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Journal of

MILK and FOOD TECHNOLOGY

55TH ANNUAL MEETING
August 19, 20, 21, 22, 1968
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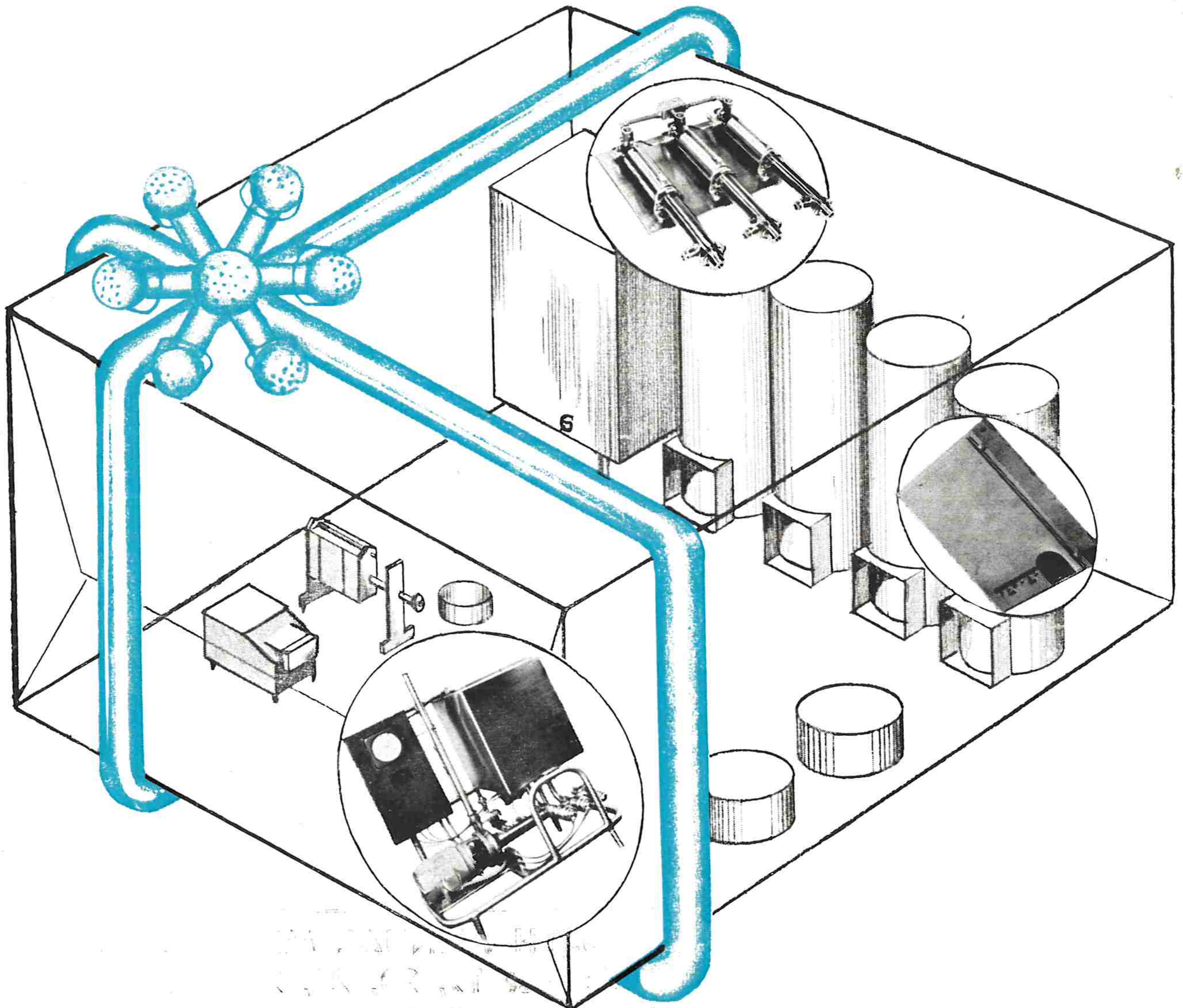

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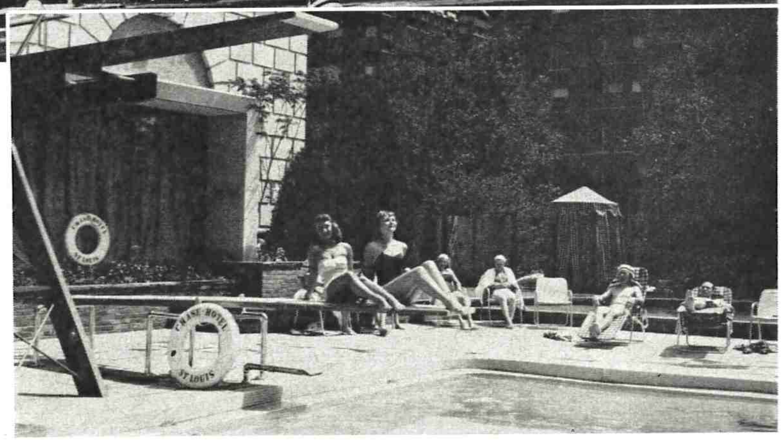

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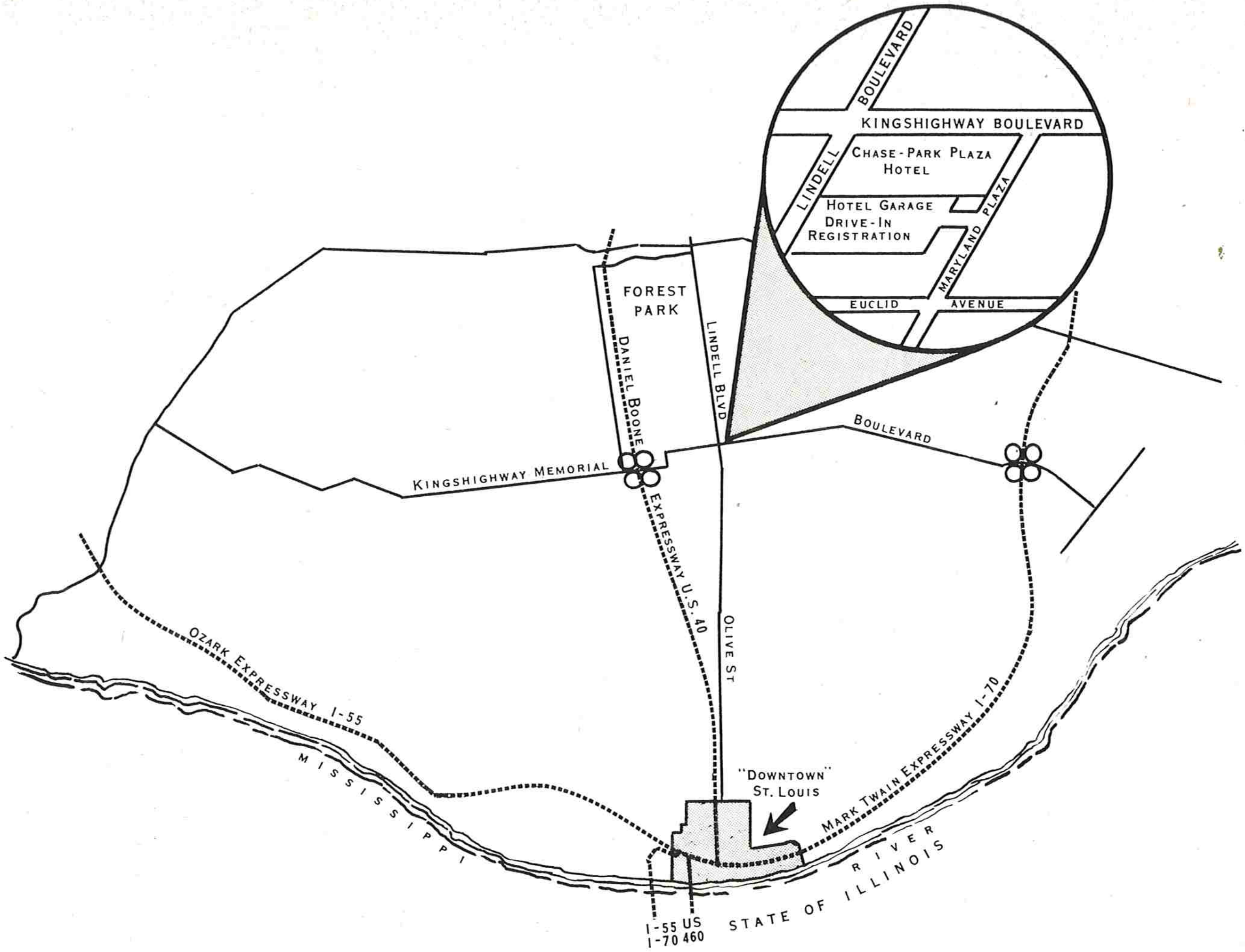

