New England Green Pastures Contest.

This action by Governor Dale provided the spark which intensified the interest of New England farmers in Grassland Improvement. The consequences in benefit to New England Agriculture have far exceeded the imagination of anyone at that time.

Each year, beginning in 1948, there has been a New England Green Pastures Contest which many prefer to call a Green Pastures Program because it includes a year round program of improvement of pastures and roughage crops. Each year the number of contestants has increased, and in Vermont alone there were 1185 in 1952.

All governmental agencies as well as some commercial groups have given their services with enthusiasm, and the development of splendid teamwork has been one of the very worthwhile features of Green Pastures work.

The county contestants are judged by local groups who are trained for the work by the county agents and agronomy specialists. The local winners are judged by a State Committee, and these winners are finally judged for New England honors by a New England judging committee that is selected by the overall sponsoring committee, the New England Green Pastures Committee of which Louis H. Zehner

of the Federal Reserve Bank of Boston is the very efficient chairman.

Eighteen of the first three place winners in the six New England states are the guests of the Eastern States Exposition, and very colorful exercises are held on Governors' Day and in the Coliseum on the preceding Sunday evening. Each first place state winner is awarded a silver cup presented by the governors of the respective states and the sweepstakes winner for New England receives a silver tray awarded jointly by all the governors.

As a measure of practical benefit, it can be truly said that a good pasture and roughage program is not now unusual in the New England states and that in fact one can hardly follow any road in our farming sections without realizing that examples of good grassland management are very evident.

Dr. Hugh Riddell, Head, Department of Animal and Dairy Husbandry, University of Vermont, recently commented on the Green Pastures Program as follows:

"A study of the farm and herd management practices of the 1951 Vermont county winners points the way to the future. These farms kept an average of 31 cows which is a good 50 percent more than today's average Vermont dairy farm. Cost studies show higher labor income on larger farms where more cows can be looked after and labor used to better advantage. While the average size of Vermont herds is slowly increasing, many farms could keep several more good cows with the feed and space available.

"Another sign of the times is the use which the Green Pastures winners made of commercial fertilizer and lime. They average 1,200 pounds of fertilizer and one-half ton of lime for each cow in the herd. Your Dutch farmer would give this his heartiest approval for he fertilizes and cares for his pastures as the most important crop on his farm.



Stanley G. Judd, of Montpelier, Republican, was born in Port Henry, New York, August 20, 1889 and located in Montpelier on December 1, 1944. He graduated from New York State College of Agriculture at Cornell University with degree of B.S.A. in 1911. He served as sergeant in the Field Artillery in World War I. He was a member of the Senate from Orange County by appointment in 1939 and 1943. He was extension dairyman in Vermont Agricultural Extension Service 1922-1926; and principal of the Vermont State School of Agriculture at Randolph Center from January 1, 1926 to December 1, 1944; is a director, New England Dairy and Food Council and member New England Committee of the National Planning Association; Acting Chairman, Vermont State Soil Conservation Committee. Religious preference, Protestant. Post office address, Montpelier, Vermont.

"Another point — the Green Pastures winners all believed in grass silage and a majority had corn silage as well. Thirteen of the 14 county winners had alfalfa hay. And their good roughage program paid off in less grain for the milk produced, averaging about one pound of grain to each 5.5 pounds of milk.

"A wise old Dutch farmer told the writer a few years ago that the dairy cow has only so much room inside of her. To get the most milk we need to keep that space filled with the best roughage we can grow.

(continued on page 93)

SOME ASPECTS OF AN EMERGENCY MILK AND FOOD SANITATION PROGRAM*

DAROLD W. TAYLOR, M.P.H.

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(The views expressed in this article are those of the authors and do not necessarily reflect the policies of the Public Health Service.)

The milk and food sanitarian plays a very important part in the planning, coordinating and expediting of a civil defense program. The maintenance of normal milk and food supply levels represents only one facet of the civil defense program. Atomic, biological, and chemical warfare will present new problems in addition to those known from high explosive and incendiary bombs. Preparatory over-all measures at state and local levels must be planned with civil defense authorities. The local sanitarian will be looked to for the detailed planning of the milk and food program.

AS WE ALL KNOW, a state of national emergency exists. No one knows fully how effectively sanitation personnel can cope with the problems posed by wartime disaster, but this we do know: in any such eventuality, certain sanitation problems of major significance will confront us. We must be prepared to deal with them effectively through properly planned and coordinated facilities.

SANITATION PROBLEMS

The maintenance of normal milk and food supply levels represents only one facet of the emergency planning program. The disruption of utilities and of normal channels of milk and food distribution and preparation, and the destruction or contamination of food reserves, present serious problems. Because milk is highly perishable food, the destruction of pasteurization plants, transportation services, and cold storage facilities would create many hazards. Naturally, when normal controls are disrupted, we can ex-

pect an increase in the number of food-borne and milk-borne disease outbreaks. In addition to the disruption of normal channels of operations, there will be problems associated with the mass feeding of the homeless.

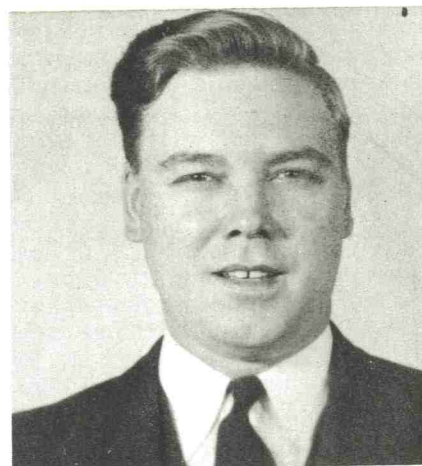
In considering any program for civil defense, we are immediately faced with the problem of personnel shortages. Trained personnel are as scarce today as they were during a comparable period preceding World War II. This shortage exists not only in health departments but in industry as well. The Armed Forces once again are absorbing many skilled individuals, and the utilization of existing manpower to the extent needed must be realized.

Equipment shortages further tend to complicate the problem. Restrictions on the manufacture of milk plant and food service equipment are being felt daily, at an increasing rate, by the industry concerned. Many segments of the milk and food industry which have not fully recovered from hectic World War II experiences are once again being called upon to operate existing equipment in excess of capacity.

Prior to and during World War II, our civil defense planning was directed toward preparedness against high-explosive and incendiary bombings. Civil defense planning today must be geared not only to the possible use of these two weapons but also, special weapons of the atomic, biological and chemical varieties.

RADIOLOGICAL CONTAMINATION

Much has been written already about the destructive powers of an atomic bomb, with its attendant radiation and fire storm hazards.



Mr. Darold W. Taylor is Regional Milk and Food Consultant in the Region III office of the U. S. Public Health Service, Washington, D. C. In 1939 he graduated from Kent State University in Kent, Ohio, with a B.S. degree in Biological Science. After working in local and state health departments and the Public Health Service for a period of years, he attended the University of Michigan in 1949, and received an M.P.H. degree. While with the Public Health Service, his assignments have been on milk and food sanitation activities in this country and in general sanitation activities while on assignment in Egypt and Greece.

Following an attack of this type, should any pasteurization plant be left standing, it is quite unlikely that we would concern ourselves primarily with the hazards of radioactive contamination of the fluid milk. Surface contamination of vats and coolers, although possible, is not probable. The destruction of the plant itself, or the loss of power or water supply, would probably create the most serious hazards.

There is a possibility that foods might be contaminated by an atomic burst. When any foods are found to be within the zone of residual contamination, radiological specialists must be called upon to determine whether or not the food may be used. Foods located in undamaged refrigerators, unopened cans, sealed bottles, jars and packages, whether in houses, markets, restaurants or storage, may be used without prior monitoring. In such cases, however, care must be exercised to wash off any dust or liquid from the outside of the container or package prior to opening.

Following an atomic attack, the

*Presented at the 31st Annual Conference of the Maryland State Department of Health, Baltimore, Maryland, May 25 1951.

milk and food sanitarian will not be faced with problems involving the decontamination of food or milk products. Nor will he be expected to determine the presence of radioactive particles. His paramount problem will be to see that milk plants capable of operating can carry on the pasteurization process properly despite additional loads. He will have to assure himself that adequate water, cold storage facilities, and utilities are provided for existing plants. The sanitary practices used in mass feeding areas will come under his surveillance. Foods of sub-standard quality will have to be excluded from the disaster area and potential outbreaks of food-borne disease must be guarded against. In short, the acceleration of the milk and food sanitarian's routine activities will account for most of his time.

BIOLOGICAL CONTAMINATION

Biological warfare alone, or in conjunction with an atomic attack, will present still another problem. The concept of biological warfare is not new to the public health worker. It is defined as the intentional dissemination of living disease organisms, and/or their toxic biological products, for the purpose of producing diseases or death in man, animals, or crops. In addition to its use in conventional warfare, where it might be disseminated into the atmosphere, it is also a readily adaptable weapon for the saboteur. Sabotage of food supplies could be successful when directed at foods, such as milk or salads, which are to be consumed without cooking, or cooked foods ready for serving. Cafeterias, bakeries, dairies, kitchens, and catering establishments, where food is prepared for mass consumption, are vulnerable to this form of attack. Improvements in our systems of reporting disease outbreaks and the acceleration of our diagnostic techniques must be accomplished. These, combined with improved methods of detecting and identifying Biological Warfare agents, and the establishment of a system of internal security to aid in preventing sabotage, will greatly strengthen our defenses against biological warfare. In connection with these concentrated efforts, once again the

sanitarian will find himself performing his usual duties on an accelerated basis.

CHEMICAL CONTAMINATION

It would be well to consider at this time a few facts concerning chemical warfare as it relates to milk and food products. Non-persistent gases (i.e., those readily dispersed by wind, air current and rain) such as chlorine and phosgene, are harmful when inhaled, but food can absorb them in rather high concentrations and remain fit for consumption. In this case the palatability rather than the wholesomeness of the food will be impaired.

The persistent liquid blister gases, such as mustard, lewisite and ethyldichlorarain, are more destructive of foodstuffs. Non-arsenical blister gases are readily absorbed by uncovered fatty foods, including milk, cream, and cheeses. Since there is no effective treatment for decontamination of these foods, they should be destroyed. Sealed cans or metal drums give complete protection against all known war gases. Waxed cartons and glass bottles covered with grease-proof paper will offer fairly good protection.

STATE SANITARIANS' DUTIES

As in the case of the special weapons previously mentioned, the sanitarian will, in the case of hazards from gas attack, play a significant part.

It would be difficult to over-emphasize the sanitarian's part in coordinating the milk and food aspects of civil defense planning. As stated, his duties will be magnified greatly should an attack be directed against us with one or more of the aforementioned weapons. He must prepare himself and his department with a plan that is practical and acceptable to local civil defense authorities. This must be accomplished not only for his area, but must be coordinated with the plans of other areas since all will be dependant on mutual aid. Peacetime planning and preparatory measures at the state and local levels must likewise be coordinated. Suggested preparatory measures that should be planned on a state-wide basis in consultation with civil defense authorities, might be summarized as follows:

1. The immediate development of specific plans by likely target areas, and advisory assistance to these areas.

2. Planning in mutual aid areas, and advisory assistance.

3. Organization of State or area mobile teams of public health workers, including milk and food sanitarians and technicians.

4. State-wide plan for diversion of raw milk supplies from target areas to plants outside these areas.

5. Preparation of rosters of qualified milk and food sanitarians and technicians. Roster should include names, training and experience. Qualified industry personnel also should be listed.

6. Training programs in emergency sanitation should be initiated for State, local and auxiliary milk and food sanitation personnel.

7. Laboratory facilities outside the likely target area should be designated to perform necessary milk and food analyses. The use of mobile laboratories should be considered.

8. Assist in education of the general public in preparedness measures.

LOCAL SANITARIANS' DUTIES

Following the inauguration of an adequate state plan for emergency milk and food problems, local health departments should be given effective assistance in developing effective emergency measures.

It is on the local level where the more detailed planning must take place through the efforts of the local sanitarian who will be called upon to answer in detail local sanitation problems relating to milk and food. It is suggested, therefore, that he prepare himself and his department with the following:

The accumulation of pertinent data is essential. This entails a survey of all processing plants in the area and should include a tabulation of the volume, type, and capacities. Location of each plant should be recorded, along with stand-by auxiliary power, refrigeration, and water supply. Milk producing farms should be geographically located and their volume tabulated. Arrangements should be made to divert the supply to un-

damaged areas. Milk powder condensing plants and concentrating plants, as well as cheese and ice cream plants, should be listed in the areas to which a portion of the target city's raw milk supply could be diverted. All cold storage plants within a radius of 100 miles should be surveyed to determine those that might be used for diverted milk and milk products.

Information relative to food establishments should be tabulated on the local level. Commercial and private food establishments in likely target areas and their peripheral districts should be surveyed as to location, possible degree of expansion, capacities of equipment, and other facilities. The location of warehouses, schools, garages, and other buildings that might be suitable for mass feeding establishments should be noted.

All manufacturing plants and distribution warehouses for food equipment, utensils, chemical bactericides, and small refrigeration equipment should likewise be listed. It is essential to maintain an up-to-date roster of all persons experienced in the preparation and serving of large quantities of food. In addition to making the above mentioned surveys in the target area and its periphery, the survey should include all communities and cities within a 300-mile radius that have

been selected to provide mutual aid.

2. Once the above information has been collected and tabulated, a comprehensive plan of action can be developed. Such a plan should be *thoroughly coordinated and integrated* with local civil defense disaster relief plans, both on the local and state levels, and where required on an area level. Plans for the number of establishments to be converted for mass feeding, their location, the number of emergency kitchens to be established, the number of persons each can serve, the type of equipment needed, source of food, and emergency measures for garbage and excreta disposal should be drawn up in advance in both the target and peripheral areas. Plans should be made for employees of eating and food preparation establishments to report for duty at a previously designated location for assignment to emergency feeding duties. Emergency milk distribution centers should be organized so that fluid milk, milk powder, or canned milk can be distributed to infants, the sick, and the aged. Each receiving station or pasteurization plant in the target area should be assigned at least three alternate processing plants, in the event it becomes necessary to divert the supply. Alternate and auxiliary milk plant per-

sonnel should be assigned to each plant to replace normally assigned personnel who might become disaster casualties. Plants should be encouraged to maintain all equipment in good repair.

3. An education and training program must be established to train key milk and food sanitation personnel in the proper techniques of food sanitation. Personnel selected for this training should be experienced, if possible, in fields allied to milk and food sanitation.

The experience of the English who were bombed heavily during World War II indicated clearly the necessity for careful emergency planning. There is no quick and easy way to develop the organization necessary to stem panic and promote orderly action. It requires, time, forethought, and the ability to translate paper patterns into working plans. Fortunately, health department personnel are trained to render specific services. Hence, as one member of the team, the milk and food sanitarian is well versed in the methods by which, during normal times, the community is assured of receiving safe and wholesome food.

We must realize that the threat of impending disaster must be met by facing the facts squarely. This and a blueprint for meeting disaster may help to save countless lives.

THE UNIVERSITY OF ILLINOIS

HOLDS

H-T-S-T PASTEURIZATION CONFERENCE

The Department of Food Technology, University of Illinois announces a High Temperature Short Time Pasteurization Conference to be held on May 7 and 8, 1952. The program is as follows:

Demonstrating the control instruments on HTST pasteurizers — J. Barber, L. L. Forward and Harold Wainess

Demonstrating the operation of HTST pasteurizers — L. T. Gustafson and V. L. Swearingen

Demonstrating the operation of the Vacreator — Frank Board,

C. E. McIntire and V. L. Swearingen

Demonstrating the operation of the Mallorizer — R. R. Crist and V. L. Swearingen

The basis for establishing the present pasteurizing temperatures — E. G. Huffer

Instrumenting HTST pasteurizers — J. Barber and L. L. Forward

Sanitizing HTST pasteurizers — L. H. Minor

Technological advances in the dairy industry — K. G. Weckel

Using two pumps in HTST systems — Harold Wainess

Pasteurizing ice cream mixes by the different HTST methods — J. Tobias

Pasteurizing milk for cheese by the different HTST methods — S. L. Tuckey

Timing HTST pasteurizers — E. O. Herreid

The registration fee is \$5.00 for each person and is payable at the time of registration.

Additional information may be obtained by writing to:

R. K. Newton, Supervisor of Conferences

713½ South Wright Street
Champaign, Illinois

SANITARY PROCEDURES AND PRODUCT CONTROL IN THE CHEESE INDUSTRY*

R. P. ZELM

Quality Control Dept., Kraft Food Co., Chicago, Ill.

The article deals with the Quality Control Program as developed by the Kraft Foods Company. It points out the object of the program, the method used to analyze the plants and the setting of standards of raw materials, finished products and packaging supplies. The paper also stresses the need of education to insure the operation of any Quality Control Program.

As you well know, Kraft is principally in the cheese business—either making it in our own plants or buying it for resale and processing from hundreds of independent cheese factories throughout the United States and Canada.

OBJECTIVES

In order to assure a continuous supply of high quality cheese the Kraft Plant Analysis program was put into effect during the early part of 1942 along with an intensified Quality Control Program.

The object of the Program is to:

1. Produce a finished product that is without question the best in the market.
2. Improve the quality of the product by pointing out for elimination, conditions that might contribute to product deterioration.
3. Promote public acceptance of the Company's products by a favorable impression on the casual visitor to our plants.
4. Reduce the losses from spoilage caused by "seeding" the machinery and equipment in the plant with objectionable bacteria that might affect the keeping quality of the product.
5. Reduce financial loss and embarrassment occasioned by seizures of products by federal or state regulatory departments.
6. Improve employee morale by ideal working conditions.
7. Avoid loss of time from acci-

*Presented at the Thirty-seventh Annual Meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, INC., Atlantic City, New Jersey, October 13-16, 1950.

dents and from breaking down of equipment.

You may notice that we do not speak of an inspection or inspectors but call it plant analysis made by an analyst. We do not like the word inspection because our plant analysis program is a cooperative project which goes far beyond a simple plant inspection. Other than just the listing of items pertaining to sanitation it covers methods of operation, housekeeping, and maintenance of plant and equipment.

PROCEDURE

Our first score sheet, however did pertain only to items of sanitation with the final score depending on the judgment of whoever made out the report. One man would emphasize one point while another learned the other way. Considering the various types of plants we have and the large area covered, another system of evaluation had to be developed.

The present method of plant analysis now has seven categories for tabulation and proper evaluation. Under housekeeping, we have cleanliness of equipment, cleanliness of plant, operating methods, and orderliness. Under repair expense, we place building and premises, equipment and correction of disorder.

The plant is divided into areas according to the operation or function they serve: office, make room, receiving room, boiler room, etc. The smaller plant may have 6 to 10 areas while the larger may have up to a hundred.

The analyst visits each and every area in a plant and records each item as observed. Such a list for a single department may include milkstone in the cheese vat, too much product spilled on the floor, improper head covering of employees, burred edges on agitator paddles, broken windows, etc., each of which counts as one item against that department.

After all areas have been visited, all items are tabulated under the



R. P. Zelm was born and reared in the dairy country of Wisconsin. He is a graduate of the University of Wisconsin. He spent 30 months in Europe during World War II with the Veterinary Corps Food Inspection service. He has been in the milk and ice cream business in Ohio and cheese manufacturing in Wisconsin, before coming to the Kraft Foods Company.

various categories. The total number of items found is divided by the number of areas which gives the average number of items per department. In figuring the final score, we used to allow 2 points per department but this year that was changed because so many plants have improved considerably over the years. The plant score is obtained by multiplying the average number of items per area by 10 and subtracting that figure from 100.