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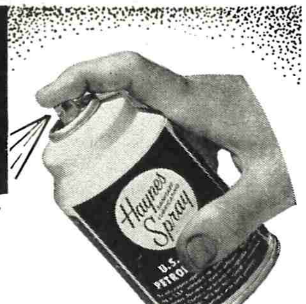

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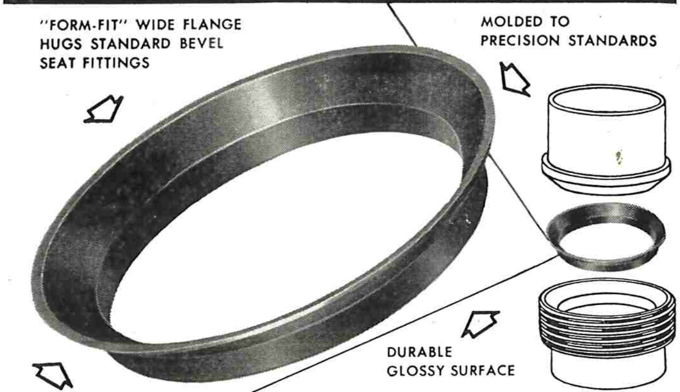

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EFFECT OF INSECTICIDE RESIDUES ON GROWTH AND FERMENTATION ABILITY OF LACTIC CULTURE ORGANISMS[1]

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(Received for publication December 11, 1967)

Abstract

Sterile whole milks containing from <0.1 to 100 ppm of dieldrin and heptachlor were inoculated with *Streptococcus lactis* A254, *S. lactis* A62, *Streptococcus cremoris* E-8, *S. lactis* var. *diacetilactis* 1816 and *Lactobacillus casei* and incubated for 48 hr at appropriate temperatures. In addition, milks containing similar amounts of methoxychlor and malathion were inoculated with *S. lactis* A254 and *L. casei* and incubated 48 hr at 32 C. Samples removed at 0, 24 and 48 hr were examined for number of viable organisms, pH, and titratable acidity. The insecticides had little or no effect on the growth or fermentation ability of the organisms.

During the past 2 decades pesticides have had an important role in improving the quality and quantity of man's food and fiber. Pesticides are designed to kill or interfere with the metabolism of living target organisms. However, because of biochemical similarities among many species, and inadequate selective specificity of the toxicant, pesticides may be potentially dangerous to living organisms utilized advantageously by man. Consequently, extensive research has been performed to learn the effects of pesticides on man and his total living environment.

With a few exceptions, publications on the influence of insecticide residues on microorganisms have been limited to organisms important in soil microbiology *(2, 3, 4, 7, 9, 13* and *14)* and indicate that in general, bacteria are not affected by the various insecticides. Some fungi, algae, yeasts and protozoa *(3, 5, 6, 9, 10, 12* and *13)* are affected by some insecticides. Painter and Kilgore *(8)* reported that none of 13 insecticides added to grape musts in wine fermentation had any measurable effect on the fermentation normally accomplished by the inoculated yeast *Saccharomyces cerevisiae* var. *ellipsoideus.*

Recently, some people working with culture organisms used in dairy products have expressed concern about the effect of insecticides on these cultures. The organo-phosphate compounds are of little consequence because they seldom survive the chemical reactions in the biological pathways occurring between ingestion or absorption and the milk secretory system. Normally the organo-phosphates gain access to milk only through post-milking contamination. However, the various chlorinated hydrocarbon insecticides are found in almost all mammalian milks, including human. The purpose of this study was to determine whether certain insecticides have any deleterious effect on the growth and functions of some culture organisms important in dairy products.

Materials and Methods

Quantities varying from 0 to 100 parts per million (ppm) of 3 representative chlorinated hydrocarbon insecticides (methoxychlor[1], dieldrin[2] and heptachlor[3]) and one organo-phosphate insecticide (malathion[4]) were added to sterile whole milk. Stock solutions containing 1 or 10% of these insecticides were prepared by dissolving the chlorinated hydrocarbons in acetone and by dissolving malathion in 95% ethyl alcohol. Preliminary experiments indicated that these solvents had no effect on the growth of the test organisms when used at concentrations up to 1% in the growth medium. Subsequent 10-fold dilutions of the stock solutions were prepared using the solvents mentioned above so that 0.1 or 1.0 ml added to 100 ml of milk would give milks containing 0.1, 1, 10, and 100 ppm of the insecticide. The original milks usually contained less than 0.01 ppm and always less than 0.05 ppm of insecticide.

The milks containing various amounts of insecticides were inoculated with 0.1% of an active litmus milk culture of *S. lactis* A62, *S. lactis* A254, *S. cremoris* E-8, *S. lactis* var. *diacetilactis* 1816 or *L. casei* and incubated at 32 C for 48 hr, except samples inoculated with *S. cremoris* which were incubated at 25 C. Two control samples of milk with no insecticide added were included with each trial, one inoculated and one non-inoculated. At 0, 24, and 48 hr of incubation, aliquot samples were withdrawn aseptically to determine plate count, pH, and titratable acidity. Plate counts for bacterial populations were performed according to the procedures recommended in *Standard Methods for the Examination of Dairy Products (1).* Titratable acidity was expressed as per cent lactic acid.

[1]Michigan Agricultural Experiment Station Journal Article No. 4159.

[1]Crystalline methoxychlor, 100% pure, from Geigy Chemical Corp., Ardsley, N. Y.

[2]Crystalline dieldrin 99+% pure from Shell Chemical Co., New York, N. Y.

[3]Crystalline heptachlor, 99% pure, from Applied Science Labs, Inc., State College, Pa.

[4]Liquid malathion, 96% pure, from American Cyanamid Co., Princeton, N. J.

RESULTS AND DISCUSSION

The effect of insecticide residues on the growth and fermentation ability of organisms frequently occurring in cultured dairy products was determined by comparing viable cell counts, pH and titratable acidity in inoculated milks containing various concentrations of commonly used insecticides, with inoculated milks containing no added insecticide.

An explanation of the data in Table 1 is appropriate. Separate inoculated control samples containing no added insecticide were used with each insecticide tested and the range of the count in these controls is shown. The cell populations expressed as per cent of control are calculated from the specific control sample used in series with the insecticide being tested. For example, when *S. lactis* A 254 was tested with dieldrin, both the control and the sample containing 100 ppm of dieldrin had plate counts of 710,000 per ml at 0 time; at 24 hr the count in the control was 630,000,000 per ml and the count in the sample containing dieldrin was 480,000,000 per ml or 76% of the control; and at 48 hr the count in the control was 570,000,000 per ml and the count of the sample containing dieldrin was 590,000,000 per ml or 104% of the control.

The data in Tables 1 - 3 show that 100 ppm of methoxychlor and malathion had no effect on the ability of *S. lactis* or *L. casei* to increase in number or produce acid. Similar amounts of dieldrin and heptachlor had little or no adverse effect on the growth or fermentation ability of two strains of *S. lactis, S. cremoris, S. lactis* var. *diacetilactis* or *L. casei.* In fact, among the various combinations of organisms and amounts of insecticides used in this work, the only evidence of inhibition occurred when *L. casei* was inoculated into milk containing 100 ppm of dieldrin, and this inhibition was only slight. In the interest of conserving space in this paper, data pertaining to cell populations and acidities in inoculated milks containing 0.1, 1.0 and 10 ppm of the insecticides are omitted.