To give each plant all possible assistance in cleaning methods and cleaning aids, the production department has two men whose job it is to investigate cleaning compounds, brushes, and methods of cleaning all types of equipment by manual or mechanical methods. They also visit each plant in order to instruct and demonstrate to the Plant Manager and the Clean-up Crew on proper methods of cleaning. The water in each plant has been analyzed for hardness, and a cleaning powder recommended to fit that type of water. The plants are required to weigh or accurately measure all washing powder to be used in wash tanks and pails to keep all wash water as close to 115°F as possible. Wire wool and metal-bearing scouring pads and brushes have been barred in all of

our plants. They may help to clean equipment but they also scratch the metal which in turn, make for harder cleaning and a shorter life of the machinery. Then too the danger of feeding the consumer bits of metal has been reduced considerably.

It has also been recommended that rubber pails be used for wash buckets and that rubber mats and parts buggies be provided on which to place washed parts instead of placing them directly on the floor.

We have also started to convert our plants to a hot water system and the use of half inch hose with automatic shut off nozzles. The saving in water and fuel costs alone more than make up the cost of installation.

As a further aid in plant cleaning and maintenance, all future replacement of equipment will be of stainless steel. The list includes cheese vats, cheese presses, curd rakes, and all other equipment coming in contact with the product. Even glass graduates and glass containers in processing rooms have been replaced by stainless steel or plastics.

Wooden equipment too has become obsolete even for equipment supports, cabinets, tables, steps, and paddles.

In many instances, we have had to build the equipment in our own shops to get just what we wanted from a standpoint of performance as well as sanitation. I might also point out here that someone from the Quality Control Department will check the blueprints of new equipment before construction has started and again before it leaves the shops to be put into the production line.

PRODUCTS STANDARDS

For the past two years, we have been developing standards for all raw materials used in production of all Kraft products. So far, we have completed about half of the raw materials used. Standards of identity as published by the Federal Food and Drug are used as a basis for our Standards. However, in many instances we have had to do considerable work in our own research laboratory and also contact many manufacturers of the product in question.

The raw material standards cover physical, chemical, and bacteriological requirements, type of shipping container, and points out any special handling necessary to maintain a high quality product. This part of the standard is used by the Purchasing Department in buying all raw materials.

For the assistance of our own plants the raw material standards also provide for the sampling and testing of each shipment and where needed special handling during shipping and storage.

Production Supply Specifications have been formulated for all containers, wrappers, liners, and labels in order to get a uniform product from all suppliers and one which will protect all of our products to the fullest extent.

Each specification gives the size, style, count, capacity, material, color, odor, packing, and copy of each item needed.

As a further precaution, we require each plant to date stamp supplies on arrival, to use the oldest stock first, and to make sure that all supplies are given protection from weathering and contamination by rodents and insects. When supplies are received a representative sample is taken and checked against the specifications to make sure we received just what we ordered.

Finished Product Standards for all items produced by Kraft have been set to serve as a guide to uphold the high quality and uniformity of all our products. All of the requirements are equal to or exceed existing State and Federal Standards for the various products.

Each of the Finished Product Standards give the definition of the product, the requirements of all raw materials needed, the physical, analytical, and bacteriological standards of the finished products as well as the type of package and special handling required. Ideal temperature requirements for shipping and storage have also been set.

PEST CONTROL

Rodents and insects are two pests that should not be tolerated in any food plant.

We have found that the best cure is prevention. Rodent proofing is accomplished by having all walls tightly sealed, doors repaired so

they fit tightly, and floor drains trapped. Insect proofing is done by following the same procedure as for rodents plus screening all doors and windows that need to be open.

After this has been done eliminate all breeding places both inside and outside the plant. Proper sanitation is just as necessary to control insects and rodents as it is for control of unwanted bacteria.

There are many rodenticides available but we have found trapping to be the most effective and safest method of getting rid of rats and mice. However, it must be cleverly and systematically carried out.

A 5 percent DDT solution in deodorized kerosene if properly applied to walls and ceilings as a residual spray has proven satisfactory for insect control. It must be noted here that DDT should not be applied to any food stuff or in any equipment that will come in contact with the product.

To make an insect and rodent control program really effective each plant should have at least one man trained in proper procedures of prevention and control.

QUALITY ENFORCEMENT

A high quality milk supply is just as necessary for the production of cheese and other manufactured dairy products as it is for bottled milk. Maybe even more so as milk is held at the optimum temperature for bacterial growth during most of the cheesemaking operation.

All of our plants are required to make an odor or "nose" test on every can of milk received and to reject any with objectionable flavors or odors.

Semi-monthly sediment tests are also made on a random can of patrons' milk. Where no state standards for manufactured milk are in effect, milk is graded according to the ADMI or National Cheese Institute raw milk sediment standards. All milk grading worse than No. 3 is rejected and daily tests are run on that patron's milk while the farm conditions are being corrected.

Naturally, rejecting milk alone does not improve the quality of milk but it also requires continued and helpful fieldwork. The farmer has to be shown how to care for

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PRACTICAL CARE OF MILKING MACHINE RUBBER

RICHARD S. GUTHRIE, D.V.M.
The DeLaval Separator Co., Chicago, Ill.

Milking machine rubber care requires the same fundamental steps in cleaning as any dairy equipment: Immediate air-brushing with clean cool water, routine disassembly, bristle-brushing in a balanced dairy cleaner solution, reassembly, sanitizing with 185°F water, and storage.

Boiling the rubber parts in a granite-ware vessel containing a solution of lye (made up of two heaping teaspoonfuls of lye added to each quart of water) for fifteen minutes, cooling, and soaking for eight hours, removes butter fat, improves resiliency and milking efficiency, and promotes sanitary milk production.

MILKING machines are essential in the labor-saving picture on the dairy farm today as the means of harvesting the milk crop. Proper servicing, cleaning, storage, and sanitizing procedures are necessary in order to keep them sanitary and in good milking condition. It is essential that a dairyman have the will and desire to follow a suggested procedure in caring for a milker, realizing the importance of clean sanitary equipment in the production of milk of high quality.

HARMFUL EFFECTS OF FAT

One of the greatest enemies of milking machine rubber is butter-fat. Rubber, an organic substance, is somewhat porous and regardless of how thoroughly the equipment is cleaned after each milking, fat finds its way via the pores into the rubber. As the fat becomes rancid, the teat cup liners in particular begin to demonstrate a noticeable change: the diameter begins to increase, the length increases, and there is a flabby greasy feeling to the touch. A noticeable butyric acid odor exists which intensifies with age. Liners in this condition are not only insanitary but have lost much of their milking efficiency.

On occasions, cow teats and udders are annointed with "udder balms" having an animal fat (lanolin) base. This film, if allowed to remain on the teats during the milking operation, will result in the more rapid development of this undesirable change in the resilience

and conformation of teat cup liners than under normal conditions.

Another condition frequently observed on farms is a crystalline sandpaper-like deposit inside of teat cup liners and milk tubes. Further check reveals the use of a strong calcium hypochlorite solution in the solution rack. The water supply is generally high in its mineral salt content. When inspecting rubber tubes stored under these conditions, it is not uncommon to observe a black sediment on the burr of the cleaning rod. This is eroded rubber. Prolonged exposure to a solution of organic acid tends to produce a sticky or tacky condition on the exposed surface of the rubber and, as the result, organic acids are very undesirable for use in solution racks.

Three fundamentals which are present in any cleaning program are:

- (1) Rinsing
- (2) Bristle brushing in a balanced alkaline detergent solution
- (3) Sanitizing with either heat or chemicals
- (4) Proper storage

RINSING

Immediately after the last drop of milk has been emptied from the milker unit at the completion of the milking operation, draw a full pail of clean cool water through the teat cup assembly using vacuum. It is important that the teat cups

are raised and lowered alternately, allowing first air then water to rush through the assembly into the milker pail. This operation is called "air-brushing". A full pail of fresh water should be used for each unit, never permitting the same water to be used for rinsing a second unit.

After the water has been drawn into the unit, turn off the milk cock, then disconnect the stanchion tube. The vacuum in the pail causes the check valve to seat firmly against



Dr. Richard S. Guthrie attended Cornell University Veterinary College and graduated with the Degree of D.V.M. in 1930. For over ten years he was a field veterinarian for Borden's Farm Products Company, carrying on a milk quality program and a program of mastitis control. The following four years were spent in the U. S. Army on active duty with the Veterinary Corps, specializing in the inspection of dairy products and meat. He was released with the rank of major. Since 1946 Dr. Guthrie has been veterinarian and milk sanitarian with the DeLaval Separator Company's Western Offices at Chicago, Illinois.

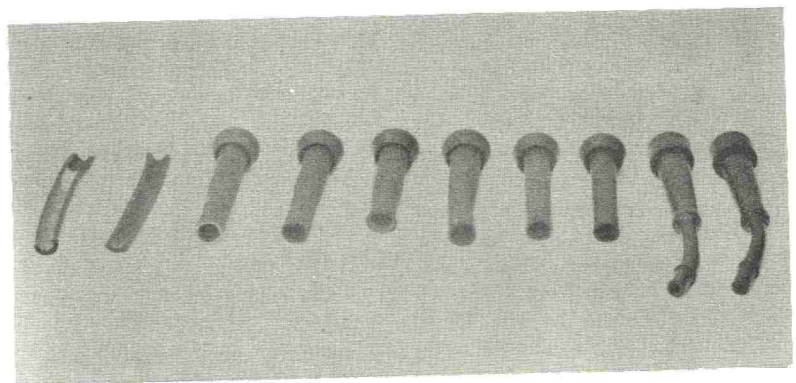


FIGURE 1

Left to right: Milkstone coated milk tube, other half boiled in lye solution, Liners 1, 2, 3, and 4 show effects of fat absorption. Note increased diameter and length. Liners 5 and 6 demonstrate result of proper care. Liner 7 fat filled, 8 boiled in lye solution. Note decrease in diameter and length.

the valve seat, thus preventing rinse water from gaining entrance into the check valve chamber. The pail is then rocked vigorously to and fro in order to rinse the milk film free from the interior of the pail and the underside of the operating cover. Air-brushing as outlined is far more effective than reverse flushing when rinsing the teat cup assembly. Reverse flushing consists of attaching the pail end of the milk tube to a cold water tap and allowing the water to run through

washing; (6) balanced dairy detergent containing a wetting agent; and (7) sanitizer.

Since the equipment was clean prior to milking, it is assumed that the unit was only soiled after use. Immediate air-brushing with clean cool water removes the greater percentage of milk film. This practice tends to improve the efficiency of the bristle brushing operation. Every square inch of surface with which milk comes in contact should be promptly and effectively brushed

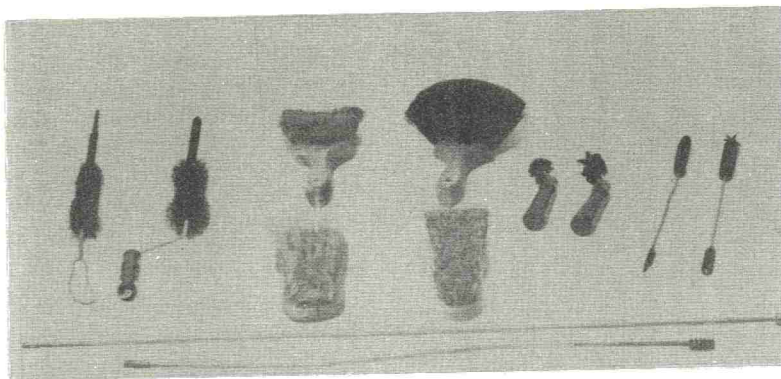


FIGURE 2

Comparative study of physical condition of assorted brushes and cleaning rods. The left brush of each pair demonstrates excessive wear and loss of brushing efficiency.

the teat cups. Milk film is ineffectively removed by this method. The longer a milk film is permitted to remain in contact with a utensil surface, the more difficult it becomes to remove it by subsequent rinsing. Prompt rinsing of the milker unit immediately after use, though a very important step in the cleaning operation is often neglected.

BRUSHING (Bristle)

The second step in caring for a milker unit consists of bristle brushing the disassembled unit in a wash vat. Assuming that a satisfactory milkhouse is at hand, certain items of equipment are desirable: (1) hot water heater providing hot water as near the boiling point as possible; (2) a two-compartment wash vat equipped with wings or trays on each end for the purpose of holding a unit for disassembly and reassembly (3) suitable brushes in excellent physical condition; (4) metal racks for equipment storage; (5) solution rack containing a 0.4 percent lye solution for wet storage of the teat cup assembly after

with the brush recommended for that purpose. These practices tend to remove all traces of food for bacteria. They will not grow on a clean dry surface.

PROCEDURE

Following the rinsing (air-brushing) of the unit with clean cool water, the wash vats are prepared. Vat No. 1 contains water at 115° F and sufficient recommended detergent. Vat No. 2 contains tepid water and 250 ppm of available chlorine. The unit is disassembled step-by-step in a methodical manner, and each component part is placed in its proper spot in the wash vat.

A suggested disassembly routine is as follows:

1. Remove stanchion tube and hang it up.
2. Remove teat cup assembly from unit a. Remove teat cups from claw and place on tray.
 - b. Remove milk tube and place in center of wash vat.
 - c. Remove twin air tube and place on tray.
 - d. Place claw and rubber plug in left side of wash vat.
 - e. Join together each pair of teat cups using a single short air tube and

place them in the right side of the wash vat. Place the two short air tubes on the tray.

3. Remove pulsator and place on tray.
4. Remove operating cover from the pail
 - a. Remove milk cock.
 - b. Remove check valve chamber and gasket.
 - c. Remove check valve
 - d. Remove operating cover gasket (Place in left side of wash vat)
 - e. Place operating cover and gasket in center of wash vat.

The brushing operating is much easier, and time is saved if a definite routine is followed after each milking. A suggested routine consists of washing the parts of a unit in this order and placing each part in the identical spot in Vat No. 2 that it occupied in Vat. No. 1:

- a. Operating cover and gasket.
- b. Claw and rubber plug.
- c. Milk cock, check valve, check valve chamber, and gasket.
- d. Teat cups—(A more effective brushing job is accomplished when the rubber liners are left in the metal shells. Liners thus under tension, can be brushed with much greater efficiency and more satisfactory results than can be obtained by attempting to brush them outside of the shells.)
- e. Milk tube (using metal cleaning rod.)
- f. Milker pail.

After brushing the pail inside and out, it is promptly rinsed in vat No. 2 and placed on the reassembly table. The unit is now reassembled:

- a. Gasket is replaced on operating cover which is placed on the pail.
- b. The component parts of the operating cover (Check valve, chamber gasket, check valve chamber, milk cock, and pulsator) are put in place.
- c. The teat cups are separated and the two short air tubes are replaced.
- d. The claw is assembled.
- e. Milk tube and twin air tube are attached to the claw.
- f. Teat cups are attached to the claw and cluster is placed on the hook on the operating cover and the tubes are connected to the proper nipples.
- g. The stanchion tube is now attached (It should be pointed out that in the event the stanchion tube interior becomes covered with a film of milk because of a split liner, overfilled pail, or other reasons, it should be rinsed and washed.)

SANITIZING

Following the brushing and reassembling of the unit, approximately six quarts of water at 185° F or higher are drawn through the teat cup assembly by vacuum. This time the teat cup assembly is not raised and lowered as with the cold water rinse. The chief interest is preserving as much of the heat in the water as possible. The milk cock is

turned off and the stanchion tube is disconnected to insure a complete seal of the check valve. The pail is briskly rocked to and fro to permit the hot water to reach all inside surfaces of the unit, imparting heat to them. This permits draining and quick drying of metallic surfaces during storage.

The teat cup assembly is promptly removed from the operating cover and attached to a solution rack where there is a reserve of a lye solution having a strength of 0.4 percent. This solution is prepared by adding two heaping teaspoonfuls of any brand of lye flakes to one gallon of water, preferably soft water.

This lye solution has a pH of 13 and is very beneficial to rubber. There is no other solution at the present time that has been found to be more satisfactory than the lye solution. It is effective, stable, economical, and readily obtainable. This method of storage which employs a solution rack, assures a fresh supply of lye solution each time the cups are attached.

The component parts of the operating cover are now removed and placed within the circle of the cover gasket which is placed on a stainless wire storage rack. The operating cover is placed on the metal rack as well as the pail which is emptied and inverted to drain and dry. The stanchion tube is hung in a vertical position.

In the event that dry storage is required, a stainless wire basket is placed in vat No. 2 which is empty. The equipment is brushed as before with all parts of the unit except the pail being placed in the basket. Sufficient hot water 185°–190°F is poured directly over the parts to cover them. After two minutes of immersion, drain the basket momentarily and place on the metal rack to further drain and dry. The pail is then washed, rinsed thoroughly with the hot water, and inverted on the metal racks.

Just prior to use, regardless of whether wet storage or dry storage is required, the unit is completely assembled and at least six quarts of water at 185°F or higher, containing 250 ppm of available chlorine is drawn through the teat cup assembly into the pail. Using the previously mentioned technique,

the pail is rocked to and fro, resulting in effective sanitizing of the equipment.

CARE OF RUBBER

Proper care of milking machine rubber cannot be stressed too strongly. The part that it plays is sanitation and milking efficiency cannot be overlooked. All rubber parts should be kept in the best physical condition possible at all times.

A dairyman will obtain best results by using two sets of liners, alternating their use every seven days. Remove the liners from the metal shells after seven days of use and boil in a lye solution for the purpose of removing any trace of butter fat from the rubber. This is a simple yet effective method.

Using a granite-ware or agate container of sufficient size, place a rack in the bottom to prevent the rubber parts from coming in direct contact with the bottom. Place rubber parts (liners, milk tubes, pail cover gaskets, check valves, and stanchion tubes) in the vessel and cover with water measured by the quart. Add two heaping teaspoonfuls of lye flakes to each quart of water used. Place the vessel on the stove and bring to a boil, and boil fifteen minutes. Remove from the fire and permit gradual cooling. Allow the rubber parts to remain in this same solution for at least eight hours. It will be noted that a film of butterfat soap is found on

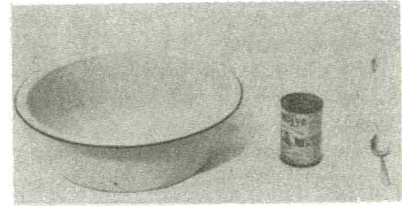


FIGURE 3
Granite-ware vessel, lye flakes and measuring spoon, the necessary equipment for boiling rubber parts.

the outer and inner surfaces of the liners.

Remove the liners and other rubber parts from the vessel, thoroughly rinsing and brushing away all traces of the film of butterfat soap. Scald the parts and permit them to drain and dry. Here it will be noted that the diameter and length of the liners will be decreased. Resiliency will be greatly improved. More pronounced changes will be noted when boiling out liners that have been obviously neglected over a long period of time.