The concentrations of the acetone and ethyl alcohol solvents used in this experiment were equivalent to a maximum of 1.0% and 0.1%, respectively, in the growth medium. The stock solutions of insecticides were not sterilized, the reason being to avoid any possible alteration of the compounds by heat. This is particularly important with malathion which is relatively unstable to heat. However, aseptic tech-

TABLE 1. VIABLE CELL POPULATIONS IN WHOLE MILK CONTAINING 100 PPM OF VARIOUS INSECTICIDES WHEN INOCULATED WITH ORGANISMS COMMONLY OCCURRING IN CULTURED DAIRY PRODUCTS AND INCUBATED AS INDICATED

Incubation time (hr)	Range of cell population per ml in inoculated controls containing no insecticide (000 omitted)	Cell population expressed as per cent of control when the milk contained the insecticides indicated below			
		dieldrin	heptachlor	methoxychlor	malathion
	inoculated with *S. lactis* A254 and incubated at 32 C				
0	240 to 730	100	96	157	100
24	42,000 to 630,000	76	95	88	94
48	120,000 to 620,000	104	135	105	117
	inoculated with *S. lactis* A62 and incubated at 32 C				
0	860 to 1,000	93	110	—	—
24	570,000 to 610,000	95	98	—	—
48	550,000 to 650,000	85	98	—	—
	inoculated with *L. casei* and incubated at 32 C				
0	240 to 390	78	97	112	100
24	110,000 to 220,000	31	100	100	86
48	260,000 to 680,000	48	114	115	92
	inoculated with *S. cremoris* E-8 and incubated at 25 C				
0	510 to 900	110	96	—	—
24	810,000 to 960,000	97	108	—	—
48	150,000 to 610,000	87	112	—	—
	inoculated with *S. lactis* var. *diacetilactis* 1816 and incubated at 32 C				
0	840 to 950	86	88	—	—
24	510,000 to 650,000	112	108	—	—
48	360,000 to 690,000	128	113	—	—

TABLE 2. CHANGES IN pH IN WHOLE MILK CONTAINING 100 PPM OF VARIOUS INSECTICIDES WHEN INOCULATED WITH ORGANISMS COMMONLY OCCURING IN CULTURED DAIRY PRODUCTS AND INCUBATED AS INDICATED

Incubation time (hr)	Range of pH of inoculated controls containing no insecticide	Insecticide			
		dieldrin	heptachlor	methoxychlor	malathion
	inoculated with *S. lactis* A254 and incubated at 32 C				
0	6.40 to 6.48	6.44	6.45	6.48	6.40
24	5.00 to 5.22	5.22	5.22	5.02	4.98
48	4.75 to 5.05	5.02	5.06	4.78	4.75
	inoculated with *S. lactis* A62 and incubated at 32 C				
0	6.42 to 6.43	6.43	6.42	—	—
24	4.80 to 5.27	5.26	5.02	—	—
48	4.64 to 5.01	5.00	4.65	—	—
	inoculated with *L. casei* and incubated at 32 C				
0	6.45 to 6.50	6.48	6.42	6.45	6.50
24	5.92 to 6.14	6.13	6.10	5.92	6.10
48	5.42 to 5.51	5.53	5.40	5.05	5.30
	inoculated with *S. cremoris* E-8 and incubated at 25 C				
0	6.42 to 6.44	6.42	6.41	—	—
24	4.83 to 4.99	5.00	4.83	—	—
48	4.45 to 4.98	4.99	4.46	—	—
	inoculated with *S. lactis* var. *diacetilactis* 1816 and incubated at 32 C				
0	6.43	6.44	6.43	—	—
24	5.44 to 5.47	5.44	5.46	—	—
48	5.28 to 5.32	5.28	5.31	—	—

TABLE 3. CHANGES IN TITRATABLE ACIDITY IN WHOLE MILK CONTAINING 100 PPM OF VARIOUS INSECTICIDES WHEN INOCULATED WITH ORGANISMS COMMONLY OCCURRING IN CULTURED DAIRY PRODUCTS AND INCUBATED AS INDICATED

Incubation time (hr)	Range of titratable acidity of inoculated controls containing no insecticide	Insecticide			
		dieldrin	heptachlor	methoxychlor	malathion
	inoculated with *S. lactis* A254 and incubated at 32 C				
0	0.14 to 0.16	0.14	0.15	0.14	0.16
24	0.56 to 0.61	0.58	0.62	0.57	0.58
48	0.64 to 0.69	0.70	0.68	0.64	0.66
	inoculated with *S. lactis* A62 and incubated at 32 C				
0	0.14	0.15	0.15	—	—
24	0.55 to 0.56	0.55	0.56	—	—
48	0.58 to 0.63	0.64	0.59	—	—
	inoculated with *L. casei* and incubated at 32 C				
0	0.13 to 0.14	0.15	0.16	0.13	0.14
24	0.19 to 0.26	0.27	0.21	0.21	0.20
48	0.40 to 0.49	0.43	0.46	0.49	0.41
	inoculated with *S. cremoris* E-8 and incubated at 25 C				
0	0.13 to 0.15	0.14	0.13	—	—
24	0.66 to 0.68	0.64	0.68	—	—
48	0.66 to 0.72	0.66	0.71	—	—
	inoculated with *S. lactis* var. *diacetilactis* 1816 and incubated at 32 C				
0	0.14 to 0.16	0.16	0.14	—	—
24	0.49 to 0.50	0.52	0.49	—	—
48	0.55 to 0.56	0.56	0.55	—	—

niques were maintained and no contaminants were observed during enumerations.

Additional trials were performed in which the insecticides were added without solvent, directly to reconstituted sterile whole milk and to cereal milk containing 11% milk fat. Malathion has a solubility of 145 ppm in water at 25 C *(11)*. The chlorinated hydrocarbons dissolve in the fat when added to a substrate containing fat. In one group of experiments methoxychlor was dissolved in butteroil, which was then mixed with non-fat dry milk solids and water, and reconstituted into milks used as a growth medium. When these milks were inoculated with *S. lactis* or *L. casei* there was no significant difference in the growth rate of the organisms even when the insecticides were present in concentrations up to 1000 ppm. Little difference was observed in the data resulting from different methods of incorporating insecticides into growth media, therefore only one representative portion of the data is included here (Tables 1 - 3).

In this work 3 chlorinated hydrocarbon and 1 organo-phosphate insecticides were tested against 2 to 5 representative lactic organisms. Since concentrations up to 100 ppm of the insecticides showed little or no adverse effect on the metabolic ability of the organisms, it seems probable that amounts of insecticides apt to occur in milk (up to 0.05 ppm in the milk or 1.25 ppm in the milk fat) would not interfere with normal growth and fermentation of lactic culture organisms used in milk products. The toxic mechanism of organo-phosphates is through inhibition of cholinesterase and since the bacterial system is not known to possess a cholinesterase it is logical that the organophosphates would be unable to interfere with the metabolic activity of bacteria. The toxic mechanism of chlorinated hydrocarbons is not as well elucidated as that of organo-phosphates. Most chlorinated hydrocarbons are known to be contact insecticides which function as nerve poisons *(11)*.

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FOOD INDUSTRY DEVELOPMENTS IN THE FUTURE[1]

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Abstract

It is apparent that the food industry of the future will be a dynamic, complex and a large-scale commercial operation. Vertical and horizontal integration will likely increase and thus blur the lines between agricultural production and agricultural processing. The growing need for food can only result in further rapid technological development. Accelerated progress toward more sophisticated, more convenient, nutritious and attractive foods can be expected to result from intensified application of science and technology. The amount of processing, handling and distribution of food will increase as a result of the lengthening distance between producer and consumer. Production of food, water, and energy to do man's work will be of the utmost importance. Nuclear energy will be used in producing man's food and water. Maintaining the safety and wholesomeness of an ever-changing food supply will require increasing emphasis on food sanitation.

Quite apart from its importance in supplying world food needs, the food processing industry—including the production, distribution and marketing activities that are associated with it—will be considered a national resource of highest priority in meeting problems which affect our interests in international trade and assistance to developing countries. Food processing will be the key to economic development.

Today's world can depend upon change—rapid change. Revolutionary changes have taken place in the production, processing, packaging and distribution of food in the past 20 years. Two-thirds of the 8,000 items now available in the supermarket were not available before World War II or are considerably modified pre-war products. New products are appearing every day and, 10 years hence, the number is expected to exceed 12,000. These statistics depict the impact of an affluent society on a highly competitive and efficient food industry. The challenge of the future lies in adapting the food industry to changing social and economic factors.

There is much processing and manufacturing of agricultural products between the farm and the consumer. Perhaps the single, most significant development in the food industry has been the transfer of food preparation and processing from the home to the food manufacturing plant. Despite the significance of this event, the food industry's ability to provide the nation with more food, of higher quality, nutritive value and stability and at less cost is often taken for granted.

The United States food industry is a successful multibillion dollar business. It provides an abundant, safe and economical food supply. Broadly viewed, the production and distribution of food products involves 5 fairly distinct and separate stages: (*a*) agricultural production, (*b*) manufacturing and processing, (*c*) merchandising, (*d*) wholesaling, and (*e*) retail distribution *(18)*.

This report is concerned mainly with agricultural production and manufacturing or processing. It attempts to highlight the major technological developments which in the next few years will have a major impact on the supply of food available. Emphasis is placed on research and development needed for future growth.

Discussion of developments in the food industry requires a brief summary of the economic and social changes that give rise to current trends.

America is now 70% urbanized. The national economy has been expanding. Science and technology have become a major key to technological change and national growth. Use of nuclear energy will expand. Man's ability to alter the face of the earth through technology seems to be limited only by his ingenuity and imagination.

Agricultural Production

Since World War II there has been a surge in the use of science and technology in agricultural production. Extensive adoption of engineering, biological and economic technology has brought about significant changes in American agriculture. These changes have resulted in fewer but larger farms and increased specialization. Today there are about 3.2 million farms in the United States as compared with 6.1 million in 1940.