The liners thus treated, should be stored in a dry dark place for a rest period, or until the second set is ready for the boiling operation. In addition to the boiling in a lye solution, the rest period appears to add to the resiliency of the rubber and better milking efficiency, as well as prolonging the period of efficient usage. Boiling in a lye solution, as outlined, will eliminate the milker rubber parts com-

(continued on page 96)

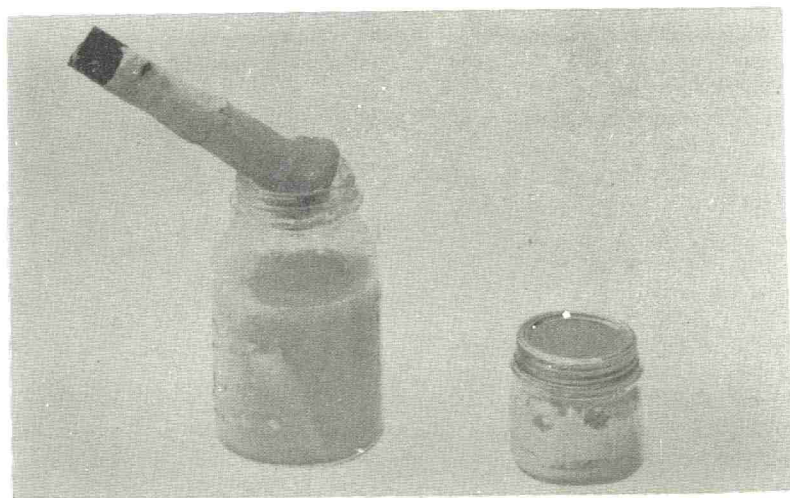


FIGURE 4

Specimen of a fat-filled rubber liner removed from the vessel following the outlined boiling procedure using lye. Note the copious film of butterfat soap. Small jar on the right contains the butterfat soap filtered from the solution used to boil four liners.

HEAT PROCESSING OF FOODS

(continued from page 69)

periment with a rabbit, oral administration of a large dose of subtilin (1 g./kg.) caused no ill effects. (d) Although *B. subtilis* is often found in foods, where it may well have produced appreciably quantities of subtilin, no case of food poisoning has ever been attributed to it. (e) The microflora of the intestinal tract are presumably not affected, because subtilin has no antibiotic effect against the Gram-negative bacteria which predominate there."

"In this note we have announced a new principle in food preservation, outlined a tentative method for its application, and described experiments that illustrate the effectiveness of the process. The greatly reduced heat requirements as compared with present canning practice would shorten cooking times, eliminate the need for pressure heating equipment, and give promise of higher food quality."

Thirdly, it appears entirely logical and possible that many cleaning and sterilizing jobs could be simplified, made more effective, and accomplished more economically by a combination of killing agents, known not to be incompatible, and compounded and prepared for the specific job to be done. More knowledge is needed on the special sensitivities of particular microflora. Then, do the killing job by the fastest, cheapest and best method available. In this age of new chemical detergents, along with the new uses for those long known, and the many new and effective antibiotics, this approach appears clear and bright.

It is important that we understand the principles governing the killing of bacteria, regardless of the means employed. But *selective killing* appears to offer the solution. The combining of heat, chemicals, and antibiotics, in my opinion, opens a new era in the equipment cleaning and food processing industry.

GREEN PASTURES PROGRAM

(continued from page 84)

"We are coming slowly to appreciate the truth of that statement. It offers the best opportunity for lowering costs of production and for improving Vermont dairying. We might even say that the future of dairying in Vermont is tied up with a better roughage program. And your Dutch farmer has the facts to prove his point. The one and a half million cows in that small country today average close to 300 pounds of butterfat per cow which compares with about 240 pounds for Vermont's population of 281,000 cows. But the startling fact is that the Dutch cow makes this production on about 500 pounds of grain annually, or less than one-third the grain fed here in the Green Mountain State. How does she do it?"

"The answer lies in the wonderful pastures which are the Dutch farmers' most valued possession. For six months of the year they furnish the only feed the Dutch cow knows and from these pastures are cut the high quality hay and grass silage which make up the bulk of the winter ration. Long ago the Dutch farmer learned that better pastures mean higher milk production per acre at lowest feed cost."

In each state the county agricultural agents are the key men in the Green Pastures Program under the leadership of the state agronomists. But as stated before, one of the great benefits has been widespread support of all agricultural groups and agencies. Deep appreciation is due to the large number of organizations and individual firms that have contributed the funds to meet the necessary costs. Very valuable support has been received from all the agricultural journals of the regions, particularly the New England Homestead and the American Agriculturist.

There seems to be an increasing realization that "Anything a farmer does to improve his pastures is a step in the right direction," as so ably expressed by Harold J. Shaw of Sanford, Maine, President of the Holstein-Friesian Association of

America who has long been a leader in grassland farming and a most convincing supporter.

Plans are well under way for the 1952 program and we are confident that we will exceed the excellent records of the previous years and make another big stride toward more efficient dairy farming in Vermont and New England.

SANITATION IN CHEESE INDUSTRY

(continued from page 89)

his herd, his equipment and that the dairy plant is really interested in receiving high quality milk.

We have been asked how we were able to enforce our Quality Control program while law enforcing officials have had trouble with these same problems for many years. Unless you have the backing of top management no set of rules and regulations will clean up a plant. Many managers say they know all there is to know about Quality Control procedures but unless they put this knowledge into practice it is not of much help.

Along with the backing and cooperation of management, superintendents and foremen is the educational program for the benefit of the dairy worker. Unless he knows what you want the Quality Control policies have little or no meaning. Special attention must be given to new employees so that the habits they form are the right ones. Old habits are very hard to break.

In closing I would like to leave with you this thought as expressed by the National Sanitation Foundation and which we now have posted in everyone of our plants: Sanitation is a way of life. It is the quality of living that is expressed in the clean home, the clean farm, and clean business and industry, the clean neighborhood, the clean community. Being a way of life it must come from within the people; it is nourished by knowledge and grows as an obligation and an ideal in human relations.

Association News

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FUCHS DIRECTS ISRAELI SANITATION

A. W. FUCHS

Sanitary Engineer Director
 Tel Aviv, Israel

At the request of the Israeli Government, a Public Health Mission is being sent to Israel under the Point 4 Program of the Technical Cooperation Administration of the Department of State for a period of one to two years. The Director of Public Health has not yet been selected and will be sent at a later date. Mr. Fuchs is going as the Director of Sanitation for the Point 4 Program in Israel. From the information available, it appears that milk and food sanitation is at present the most pressing problem in the field of environmental health. Because of the lack of foreign exchange, the Israeli Government has been unable to allocate sufficient foreign funds for the importance of sanitary milk and food equipment. It will therefore be necessary to improvise equipment with materials available in Israel to the fullest extent. Needless to say, this offers a challenge to which he is looking forward with great interest.

Mr. and Mrs. Fuchs expect to secure passage on the S. S. Independence sailing from New York April 8. Mr. John D. Faulkner becomes chief of the Milk and Food Branch, United States Public Health Service.

MICHIGAN ASSOCIATION OF MILK & FOOD SANITARIANS

What Every Michigan Sanitarian Should Know About The International Association of Milk and Food Sanitarians

H. L. Thomasson, present president and executive secretary of the International Association of Milk and Food Sanitarians, met with the executive committee of the Michigan Association of Sanitarians at the Michigan State College Union on January 16 to acquaint Michigan sanitarians with the reorganization which the International has been undergoing to make it a more representative and better functioning Association.

The scattering of the offices of the International to locations in various parts of the country has led to "hit or miss" methods of doing business and to confusion in getting out the Journal. But, with the adoption of a revised constitution in January 1951, the process of reorganization was under way. Here are some of the indications of an upsurge on the part of the International:

1. The redesign of the Constitution to meet the needs of a growing number of professional sanitarians.
2. The change in format of the Journal of Milk and Food Technology, and a reconsideration of its scope.
3. The creation of the office of Executive Secretary and a consolidation of the diverse affairs of the printing of the Journal, secretarial duties and Journal management into one office. As a result of this, an increased area of business activity in the service of the increased membership of the Association.
4. The addition of two affiliate sanitarian organizations to those already affiliated, namely the Washington State and the Indiana Milk and Food Sanitarians' Associations. Good ground work with others has been made this year.
5. The conduct of one of the best annual meetings in the history of the Association—the 1951 meeting in Colorado.
6. The establishment of a sanitarians' award of \$1000 for outstanding achievement, to be presented at the next annual meeting.
7. The very active participation by the committees of the Association in their assigned work. Such participation is looked upon as the

backbone of the Association, showing the interest its members have in the work of the Association.

H. L. Thomasson pointed to two things which the International plans to work towards: (1) to help state affiliates to build up their funds, and (2) to pay travel expenses to committee members so that they may work with state affiliates in raising the professional status of sanitarians. Thomasson stated that the International cannot succeed without the help of local groups; that its affiliates already have a greater voice in the operation of the International through the Affiliate Council.

BROADENING CONCEPT OF WHAT IT TAKES TO MAKE A SANITARIAN EMPLOYED BY A LOCAL HEALTH DEPARTMENT

The sanitarian is growing up. There is a widening vista in his philosophy with regard to his inspectional duties and with regard to his place as a servant of the community. How do we all measure up to this concept of a local health department sanitarian?

- I. Philosophy of Inspection
 1. Education of public and industry is fundamental attitude of sanitarian.
 2. Enforcement is used only as a last resort, after educational approach has failed to produce desired results.
 3. Support of community groups and civic organizations is secured whenever possible.
 4. Inspection supported by industry is desirable and is per health department sanitarian?
- II. Philosophy of Program
 1. The sanitarian is a public servant.
 2. The services of the health department are for and to be used by all citizens rather than being limited to a special group.
 3. The sanitarian emphasizes the positive aspects of the situation.
 4. The sanitarian is trained to and does evaluate his activities in terms of the public health importance of the problem.

5. Each sanitarian is urged to conduct a generalized sanitation program; i.e., each man conducting a program in all phases of sanitation. The majority of counties do conduct generalized programs although specialists may be assigned to specialized programs. The majority of cities confine their activities to food, milk and meat sanitation problems, to nuisance complaint investigations, to insect and rodent control and, in a few instances to housing.