The number of farms may be going down, but the capacity of agriculture to produce keeps on growing. The size of farms and the amount of capital resources and machinery per farm have increased. Productivity per man hr has nearly doubled in the past 10 years and productivity per acre has increased 76%. Today, the average farm worker produces enough food and fiber for himself and 39 others.

[1]Presented at the 54th Annual Meeting of the International Association of Milk, Food and Environmental Sanitarians, Miami Beach, Florida, August 14-17, 1967. Opinions expressed are those of the author and not necessarily of the U. S. Dept. of Agriculture.

Possibilities for adjustment in agriculture point to a continuation of rapid change in farm numbers and in the structure of agriculture. Scale economies and capital-labor substitution will likely be continuing trends. In the future, plant breeders will be developing plants of known composition for specific purposes. With the emphasis on nutritionally adequate foods, farmers will relate production from one crop to another in such terms as tons of protein per acre.

Agriculture/2000 *(20)* envisages many changes in agriculture. The experts predict disease-free crops, automated farm machinery, robot harvesters and computer-controlled operation. Agricultural production will continue to change.

FOOD PROCESSING AND MANUFACTURING INDUSTRY

The performance of the food processing industry is highly important to the total national economy. Over

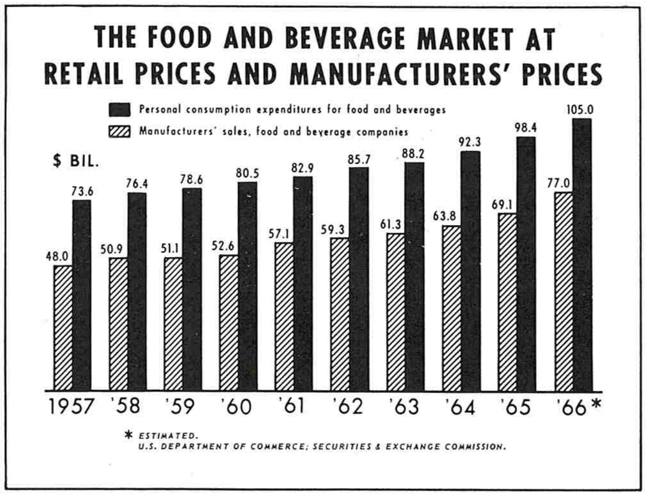

Figure 1. Scope of the food and beverage market.

the decade ending with 1966, the nation's food and beverage market grew from $74 billion to $105 billion at the retail level, and from $48 billion to $77 billion at the manufacturer's price level (Figure 1).

The $105 billion includes the bill for services of about 300,000 retail food stores, approximately 13,000 food manufacturing plants with 20 or more employees, and a large portion of the 3.2 million farms. Food processors and distributors alone employ about 3 million persons.

A variety of dynamic movements have been and are at work in the food processing industry *(17)*. These include a substantial decline in the number of companies involved in food manufacturing generally; an increase in concentration in the food manufacturing industry; a substantial increase in the conglomerate nature of leading firms in the industry; a sizable increase in the number of large acquisitions by the larger food processors; and substantial in-

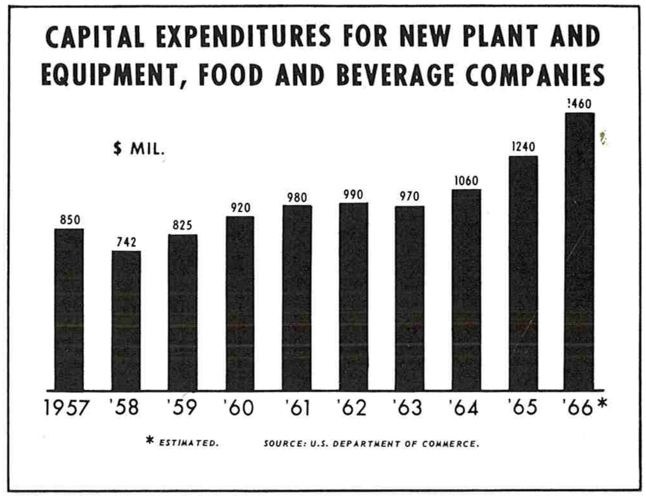

Figure 2. Expenditures for new plant and equipment, food industry.

creases in research expenditures by large food manufacturers.

The food industry's dynamic growth has resulted from product innovation and plant expansion and moderization. Figure 2 reveals that outlays for new plant and equipment during the period 1957 to 1966 grew from a level of about $800 million a year to nearly $1.5 billion. Many new processing technologies were adopted. These include processes such as freeze-drying; continuous mixing techniques; and controlled atmosphere storage.

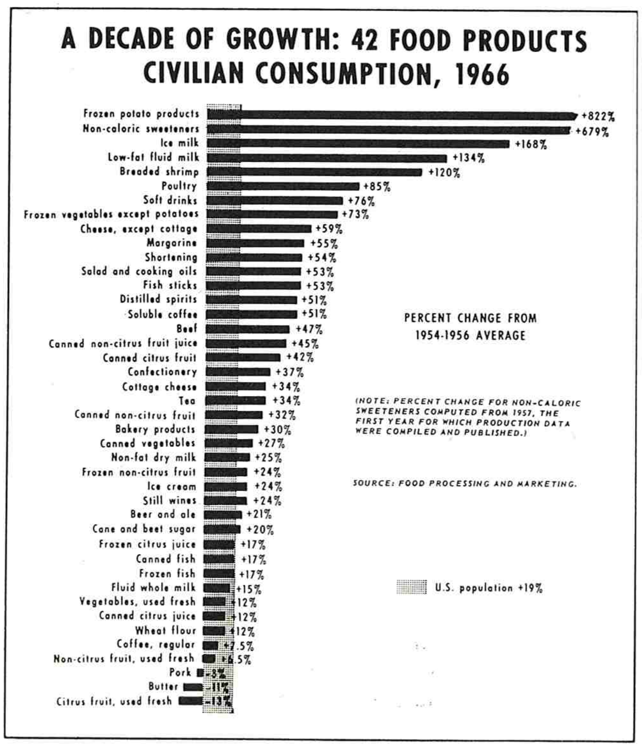

Figure 3. New product consumption, 1966.

New products offer important sources of profit for food firms. It is not uncommon for major food firms to have one-half or more of their sales represented by products new within the past 10 years. Illustrations of new products and new uses for food products that have become important in recent years are frozen concentrated juices, frozen fruits and vegetables, prepared cake mixes, non-fat dried milk and potato flakes.

Figure 3, taken from *Food Processing and Marketing's* "Fourth Biennual Review of Ten Year Growth Patterns" in the food industries *(10)*, documents strong consumer preference for convenient, low-calorie, and high protein foods. Despite the apparent success of some items, 3 out of 4 new products developed either fail or do not reach expected levels of profitable marketing. More effective product development techniques are needed.

Modern highways have improved truck transportation between cities and have led to increased long-distance hauling by trucks. Improved transportation coupled with new processing technology has resulted in growth of larger plants and less isolation of local markets. Future advances in food processing and manufacturing will reflect the contemporary level of biological sciences and engineering development. Applications of chemical, physical and bacteriological knowledge combined with modern chemical engineering principles will contribute to the new processing technology. New processes will find expression in new consumer products. Food product development will continue at a fast pace since easy to prepare, easy to serve products will be more attractive than ever.

Improvements foreseen include: a rapid and continuing change from batch to continuous flow methods; an increased use of the clean-in-place idea with modification of the design and construction of processing equipment in order that equipment and plant can be cleaned and sanitized without disassembling them; widespread use of automated processes including use of sequences of operations and programmed control of sanitation and cleaning cycles; and expanded use of packaging and prepackaging methods.

Applications of computers will be a future way of life in many food companies. In addition to use in the normal operation of a business, computers will be used for process control, ingredient blending and simulation of segments of the food industry. Computers lend themselves to use in mobilizing powerful new means of processing and communicating information and in developing modern analytical techniques to deal with problems in their entirety. This will help insure that efforts are aimed in the right direction whether the industry is seeking research information or planning marketing programs.

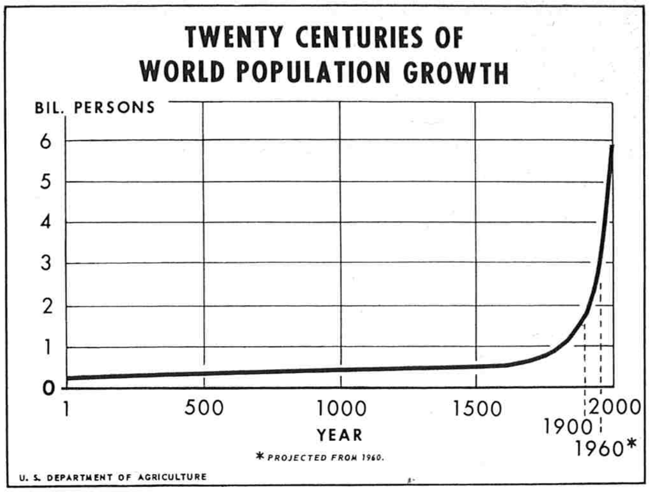

Figure 4. World population growth.