III. Program

1. The sanitarian program of a local health department is conducted in three phases: (a) Survey or fact finding, (b) Evaluation of survey and determination of extent of public health problem, and (c) Application of remedial measures. In applying such remedial measures, the sanitarian identifies the problem to the public or the operator, he plans with the public or the operator on the method to use in correcting the problem, and he coordinates activities relative to correcting the problem.
2. This program is applied to the following items of man's environment:
 - (a) Housing (water supply, sewage disposal, resorts, trailer parks and home safety).
 - (b) Food (milk, meat, food serving establishments, food processing establishments).
 - (c) Water supply for communities.
 - (e) Disease vectors (control of insects and rodents).
 - (f) Schools (lighting, seating, water and food supply).
3. In each establishment which is inspected by the sanitarian all problems which affect public health are considered and evaluated.

EDUCATIONAL BACKGROUND OF MICHIGAN SANITARIANS

	sanitarians
Master's Degree	38
Undergraduate degree (AB, BS)	52
College, 3 years or less	24
High school graduates	43
Less than high school	2
	159

FOOD TECHNOLOGY IN SUMMER SESSION AT MASSACHUSETTS INSTITUTE OF TECHNOLOGY

To investigate important recent scientific advancements in the food industry, a special program in Food Technology will be offered at the Massachusetts Institute of Technology during Summer Session 1952, from June 16 to July 3.

This course is planned to enable those in the food industry to study recent developments in food manufacture and control. It is also planned for advanced engineering and chemistry students who may desire to investigate opportunities open to them in this field. Food origin and composition will be discussed, as well as food processing, handling, transportation, storage, and control. Emphasis will be placed on related chemical, microbiological, and engineering factors.

OUTLINE OF PROGRAM

Food Technology, Subject Number 20.82, will be held from 9:00 to 12:00, and from 1:00 to 4:00, from Monday through Friday each week, and will include the following fundamental topics:

Economics & Statistics of Food Supplies, Equipment Used in New Processes, Flavor & Food Acceptance, Food Bacteriology, Sanitation, & Fermentations, Food Chemistry & Nutrition (including the use of "tracer" elements), Unit Processes in Food Engineering, Sterilization of Food by Electronics, Food Control Instrumentation, Food

Packaging, Materials Handling.

Detailed studies of food processing in the following fields will also be included:

Bakery Operations, Brewing, Canning, Dairying, Fisheries, Food Specialties, Freezing, High-Vacuum Drying, Juice Concentrates, Meat Packing, Milling, Refrigeration, Yeast Operations.

Opportunities for group visits to representative companies in the Boston area will be offered in addition to the lectures, demonstrations, conferences, and reports. Research problems requiring specialized equipment may be assigned to competent workers in areas of their particular interest.

TUITION AND CREDIT

Tuition for the three-week course will be \$100, of which \$25.00 is due at the time the application is accepted. Only registrations for the entire course will be accepted. Academic credit, which will be optional, will be given for satisfactory completion of the program to those who take a final examination.

The Alfred Edgar Burton House, overlooking the Charles River and

the Boston skyline will be available for those participating in the program. Rooms for single men, as well as a limited number of accommodations for married couples and single women, will be reserved if specifically requested in the application for admission to the course. The rate will be \$3.00 per person per day \$18.00 per week, \$28.00 per couple per week. Campus dining facilities, including a snack bar in Burton House, will be open for all meals. Restaurants and hotels are located nearby. Summer guests are invited to use the Institute's libraries and recreational facilities which include tennis courts, the Alumni Swimming Pool, and the sailing pavilion on the Charles River.

ADMISSION

Since enrollment in the special course will be definitely limited, early registration is advisable. Preference will be given to applicants having a background of technical, production, or executive experience in food industries, faculty members of other schools, government workers in food control or nutrition, and advanced students in chemistry and engineering. Letters of application, including appropriate details regarding experience and background should be mailed to Professor BERNARD E. PROCTOR, Department of Food Technology, Massachusetts Institute of Technology, Cambridge 39, Massachusetts.

(continued from page 92)

PRACTICAL CARE OF RUBBER

pletely as a source of Thermoduric and thermophylic organisms.

Sunlight is another enemy of rubber. Tiny cracks or light checks may appear in rubber stored near a window through which the rays of the sun are permitted to come in direct contact with the rubber.

SUMMARY

The cleaning and care of milker rubber parts is integrated in the methodical cleaning technique of a milker unit. After each milking the unit should be:

1. IMMEDIATELY air-brushed with clean cool water.
2. Disassembled and bristle-brushed in a balanced detergent-solution 115° F containing a wetting agent.
3. Reassembled and sanitized with water of 185° F or over.
4. Stored.
 - a. Pails and operating cover on metal racks
 - b. Teat cup assembly

(1) wet storage on solution rack using 0.4 percent lye.

-or-

(2) dry storage—component parts stored in metal basket on racks between milkings.

5. Rubber parts are boiled in a lye solution as outlined. Two sets of teat cup liners should be alternated every seven days.

RESULTS

1. Improved rubber resiliency, liner conformations, and longer life.
2. Continuous milking efficiency.
3. Improved sanitation.

CONCLUSIONS

It is essential that a milking machine unit be kept in the best sanitary and physical conditions at all times in the interests of sanitary milk production and efficient operation. A methodical approach to the techniques employed in milker care is important. The same routine followed after each milking encourages efficiency: Namely, IMMEDIATE air-brushing with clean cool

water after use, disassembly and bristle-brushing in a balanced detergent solution (115° F) containing a wetting agent, reassembly and sanitizing with water (185° F or over), followed with correct storage. The pail and operating cover are placed on metal racks. The teat-cup assembly may be placed on a solution rack using a lye solution (0.4 percent) or dry storage may be used as outlined.

It is important that the rubber parts be boiled in a lye solution after seven days of use in order to remove butter fat absorbed by the rubber. Two sets of liners, alternated every seven days and the used set boiled in a lye solution as outlined, will promote improved rubber resiliency, better liner conformation, and longer life. Continuous milking efficiency and improved sanitation will be the gratifying results.

NEW YORK STATE ASSOCIATION OF MILK SANITARIANS

The Executive Committee has made a good start toward whipping into shape the program for the 1952 annual meeting to be held in New York City on October 1, 2, and 3. We hope we won't have to compete with a subway World Series. The first program committee meeting was held in New York City on January 18, 1952, and another is scheduled for Albany on March 21. For the first time, the program will be divided into two sections on one afternoon, a food section and a milk section will be carried on simultaneously with an auditorium capacity of 250 for the former and 500 for the latter. A recognized authority on staphylococcus food and milk-borne outbreaks will highlight the food section. Reports from our many new committees will be interspersed throughout the milk section.

Our Committee on Dairy Industry Equipment which carries the mail to and from the 3A Standards Committee is scheduled to meet at Cornell University on March 28. This Committee has two primary functions: to assist in the development of sound 3A Sanitary Standards for Dairy Equipment by collecting factual field data and opinions of the practicing sanitarians and to obtain acceptance of the adopted standards by keeping sanitarians and operators abreast of the progress being made. The recommendations of this active committee are appreciated and will be carefully considered by our members on the Committee on Sanitary Procedure and will serve as a valuable guide in their deliberations at the Chicago meeting of the 3A group to be held on April 24 and 25.

Our parent association has been very helpful in finding and stimulating us in new and broadened activities. The mutual benefits accrued from collaboration on dairy equipment standards has led us to appoint a number of new committees which we hope will work in harmony with similar committees of the International Association. The committees appointed or being considered are as follows:

DAIRY INDUSTRY EQUIPMENT
LEGISLATIVE
PROFESSIONAL STATUS
FARM METHODS
LABORATORY
ANIMAL DISEASES AFFECTING
MAN
LOCAL AFFILIATES

These committees are desirous of cooperating with similar committees of the parent association and all other affiliate associations.

C. W. WEBER,
Secretary-Treasurer

POSITION WANTED

Milk and Food Sanitarian, B.S., M.P.H. Age 35, 10 years Public Health Milk Sanitation. Desires position as Director of Milk Division, preferably on Pacific Coast. Box 286, Shelbyville, Ind.

Industrial Notes

KLENZADE CELEBRATES TWENTY YEARS OF PROGRESS



From one room to two modern plants and forty-four branch offices and warehouses . . . that's the industrial miracle of Klenzade now celebrating its twentieth anniversary.

Recently, upon completion of the new Klenzade administration building, a research chemical and bacteriological laboratory was instituted for field collaboration and special development work.

After several years of research and practical field work on some

of the country's leading dairy farms, Klenzade now offers a complete program of cleaning and sanitizing in-place pipeline milker installations and equipment.

Complete cleaning directions for the four conventional methods in use: circulation pressure; mechanical vacuum flush; vacuum air-brush; and circulation vacuum, are contained in Klenzade Bulletin No. 3016. Free copies may be obtained from Klenzade Products, Inc., Beloit, Wis.

SCHOLARSHIP AWARDS AT OHIO STATE UNIVERSITY

Dr. I. A. Gould, Chairman of The Department of Dairy Technology, Ohio State University, announces the winners of the 1952 scholarships given by the Ohio Dairy Boosters Association and The Robert B. Stoltz scholarship funds.

In 1947 The Ohio Dairy Boosters Association established a fund at The Ohio State University, the income from which is to be used for a scholarship to be awarded to an outstanding student majoring in the Department of Dairy Technology. This year the recipient is

Warren E. Foster of London, Ohio.

In 1945, the Robert B. Stoltz Dairy Technology Fund was established at The Ohio State University by an anonymous donor. The income was to be used to provide scholarships to outstanding students in The Department of Dairy Technology. This year the scholarships were given to three outstanding students as follows: Hartly R. Jones, from Columbus, Ohio, Joseph W. Benedict of Corn- ing, Ohio, Bruce H. Collins of Charleston, West Virginia.

ONE-YEAR DAIRY INDUSTRY COURSE AT CORNELL

A one-year course in dairy industry will be offered again this fall for the fifth season by the New York State College of Agriculture at Cornell University in Ithaca, New York. Designed to give a well-rounded training to those interested in dairy plant operations, the course begins in September and continues until early June.