It has been suggested that nutrition should be established at the basis for production, buying, and selling of farm and food products *(8)*. This points toward a computer-controlled system of specification of foods and marketing of nutrient labelled food products.

DEMAND FOR FOOD

The growing demand for an adequate food supply is a significant force that confronts the agricultural production and food processing industries. Never has food been so widely recognized as deserving of increased emphasis on both domestic and international fronts. At the risk of rhetorical overkill—the precarious state of the food supply must be emphasized. Figure 4 depicts a part of the burgeoning problem of meeting the nutritional needs of a hungry world. It took almost until 1900 for the world population to reach a billion people. There are more than 3 billion now and projections indicate the possibility of 6 billion by the year 2000.

Secretary Freeman has said:

> "The greatest single challenge the world faces today is whether the swelling ranks of mankind can produce enough food to sustain life without hunger."

Hopefully, research and education will provide the long-term solutions. One of the most pressing needs is an adequate supply of low-cost, high-quality protein. Ways to extend both animal and plant protein sources are sought. Sources such as fish protein concentrates, petroleum hydrocarbons, and plant and oilseed proteins have received intensified study and several processes have reached the pilot plant stage *(2)*.

In the United States, increases in population and consumer buying power are major determinants of demand for food products. Domestic markets for food are expected to grow a little more rapidly than population. Consumer demand is influenced by income and consumer preference for food. Rising incomes have had more impact than growth of population on the American food industry. Demand for services incorporated in or associated with processed foods has increased more than demand for raw food materials. A decline in the significance of price in determining consumers' purchases has occurred. The fact that an increasing number of women hold jobs outside the home portends an ever increasing demand for high-quality, time-saving convenience foods. Housewives are happy to be freed from peeling, washing, cleaning, mixing, and preparing food 3 times a day. However, a successful product must have high quality, taste, nutritive value, and convenience to meet their high standards.

Expanding and affluent populations have enhanced the demand for greater quantities of more highly processed food products. Per capita consumption, in the United States, of a basic staple such as potatoes illustrates this trend. In 1950 11.2% of potatoes consumed was processed; in 1966, 38.4% was processed. Industry members predict that over one-half of the potato crop will be utilized in processed form, thus continuing the shift toward more processed items.

American consumers can eat a different meat product every day of the year, and they want even more variety. Data on food consumption per capita reveal changes in consumption patterns—more meat, more poultry and less cereal products.

Despite an upgrading of the diet, food expenditures relative to income have declined. Income spent for food dropped to 18.2% in 1966.

Eating habits are changing. More people are eating out. From 1955 to 1965, meals and beverages consumed outside the home increased by 50%. A close look at the composition of the diet indicates a reduction in calorie intake as well as a shift in composition. Furthermore, sources of protein are changing.

A survey by *Progressive Grocer* indicated that the majority of consumers would not be willing to accept reductions in shopping services or convenience foods in order to obtain lower food prices. A buying population that on the average is younger, better educated, mobile, and more affluent will generate changes in relative prices. This will further modify diets.

Technology produces more than physical change. It brings about farreaching alterations in our food supply, food habits, and tastes. Changes in the quality and character of foods are occurring rapidly. Clausi *(9)* believes that the consumer of tomorrow is going to accept fabricated foods, and will be experiment-minded enough to embrace new ideas if they satisfy the need. Study of human population will lead to better understanding of the state of health on low intakes of essential nutrients and of the relation of nutrition to physical and mental development. A strong interest in health and diet will continue. There is increasing concern with factors in foods which influence appetite and induce or condition deficiency or toxic states.

Mortimer *(15)* has stated:

> "I foresee a time when we will be catering to a society that will be much more calorie conscious; one in which foods will prevent rather than combat obesity and other forms of malnutrition."

In the "far-out" view of how foods will be marketed and consumed, it is probable that the housewife will be shopping in a supermarket quite different from today. She will likely be riding on a moving sidewalk, selecting items from the shelves by electronic control and almost instantly going through checkout and delivery.

RESEARCH AND DEVELOPMENT

Competition and change have characterized man's forward progress for centuries. Competition finds expression through research and development. Research produces information. Application of that information yields new and improved products. Progress and economic growth can be accomplished only on the foundation of research and innovation.

Advances achieved through research make it possible for man to enjoy a great abundance of high quality food. There are few items in today's supermarket that have not been improved through research. New processes and new food products occupy a tremendously important place in this era of innovation. Research also provides a useful base of fundamental information which serves as a springboard for innovation in foods.

A strong research program is dependent upon a constant stream of new and stimulating ideas. If the objective is new and better food products, then idea birth control should not be practiced. The food processing industry finds it necessary to invest heavily in product research and development. A tremendous amount of resources is devoted to new product development by food manufacturing companies today. Funds allocated to research and development by the food and beverage industries more than doubled in the past 10 years. Figure 5 shows the funds rose from $74 million in 1957 to close to $160 million in 1966.

In addition to industry research and development efforts, food scientists in the State agricultural experiment stations of the Land-Grant Universities and in the laboratories of the Department of Agriculture contribute significantly to the improvement of food products and processes. Although directed less to product development, this research provides basic information about the properties of agricultural com-

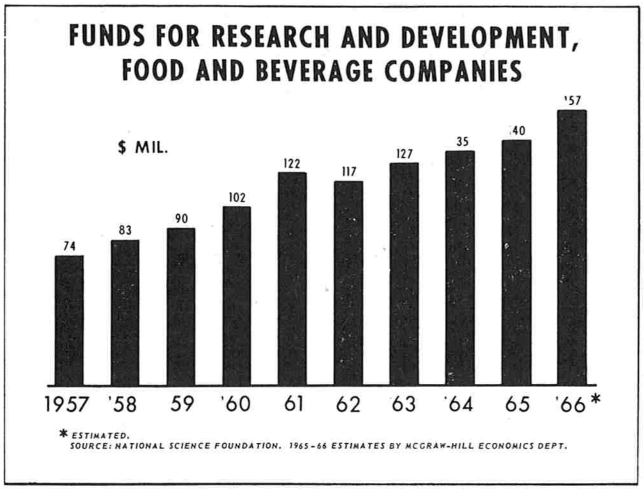

Figure 5. Funds for research and development, food industry.

modities and engineering unit operations. A recent study *(4)* indicates that research on food problems employed a total of 642 scientific man-years, comprised of 396 for State agricultural experiment stations and 256 for the Department in 1966.

Other Government and private agencies also conduct food research. However, the following examples of accomplishments have been drawn largely from State agricultural experiment station and Department sources.

New Products

Recent developments in food engineering and product development have made it possible to provide an ever increasing array of poultry products. Only a decade ago, a scant 1 million lb of ready-to-cook poultry went into further processed products. Today the volume is near 750 million lb. Over 20% of turkey is now further processed.

Interest in further processing of poultry and development of poultry products has lead Cornell scientists to investigate the emulsifying properties of meat obtained from the various parts of fowl, fryer-roosters and turkeys. Parts were analyzed for collagen content and used to prepare basic meat emulsions. The collagen content of poultry meat was found to give an excellent estimate of its emulsifying capacity.

New "instant fruit" consumer products have become available as the result of a process of freeze-drying crushed fruit in pellet form developed by North Carolina station food scientists. These pellets provide the homemaker with the same "instant" convenience in fruit that she enjoys in such products as coffee, potatoes and milk. Several food firms are now testing the peach, strawberry, and blueberry pellets in prepared mixes for cakes, pancakes, muffins, and other products.

A new sweet potato product that is canned hot and congeals in the can so that it can be removed as a roll has been developed by Georgia station food scientists. The roll can be made from sweet potatoes that have been lye peeled, cooked, pureed, and mixed with a small amount of dry milk solids.

Short supply of protein in some areas of the world has stimulated the search for low cost methods for processing plant proteins into suitable forms for human consumption. A process, developed by South Carolina food scientists, involves converting peanuts into full-fat precooked flakes by grinding, heating with water, and drum drying. A white flour made from glandless cottonseed by Texas station researchers may expand the use of cottonseed protein for human food. Characteristics of the cottonseed flour made from glandless cottonseed indicate that it may have potential for use in the production of simulated meat products made from vegetable proteins.

Food scientists at the Puerto Rico station have successfully freeze-dried sweet peppers (*Capsicum frutescens*). The process consists of steam treatment to inactivate enzymes, freeze-drying, and packing the diced peppers in jars or cans. Microbial counts are reduced by steam treatments. The freeze-dried product rehydrates readily and retains good flavor. It is especially useful in those instances in which uniformity and stability of flavor are important in the product.

Despite the research effort and success mentioned, additional new products are needed in such form that meals can be readied in a few moments by the housewife or by the institutional kitchen. Snack food sales in the United States have, since 1945, exceeded both population growth and food sales in general. Sales of potato chips rocketed from $147 million in 1946 to $600 million in 1964.

Research provides information on the physical and chemical properties of basic agricultural commodities. Ingredients with built-in properties which made product development easier have been developed. Food manufacturers may specify texture, size, shape, color, flavor and a sanitary quality to meet product needs. High protein fractions obtained from corn, soya, oats, rice and rye offer functional properties that can help make better foods more economically.

It is likely that the future will see more exploitation of molecules, powders, fat, carbohydrate and protein fractions to build new foods which are pleasing for people to eat. To obtain proper gustative and appetite stimulating properties greater knowledge is needed in rheology, instrumentation, and flavor.

PROCESS DEVELOPMENT

Methods of handling and processing foods change in response to modifications in production practices; harvesting procedures, including mechanical harvesting methods; processing, packaging and handling; storage and distribution. Furthermore, processing, handling and distribution procedures are frequently modified to conform to markets and to variation in consumer habits and preferences. New processes emerge from the laboratories and pilot plants of food and allied manufacturers, research agencies of Government, university and private firms, and firms outside the United States.

During the past 20 years, the food processing and manufacturing industry has become increasingly mechanized. Much of the food is now mass-produced by continuous methods and the speed of production and distribution has been increased.

Many important developments are occurring in food processing methods as advanced processing techniques are being perfected and applied. Within the past decade, a large body of scientific knowledge pertaining to such radiation processes as sterilization, pasteurization, disinfection, sprout inhibition, and product improvement has accrued. There are problems related to reduction and control of undesirable side reactions, methods for achieving dose reduction, and wholesomeness which must be solved. Nevertheless, the preservation of food by ionizing radiation is fast approaching commercialization and will likely take its place among the acceptable techniques for food preservation *(11, 21)*. Food irradiation processes will find major uses where their unique features will fulfill needs not satisfied by other processing techniques. In cooperation with the Atomic Energy Commission, the USDA has just begun work on the world's first free-flowing bulk grain irradiator at Savannah, Georgia.

Confronted with the problem of how to cull bad black walnuts from good ones without cracking them open, Missouri station scientists used theoretical concepts to design a workable machine with a computer. The walnut sorting machine was designed after determining many of the physical characteristics of the whole and cracked nuts. The multi-million dollar black walnut industry will welcome the big saving in tedious hand labor required to separate bad nut meats from good ones. The machine also saves the cost of handling and cracking bad nuts.

Recent research at Oklahoma State University, cooperative with USDA, has shown that ham can be satisfactorily processed within 15 hr from time of slaughter. The shorter processing time was accomplished by eliminating the 24 hr chill treatment.

For centuries apple juice has been prepared by grinding the fruit and wrapping the pulp in open weave cloths to form "cheeses" which are stacked between the platens of a screw or hydraulic press. To replace this "batch process," New York food researchers have developed a continuous screw press for making apple juice. Use of the continuous press makes it possible to maintain a uniform flow of juice and requires much less labor. Principles developed will be useful in design and operation of large continuous presses.

Development of a fluidized-bed technique that reduces time of freeze-drying meats and vegetables to 3 to 5 hr at costs of 3.3 to 4.3¢ per lb of water removed has been reported *(22)*. In a new Danish freeze-dryer, liquids are spray-frozen in cold air in sec. Then particles are dried in a rotating drum that agitates the product bed. Microwave experiments have indicated that mold spores in unwrapped sliced bread have been killed by heating to 150-160 F with no effect on product. Aseptic processing and packaging has taken another step forward with the successful cold packaging of single strength orange juice.

Reverse osmosis is being developed as a new way to remove water from a liquid product without use of heat. It is adaptable to liquids which have a low temperature sensitivity. Some problems exist. The right membrane must be used on dissimilar liquids and proper sanitation procedures are important.

Advances in other processes and unit operations are finding wider use. Cryogenics, ultrasonics, membrane filtration, larger-scale electro-dialysis, and microwave and infrared heating are examples.

Some new processes will have implications for sanitation and pollution control. USDA's process for cleaning and reusing the brine used in processing olives will help reduce stream pollution. In the process liquids are passed through a column of activated carbon to remove the contaminants and make brine reusable. Recycling saves water and chemicals and prevents stream pollution.

Water usage and management in potato processing plant operations has been studied by Maine food scientists *(12)*. Factors found to affect water use and reuse were volume of raw materials processed per day; conditions of raw materials at time of processing; loadings of total suspended solids; microbiological populations in effluent waters from various processing steps; and wide variations in processing procedures within individual plants.

Instrumentation and control methods are developing rapidly. Chemical and rheological methods of analysis of foods have in many instances been adapted to continuous in-line techniques which give rapid results. A system of onstream color control for cranberry juice has been devised. A device which measures egg shell fragility by use of beta-ray reflections has been used to detect cracked eggs. These research developments will extend the scope of application of food processes and lead to entirely new processes.

PACKAGING

Good packages protect and display the product. They provide convenience in buying, handling, storing and using the food item and may also be designed to appeal to consumers. The protection offered by a package is determined by the nature of the packaging materials and by type, design and construction of the package. The average package gets only one-fifth of a sec to attract the consumer's eye. It must be functional, convenient and attractive. If the search for better processed food quality is to be successful, better packaging must be developed.

Reports indicate that tinless steel cans may soon be feasible in the United Kingdom as a result of development of a blackplate that has been chemically treated to produce a surface film containing hydrated chromic oxide *(6)*. The material can be produced in a variety of finishes from the color of bright untreated steel to blue.

Illinois food scientists have developed an edible film for packaging meat that minimizes bacterial growth, moisture loss, and pigment loss. The film is prepared from sodium alginate, crystalline corn syrup solids, and calcium propionate. In comparative studies at 3 C with rib-eye steaks, samples dipped in the film preparation did not spoil until after 10 to 12 days.

United States Department of Agriculture researchers have developed a tasteless, colorless fat from cottonseed oil which, when sprayed on a food, forms a "package" upon contact. Economists say that today about 35 million lb of edible coatings—packages that can be eaten—are used on food and they expect this to double in a few years.

There exists a need for more extensive studies on application of plastics to heat-sterilized foods. Work has been underway on the development of a transparent plastic folding carton for more than 20 years. Fulfillment of this research goal has recently been reported. "Show-off" cartons made by Finn Industries are constructed as one-piece boxboard folding cartons. They are made of a vinyl plastic formulation and are totally transparent, enabling the product to be completely visible. The new material is available in most conventional carton, tray, and sleeve style construction *(3)*.

Prepackaging is also increasing. It is considered an aid to marketing and implies packaging in small consumer units and may also involve some measure of preparation for use, i.e., washing-peeling. Additional information is needed regarding the conditions created in the package; the micro-climate and limits of safety in the use.

Interaction(s) between the package and the product need further study. Some packaging material components react with the package contents. Toxicological hazards must be kept in mind. The ideal food package is yet to be designed.

FLAVORS AND TASTES

Trends in tastes, habits, social customs or the availability of new food products affect future food consumption patterns. The factors which determine food choice in man are not well known. Little is really known about what shapes the attitude of groups and individuals toward foods and the factors determining the preferences, habits and choice of particular foods. Although tastes are becoming international, introduction of new or unfamiliar foods remains a challenge. Anthropologists and sociologists believe that food habits are more or less fixed in the period of 4 to 14 years of age.

It is obvious that flavor(s) and flavor research are important and will have a profound impact on the future foods. Sensory properties of foods stand second only to purity and safety among the list of desirable quality aspects of food. Food processors place great emphasis on the flavor quality of their product. Stated simply, if the flavor of a food is poor it is not eaten.

Better and more natural tasting food flavors are being developed. Greater knowledge of natural food flavors is accumulating. Newer analytical techniques, such as gas chromatography and mass spectroscopy contribute to knowledge of flavor and make possible development of new flavors. It is likely that increased use of flavor concentrates to enhance the flavor of natural foods will occur.

Flavor potentiators and flavor enhancers, compounds which act on the sensory mechanisms and, even when used in small quantities, exaggerate the effect(s) of other agents on that system open up many possibilities. There is interest in the use of 5'-ribonucleotides as flavor "potentiators". Psychophysical investigations using pair-comparisons were carried out by California food scientists to check the bitterness-suppression effects of these compounds. Results indicated that ribonucleotides suppress bitterness of quinine sulfate, oxalic acid and caffeine. Use of these compounds, coupled with molecular biology techniques, may lead to an understanding of the detailed mechanism of action and interaction of flavors.