The subjects taught are as follows: composition and testing of milk and milk products, bacteriology, production of milk, oral and written expression, dairy plant equipment, processing and quality control of milk and milk products,

dairy mathematics, marketing of dairy products and a survey of topics of current interest in dairy industry.

Anyone interested in taking the course or in obtaining additional information should write to Prof. R. P. March, Department of Dairy Industry, Cornell University, Ithaca, New York. Since only a limited number of students can be accepted each year, inquiries should be made immediately

CALENDAR

Apr. 1-2—Dairy Technology Conference University of Illinois, Urbana, Ill.

April 1-4—National Packaging Exposition, Auditorium, Atlantic City, N. J.

May 5-9—Thirty-third Annual Convention and Exposition, National Restaurant Association, Chicago, Ill.

May 6-7—Dairy Technology Conference, University of Illinois, Urbana, Ill.

March 3-7—National Association of Frozen Food Packers, Conrad Hilton Hotel, Chicago, Ill.

May 24-28—American Association of Cereal Chemists, National Convention, Chicago, Ill.

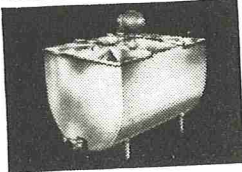
June 8-12—Institute of Food Technologists, Twelfth Annual Meeting, Grand Rapids, Mich.

June 23-27—Annual Meeting and Short Course of the South Dakota Assn. of Sanitarians at Sylvan Lake, South Dakota.

Oct. 20-24—Annual Meeting of the American Public Health Association in Cleveland, Ohio.

SAVE LABOR with MOJONNIER BULK-MILK SYSTEM

Cooling milk in a stainless steel bulk tank saves labor in the milk house, and when combined with tanker pick-up, overall labor requirements are



even more sharply reduced. In addition, with bulk milk, quality is up and spillage and drainage losses are eliminated.

If you need new milk cooling equipment you owe it to yourself to write for "The Bulk Cooling Story"—Mojonnier Bulletin 240. Address:

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Mojonnier
Bulk Milk Systems

MILK SANITARIANS:
Write for the name of
the bulk route nearest
you.

Oakite Cleaner-Sanitizer gives long lasting protection against bacteria regrowth

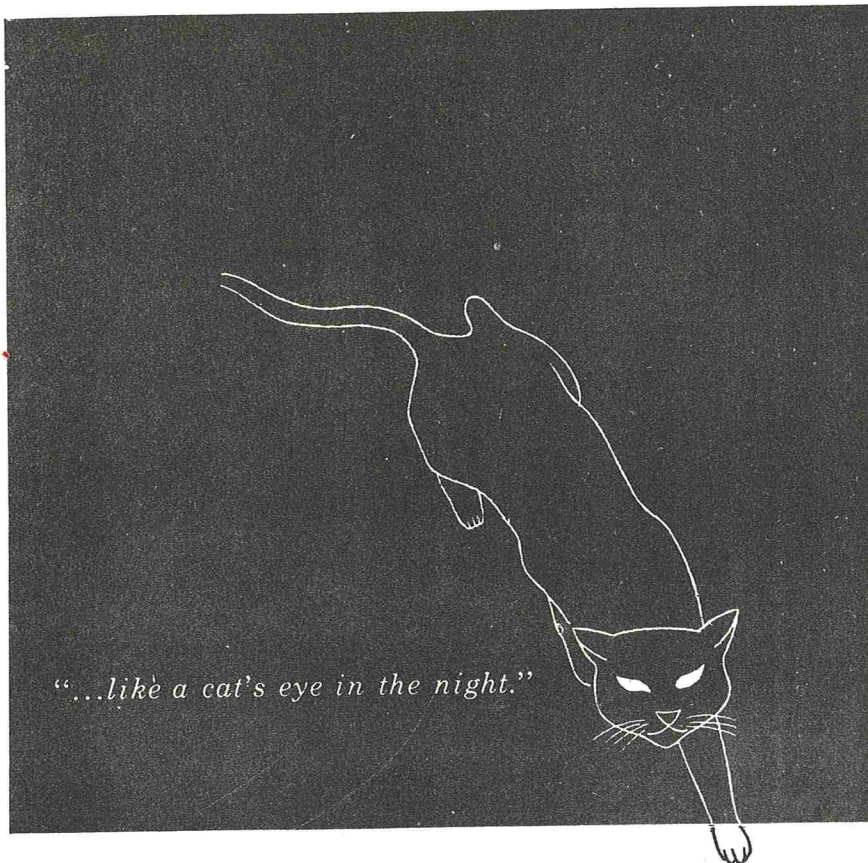
Carefully compounded of quaternaries and synthetic detergents, Oakite Cleaner-Sanitizer quickly cleans away milk films, reduces thermogenic counts by as much as 99%, protects against recontamination while equipment is not in use. Dissolves instantly, works well in hard water. Safe on equipment, hands, udders.

FREE FOLDER gives details. Write Oakite Products, Inc., 38C Rector St., New York 6, N. Y.

OAKITE
CLEANING AND GERMICIDAL MATERIALS

DAIRY
RESEARCH
DIVISION

Technical Service Representatives Located in
Principal Cities of United States and Canada



A visit to the first milk plant, opened almost a century ago by Gail Borden, was a refreshing experience. "Inside, there were women dressed in white from head to toe—the men wearing white aprons, everyone wearing white gloves, with the floors and sideboards and walls whitewashed. A speck of dirt would stand out like a cat's eye in the night."*

Visible dirt was taboo—but *invisible* dirt also is a source of contamination. The Borden Company has conducted extensive research to combat this danger. Better cleaning and sanitizing compounds, methods and service—available to the entire milk industry—are the result, bringing milk plant sanitation within a cat's whisker of perfection.

The Borden Company • Tykor Products Division
National Executive and Sales Office:
350 Madison Avenue, New York 17



*
From the book:
GAIL BORDEN:
DAIRYMAN TO
A NATION, by
Joe B. Frantz.

Job-Engineered Compounds...Developed From a Century of Cleaning and Sanitizing Experience

KLENZADE SERVICES

TO THE
dairy industry

KLENZADE

First

to pioneer the now famous Alternate System of Cleaning. A Klenzade innovation scientifically alternating organic acid and alkaline detergents.

First

to offer complete Plant Sanitation Surveys and set up Cleaning Programs raising sanitation standards and reducing labor and material costs.

First

to offer simple, economical field and plant Test Kits for testing solution strengths of detergents, bactericides, pH, water hardness and causticity.

First

to offer the Chem-O-Shot . . . the only positive displacement feeder on the market . . . powered by motion of the washer itself. Used on bottle washers and can washers.

First

to offer Fog Sanitizing Units for applying sanitizing solutions to tank trucks, storage tanks, milk cans and vats.

First

to offer Mineralight Ultra-Violet Light which detects milkstone by fluorescence. A simple but efficient sanitation aid.

Other Klenzade Services

Other services to the dairy industries include: Laboratory Testing; Water Analysis; Boiler Water Treatment; Water Chlorination; Detergent Brick Feeding; Vitamin Feeding and Educational Programs. Every well informed plant manager should know all about these Klenzade Services.

KLENZADE

Write for Complete Information

KLENZADE PRODUCTS, Inc.

Offices in Principal Cities

BELOIT

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MINERALIGHT Ultra-Violet Light FOR DETECTING MILKSTONE, FATS AND OTHER SOILS

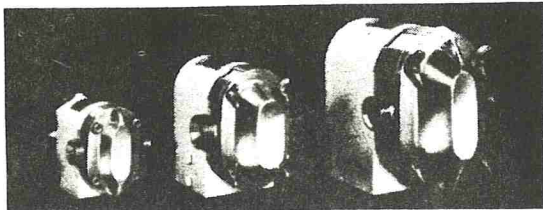
For Sanitarians, Field Men and Inspectors

Mineralight is a compact portable long wave ultra-violet light which causes fluorescence in milkstone, fats, and other soils not readily seen by the eye. Used like a flashlight. Operates 110 V-AC or batteries. Adapter available for 110 V-DC. Carrying case optional, but necessary for battery operation. Moderate cost. Valuable aid to any size plant. Indispensable in improving sanitary standards. Write for literature

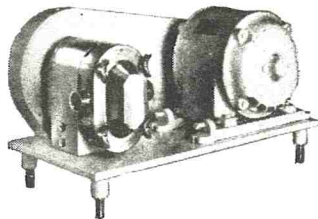


KLENZADE

KLENZADE PRODUCTS, INC., BELOIT, WIS.

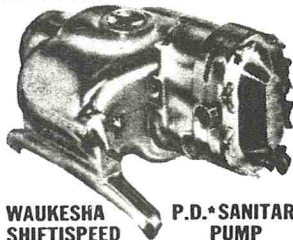


Waukesha P. D.* Sanitary Pumps are available in a wide range of sizes, in capacities from 20 pounds to 60,000 pounds per hour — against head pressures up to and including 100 pounds — for a wide variety of applications.



**WAUKESHA V-BELT
P.D.* SANITARY PUMP**

Compact design with new steel plate base and adjustable ball feet for floor clearance and utmost sanitation. Capacities from 1,000 to 60,000 pounds per hour.



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SHIFTISPEED
P.D.*SANITARY
PUMP**

Permits capacity changes while pump is in operation. Just turn the handwheel, watch the dial on top of housing. High speed stop and external sealing device prevents over-shooting flow capacity. Streamlined, sanitary housing.

* P. D. — Positive Displacement — Smooth Flow — Slow Speed

Write or wire — for advice and details on the Waukesha P. D. Sanitary Pump to fit your needs exactly.

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COMPANY**
WAUKESHA, WISCONSIN

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P.D.* Sanitary Pumps

WILL EARN MONEY FOR YOU...
IN SAVINGS AND PRODUCT PROTECTION.