It has been reported that glutathione may be responsible for the widely varying personal tastes in food *(1)*. Perhaps chemicals can be used to temporarily change man's taste sensations. Research at Florida State University indicates taste receptor cells react to all taste qualities—sweetness, sourness, bitterness and saltiness—not particular cells to specific qualities *(7)*. Chemical treatment of cells can alter taste for a short period of time, possibly 30 min to 1 hr. Data indicate that the individual taste receptor lives about 10 days, and chemical treatment thus, would not damage the taste receptors permanently.

Developments in other ingredients such as bland protein concentrates will increase the opportunity for some "new" flavors to be incorporated into them. These open enormous future possibilities for new food formulations.

SANITATION

Sanitation must keep pace with the complex changes that are occurring in production, processing, marketing, and serving of foods. With new developments, new problems occur. Continuing problems with post-processing contamination have led to intensive programs to improve sanitary practice. Foodborne diseases such as salmonellosis and staphylococcal food poisoning appear to be on the increase.

Potentially harmful contaminants can enter the food chain in many ways. In addition to the pathogenic and spoilage microorganisms, a diverse group of chemical contaminants may find their way into foods at various stages of their production. Safety of additives and antibiotics must be determined. The presence of pesticide residues in food products has been of considerable concern. In addition to precautions designed to avoid contamination, considerable effort has been devoted to removal or reduction of residues through normal or modified processing procedures.

Food plant sanitation is receiving increasing attention. The use of established scientific principles and careful attention in practice will render this significant activity more effective. Study of the physical chemistry of plant sanitation will make the cleaning-in-place more effective and increase our understanding of detergency *(5)*. Sanitation problems in food vending machines have been reviewed *(13)*.

Water quality is important to the food industry. Factors influencing the taste and odor of water are under study. Information is sought on the specific chemical, physical and environmental factors which influence the acceptability of water and the sources of undesirable tastes. The ultimate objective is control to enable the upgrading of water quality.

Control of bacteria in the nation's food supply must improve. Facing the realities of the *Salmonella* problem will lead to an advance in the level of sanitation in the food industry. A by-product may be a more imaginative use and understanding of fermentation and of desirable organisms; a better understanding of anti-microbial agents and environment control. Already tightening of Federal regulations regarding *Salmonella* control in egg products has resulted in a new process for stabilizing protein in liquid egg white prior to pasteurization. The pH of liquid egg white is adjusted with lactic acid and aluminum sulfate to permit pasteurization to eliminate *Salmonella* without adversely affecting whipping properties.

A recent symposium *(19)* reviewed the implications with regard to microbial selection. While modern processing, packaging and distribution methods have considerably lengthened the effective marketing life of foods, spoilage patterns may have been altered and foods may be rendered more susceptible to certain organisms. Heat pasteurization, irradiation pasteurization, and air drying may be expected to alter the microbial flora. Microbial selection may also occur as a result of freeze-drying, storage or packaging. As traditional foods and processing procedures are modified and expanded, the new products must be carefully tested for safety and wholesomeness, for alterations in flora and for possible changes in spoilage patterns.

New methods for detection and control of mircoorganisms of public health significance must be developed. New ideas that will continually improve existing methods for evaluating sanitation and the effectiveness of sanitary programs are needed.

A new laboratory technique has been developed by Department scientists that may cut 2 days from the time required to test pasteurized, dried whole egg for *Salmonella*. Adaptation of an electronic particle converter to counting microbial populations has proven to be a valuable research tool and shows promise as a rapid method for determining growth of microbial populations in foods *(16)*.

A rapid test has been reported for determining post-pasteurization contamination in market milk *(14)*. Use of the test in 2 commercial operations indicated an accuracy of more than 80% in predicting post-pasteurization contamination and shelf-life. The 20 hr tests, as opposed to 6 to 7 days, permits product evaluation before sale. A replica-plating technique has been developed to obtain a rapid quantitative estimation of the viable microbial flora on foods during storage. Experiments on milk and milk products disclosed the level and type of initial population and the rate and development of the various bacterial types during storage. Treatment of the food with heat or chemicals introduced a selective factor. Texas researchers report that this information, coupled with knowledge of the biochemical characteristics of the species, may be used to predict shelf life, possible spoilage pattern and potential hazards to public health.

Sterile tissue techniques are being used by researchers at the Ohio Agricultural Research and Development Center to remove germ-free samples of tissue from a carcass. This technique provides samples that may be stored at room temperature for extended periods. These unprocessed samples provide excellent control material for microbiological studies to determine the microflora that affect the flavor and quality of meat. Leads to improving color retention, flavor and shelf life of meats may be forthcoming.

Danger of mass contamination of the food supply gives urgency to development of basic knowledge in microbiology. More information is needed regarding the growth of microorganisms. Microbiological assays are too tedious to permit adequate sampling in the plant and too slow to prevent contaminated products from entering distribution channels before contamination has been confirmed. Knowledge needs to be strengthened with regard to growth characteristics; occurrences in nature; factors affecting growth; resistance of spores and toxins to heat, chemicals and other agents; characteristics of toxins produced; and special methods for their detection in foods.

Much useful work needs to be done to discover the effect of minor ingredients on the microbial condition of foods and effective sanitary control procedures for food ingredients and food products. Increased mechanization of the food processing industry leads to increased problems with foreign materials. Inspection procedures must be developed to facilitate removal of foreign bodies.

Foodborne illness for which causative organisms are not determined constitute an important group of problems requiring further study. Methods must be developed for the recovery of viruses from foods.

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WHAT THE SANITARIAN SHOULD KNOW ABOUT STAPHYLOCOCCI AND SALMONELLAE IN NON-DAIRY PRODUCTS. I. STAPHYLOCOCCI[1]

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Abstract

After a review of the nature of staphylococci and staphylococcal enterotoxins including data on survival of these organisms under both natural and food processing conditions, the epidemiology of staphylococcal intoxications is discussed. The human nose is the main reservoir of *Staphylococcus aureus.* A number of circumstances must be fulfilled for foodborne staphylococcal intoxications to occur; these include: a reservoir for the infectious agent, a mode of dissemination of the organism, contamination of a food capable of supporting bacterial growth, enough time at a temperature which permits bacterial multiplication, and ingestion of sufficient amounts of staphylococcal enterotoxin by susceptible hosts. Control measures must be based on these circumstances. Principles of control, therefore, include limitation of contamination, inhibition of growth, and destruction of the organism. Control of staphylococcal intoxication must be emphasized at places foods are prepared (food processing plants, food-service establishments, and homes).

Nature of Staphylococci

Staphylococci are spherical cells occurring singly, in pairs, in tetrads, and in irregular clusters resembling bunches of grapes. These organisms are asporogenous, nonmotile, and Gram-positive. Colonies may appear white, yellow, or orange as a result of water-insoluble pigments. The species of concern to sanitarians is *Staphylococcus aureus*, pigmented and non-pigmented varieties. This species, distinguishable from the other species in the genus, *S. epidermidis*, by its ability to ferment mannitol and to coagulate citrated rabbit or human plasma (coagulase-positive), now includes organisms formerly known as *Staphylococcus pyogenes, Staphylococcus albus, Micrococcus pyogenes* var. *aureus* and var. *albus*, and *Staphylococcus citreus,* as well as *S. aureus.* Coagulase-Positive staphylococci produce a variety of toxins and enzymes, including a lethal toxin, dermonecrotoxin, hemotoxins, leucocidins, fibrinolysin, hyaluronidase, deoxyribonuclease, penicillinase, lipase, and enterotoxin.

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S. aureus requires several amino acids, thiamin, and nicotinic acid, for growth. It is facultative and hence grows very well under anaerobic conditions if fermentable carbohydrates are present, but it grows even better under aerobic conditions. These organisms tolerate sodium chloride well, in fact, they grow vigorously in a 10% salt solution that would inhibit the growth of most bacteria. Under aerobic conditions S. *aureus* has a water activity (a_w) of 0.86 and can grow in solutions containing salt in concentrations as high as 22% (w/v); the rate of growth is substantially reduced when the water activity is less than 0.94 (10% salt solution), *(23, 35).* Staphylococci also withstand drying at room temperatures and are able to survive in dust.

McDade and Hall *(25, 26)* examined the effects of temperature and relative humidity (RH) on the survival of staphylococci on various surfaces. The organisms were observed for a period of 7 days on glass, tile (asphalt, ceramic, rubber), silk sutures, and polished stainless steel. These contaminated surfaces were held at temperatures between 39.2 F and 98.6 F and at various relative humidities. In general, die-off was progressive as the temperature increased and became more pronounced at 77 F, and die-off increased at humidities toward the midrange (53-59% RH), except at 39.2-42.8 F. Minimal die-off and even some growth occurred at 95 to 98% RH. The best survival was at 11 and 33% RH.