Whether your product is light liquid, creamy, semi-solid or even chunky, you can handle it more efficiently and more economically with a WAUKESHA P. D. Pump. For with Waukesha's Positive Displacement principle of action, your product comes *out* of the pump exactly as it goes *into* the pump. There's no possibility of churning, aeration, agitation, crushing. That's why it's standard in leading food, beverage, dairy, chemical and textile plants the country over.

The Waukesha P. D.* Pump features: One-Piece O-Ring Sanitary Seal — Compact streamlined construction of Corrosion-Resistant "Waukesha Metal" or Stainless Steel on all product-contact parts — Heavy Duty Ball Bearings — Faster cleaning and sanitation — and other advantages.

Waukesha **100%
SANITARY
PUMPS**

Dependable Product of a Responsible Manufacturer

Serving... **THE MILK AND FOOD SANITARIAN
IN THE ANALYSIS OF MILK AND FOOD PRODUCTS**



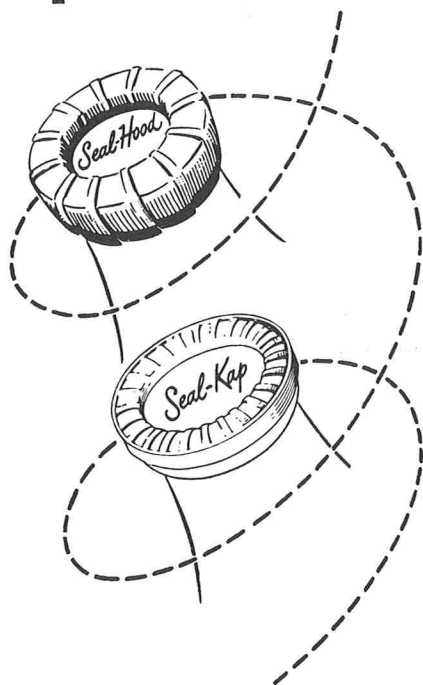
For more than 25 years, the Wisconsin Alumni Research Foundation has provided milk and food sanitarians with an analysis of milk and food products. Inquiries about the assay for vitamins and minerals of all foodstuffs are invited.

Prompt, Efficient Service in:

- *Procurement of Samples*
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...either way!

● Seal-Hood and Seal-Kap closures provide far more than old-fashioned dairy-to-doorstep protection. Each keeps milk free from contamination and odors long after delivery—in fact, down to the last drop in the bottle.

With Seal-Hood, the capper *never touches* the top of the bottle. No wires, forks or tools needed to open. And Seal-Hoods snap snugly back on as often as required.

Seal-Kap, the original “twist-off ... snap-on” closure, combines seal and cap in one simple unit. Even when the bottle is tilted, Seal-Kap prevents leakage.

Thousands of prominent dairies are using Seal-Hood and Seal-Kap closures to completely safeguard their milk and milk products. These dairymen, too, welcome the one-operation economy each closure provides.

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Exclusive NEW Patented
Chemical Compound

DIVERSEY SPEC-TAK

REVOLUTIONARY NEW BOTTLE WASHING
COMPOUND GIVES SCALE AND FILM
CONTROL!

Unquestionably, SPEC-TAK exceeds by a wide margin the performance of any other bottle washing compound on the market today.

A new chemical combination, developed by Diversey and used for the first time in formulating a bottle washing compound, completely ties up and holds in solution scale and film-forming hard water salts. That's the secret of SPEC-TAK's unique action.

ONLY SPEC-TAK OFFERS ALL THESE ADVANTAGES!

- Dependable, effective control of scale.
- Cleaner, brighter bottles—less rejects.
- Elimination of hard water rings and film on bottles.
- Elimination of clogged jets in semi-fresh rinse section.
- Elimination of clogged overflow pipe with attendant scale formation on overflow pipe, washer and floor
- Elimination of periodic acid-descaling of washer with a saving in maintenance costs.
- Scale-free semi-fresh water rinse tank.
- Easier soak tank clean-out—no gummy sludge present; tank drained easily and rinsed rapidly.
- Reduced upkeep requirements due to absence of scale—an important saving.
- Pride in bottle washing machine.
- Reduced power consumption due to less drag on chain ... no scale to slow up operation.
- More complete scale control in final rinse section.



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Thanks! Inspector...

**...FOR THE JOB YOU HAVE
DONE...AND FOR YOUR
CONTINUING EFFORTS TO
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In our business, sanitation is a most vital aspect of quality. While we as manufacturers undertake the necessary research and inspection to keep DARI-RICH at the top in quality . . . it is your important function to *maintain* such standards in the field.

And these efforts over the years have greatly increased the quality of dairy products, including the nationally-famous DARI-RICH Chocolate Flavored Milk and Drink. For your help, we thank you—and endorse your constant vigilance to protect the health of our nation.



**Completely protects bottled milk
... convenient in the home**



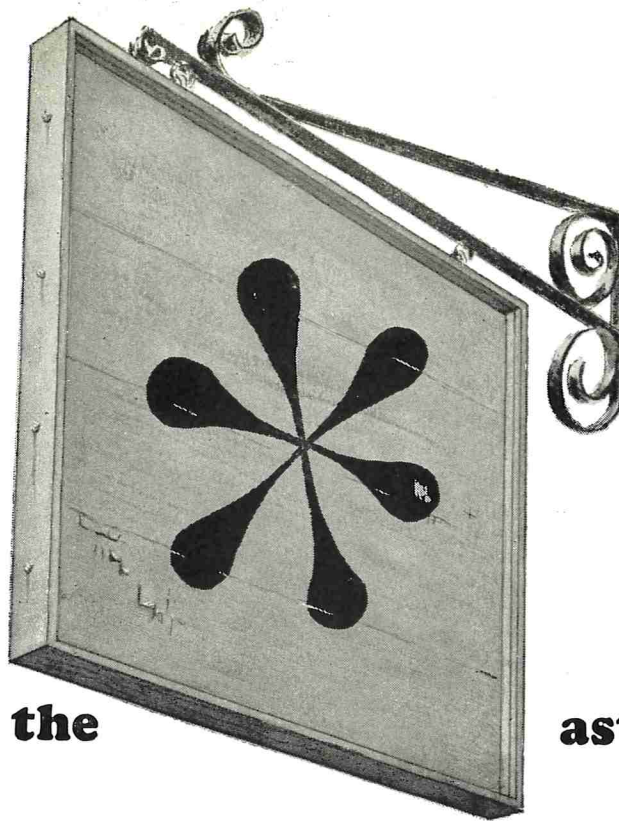
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Stop at the sign of the

asterisk

Ever hear of the old roadside inn called "The Asterisk"? It is said to have been a popular place in its day, famous for cheerful hospitality, safe lodging, and above all good food... This was perhaps the first association on record of an *asterisk* with the term "good food"—but it was certainly not the last.

Over the past 94 years many an asterisk in the medical and nutritional literature has referred to Borden food products or to work done in the Borden laboratories. It was in 1857 that Gail Borden helped establish the foundation for today's specialized knowledge of infant feeding by inventing a process for concentrating and preserving milk. A committee of the New York City Academy of Medicine praised the purity of his product in comparison with raw milk from the unsanitary cowsheds of that early day.* Following in Gail Borden's footsteps, Borden has since dotted the literature with

asterisks referring to important developments stemming from its research. To cite only a few instances—collaboration with public health authorities in establishing pasteurization standards,** perfecting of process for freezing human milk,*** work done on the development of riboflavin,**** numerous improvements in infant and adult foods.*****

Today you are more likely than ever to encounter an asterisk referring to Borden in the literature. Borden products now range from milk and milk products, ice cream, cheeses, Instant Coffee and many other foods for daily family use, to the special prescription foods, Bremil, Infose, Biolac, Dryco, Gerilac and Mull-Soy. We have come a long way since the 1850's but our goal is still what it was in the beginning: better nutrition for the American people, in sickness and in health.

Leslie's Weekly* May 22, 1858. *Public Health Bulletin*, No. 147, published by U. S. Public Health Service, Feb. 1925. ****J. Pediat.* April 1933. ****Silver medal awarded to Borden research workers for original investigations of pure lactoflavin (riboflavin) at 87th Annual Session of AMA, Kansas City, May 1936. *****For a recent reference to Borden's New Improved Biolac, see: *J. Pediat.* Jan. 1951; for Gerilac: *Am. J. Surg.* April 1949; for Mull-Soy: *J. Allergy* Jan. 1947.

Manufacturers and distributors of BORDEN'S Beta Lactose; BIOLAC infant food; DRYCO infant food; KLIM powdered whole milk; MERRELL-SOULE Powdered Skimmed Milks; MULL-SOY hypoallergenic food; BORDEN'S Evaporated Milk; STARLAC non-fat dry milk; Instant Coffee, Fresh Milk, Ice Cream & Cheese.

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CULTURE MEDIA *for Examination of Milk*

BACTO-TRYPTONE GLUCOSE EXTRACT AGAR

is recommended for use in determining the total bacterial plate count of milk in accordance with the procedures of "Standard Methods for the Examination of Dairy Products" of the American Public Health Association.

Upon plates of medium prepared from Bacto-Tryptone Glucose Extract Agar colonies of the bacteria occurring in milk are larger and more representative than those on media previously used for milk counts.

BACTO-PROTEOSE TRYPTONE AGAR

is recommended for use in determining the bacterial plate count of Certified Milk. The formula for this medium corresponds with that suggested in "Methods and Standards of Certified Milk" of the American Association of Medical Milk Commissions.

BACTO-VIOLET RED BILE AGAR

is widely used for direct plate counts of coliform bacteria. Upon plates of this medium accurate counts of these organisms are readily obtained.

BACTO-BRILLIANT GREEN BILE 2%

BACTO-FORMATE RICINOLEATE BROTH

are very useful liquid media for detection of coliform bacteria in milk. Use of these media is approved in "Standard Methods."

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