Food poisoning strains of S. *aureus* grow well in custard at temperatures ranging from 44-114 F. Slightly less active multiplication occurred in chicken à la king and in ham salad *(1).* S. *aureus* strains have also been reported to grow in chicken gravy at 50 F but not at 41 F *(16).*

The natural flora in chicken, turkey and beef pies, and in raw crab meat may inhibit the growth of S. *aureus.* At 68 and 99 F staphylococci multiply but are outnumbered by competitors. Among the genera or species that inhibit or outgrow S. *aureus* are *Streptococcus, Lactobacillus, Micrococcus aurantiacus, Achromobacter, Escherichia coli, Bacillus cereus, Enterobacter, Pseudomonas,* and *Serratia (10, 15, 31,* *33, 36).* The bacterial flora, staphylococcus population, substrate, previous processing operations, and temperature of incubation influence the outcome.

McCroan et al. *(24)* found only a few coagulase-positive staphylococci in commercially prepared, wrapped sandwiches. No significant increase in the number of these organisms was observed after a period of room temperature storage. In the laboratory, these investigators inoculated sandwiches with staphylococci, and increased levels of the organism were observed after 48 hr incubation at room temperature. Particularly high levels of growth were found when the inoculation was made between the ham and cheese as opposed to on the ham which was placed next to a mayonnaise spread.

Crisley et al. *(7)* and McKinley and Clarke *(27)* found that at room temperature synthetic cream fillings support growth of S. *aureus.* When only water was added to the filling, staphylococci did not increase in numbers, but they remained viable. At the interface between pie crust and cream filling, staphylococci grew profusely. When other nutrients were added, the fillings readily supported staphylococcal growth. In England, Hobbs and Smith *(19)* studied synthetic cream and found that fillings limited to cooking fat, emulsifying agents, sugar, and salt (without protein) did not support the growth of coagulase-positive staphylococci, *Salmonella paratyphi* B, or *E. coli.* These organisms tended to die out in a few days. Synthetic cream with butter or margarine (without milk, eggs, or sugar) supported the growth of *E. coli* and S. *paratyphi* B, although much better growth was observed after milk, eggs, or sugar were added.

Some strains of staphylococci produce enterotoxin, a substance capable of irritating the gastrointestinal tract. Enterotoxin, an exotoxin, is a protein formed at the surface of cells. Crude enterotoxin is thermostable and can be boiled for 30 min without destroying its ability to cause vomiting, but purified toxins have not shown as much heat resistance. At least four antigenically distinct types of enterotoxin are known. Their classification (A, B, C_1, C_2, D) is based on their reactions with specific antibodies *(5).* Type A causes most outbreaks of food poisoning. Type B is rarely involved in food poisoning but causes pseudomembranous enterocolitis. Types C and D have been defined only recently, and there is little information on their relative importance, although Type C has caused food poisoning on several occasions. Type A has been purified and described quite recently. Chu et al. *(8)* compare its properties to those of the previously purified Type B.

Epidemiology

A person who has eaten food contaminated with sufficient quantities of enterotoxin will usually manifest symptoms in 2 to 4 hr—although, in some instances, as little as 0.5 hr and as many as 7 hr may elapse. The incubation period depends on the amount of toxin consumed and the susceptibility of the host. Onset of illness is rapid. Salivation is followed by nausea, vomiting, retching, abdominal cramps and, frequently diarrhea. Prostration, cramps, headache, sweating, and dehydration accompany severe attacks; blood and mucus are sometimes seen in the stools and vomitus, and there may be shock (subnormal temperature and blood pressure). Reports on temperature are inconsistent, but subnormal temperatures are frequently noted. Dolman *(11)* gives a classic description of the intoxication.

The severity of staphylococcal intoxication has a good inverse correlation with the incubation period and a direct correlation with the dose. Duration of illness is usually 1-3 days. Mortality is low, but there are some fatal cases on record *(13, 28).*

Susceptibility to staphylococcal enterotoxin varies. Ingestion of as little as 0.5 ml of crude filtrate produced vomiting in human volunteers, but as much as 13 ml of the same filtrate produced no reaction in another volunteer *(9).* Several outbreaks are known in which all persons at risk became ill. In epidemics it is difficult to determine relative susceptibility because patients eat varying amounts of the contaminated food, and the distribution of toxin in the food may vary. Evaluation of incriminated foods usually discloses counts in excess of 500,000 staphylococci per g *(18).* Counts, however, are not necessarily reliable measures of the toxicity of a food, because inadequate chilling between serving and sampling can permit further multiplication. At room or at warm holding temperatures, organisms initially present may multiply to large populations, or competitive organisms may have multiplied and restricted the growth of staphylococci—even to the point where die-off occurred. Enterotoxin can maintain its potency in a time-temperature situation that will destroy staphylococci; thus, foods that have a history of being cooked or heat processed might have low or even negative staphylococcal counts but contain enterotoxin.

According to current epidemiological information, the main reservoir of S. *aureus* is man. The principal site of multiplication is the nose. Colonization of S. *aureus* in the nose begins in infancy, and within the first 7-10 days of life as many as 90% of newborn children become nasal carriers. This rate drops to about 20% during the first 2 years of life. At 4-6 years of age the rate approaches the adult rate of

30-50% *(39)*. Hospitalized adults have a higher rate ranging up to 60% *(30)*.

There are 3 kinds of nasal carriers; those that yield the same phage type of S. *aureus* at all examinations for months and years; those that rarely harbor the organism; and the intermittent carrier, who harbors the organism for a few weeks, becomes free of it, and once again becomes a carrier—but usually of a different phage type. Some people may harbor more than one phage type. Staphylococci are more common in the nasopharynx than in the pharynx; they are often found in the nasal accessory sinuses and are frequently associated with sinusitis. Surveys have shown that the throat is positive about 4-60% of the time *(39)*. Pathological conditions in the throat are often associated with coagulase-positive staphylococci *(4)*; the same organisms are abundant in post-nasal drips associated with colds.

The incidence of S. *aureus* on human skin is estimated to be between 5 and 40%. Kallander *(21)* found these organisms on the skin of 30% of food handlers. According to Williams *(38)*, the self-sterilizing capacity (as a result of the acid reaction, the action of sweat, and drying) imputed to human skin does not seem to inhibit the growth of staphylococci. Sweat was reported to be a good medium for growth of staphylococci *(37)*. Coagulase-positive staphylococci found on hands may be of two categories: those that are superficial transients being repeatedly replenished from the nose or other sites, and those that are resident flora and multiply in the depths of the skin. Sweating can bring the entrenched resident flora to the surface.

S. *aureus* is a usual constituent of human fecal flora. In one study, this organism appeared in the stools of 73% of children less than 1 year of age and in the stools of 18% of adults who were examined *(3)*.

Staphylococci are widely distributed in the air. Incidence of the organism is at its highest in bedrooms and Turkish baths, lowest in open air, and increases with activity *(13)*. One study *(12)* reported that 2 staphylococcus cells were found per ft^3 of still air in an empty room. The presence of a person in the room increased the count to 9 cells per ft^3. After some slight activity, on the part of the occupant, the count went to 129, and after vigorous activity, to 837. Dressing and undressing increased the number to 1,672. Roundtree and Barbour *(34)* observed that sweeping and dusting increased S. *aureus* counts in air. Dust particles from clothing appear to be as important in contaminating air as droplet nuclei produced by sneezing. Handerchiefs and clothing harbor staphylococci for at least a month *(13)*.

S. *aureus* is often found in suppurative wounds. It may attack any tissue in the body; it is a common cause of pyemia. S. *aureus* often causes secondary infections. Burns, particularly if extensive, are easily invaded by staphylococci. Pimples, carbuncles, boils, sores, and superficial lesions frequently harbor staphylococci. Animals may be asymtomatic carriers. S. *aureus* is a frequent cause of mastitis in cows and ewes and is a cause of abscesses in fowls.

S. *aureus* passes from person to person and so remains endemic. Staphylococci can multiply freely in the saline nasal secretions. Droplets from the nose charge the skin, the clothing, and the air. Touching the nose and handling disposable tissues and handerchiefs that have absorbed nasal secretions transfers staphylococci to hands. Hands contaminate food during preparation. The flapping or shaking of clothing liberates dust particles laden with organisms; these particles together with droplet nuclei from coughing and sneezing account for the presence of staphylococci in the air. Aerial transmission leads to colonization of the nose, and the cycle that maintains endemicity is completed *(13)*. The ability of staphylococci to withstand drying aids in maintenance of this cycle.

For a staphylococcal intoxication to occur, *(a)* there must be a reservoir for the enterotoxigenic strain of S. *aureus* (the nose or hands of food handlers); *(b)* a mode of dissemination of the organism (handling of food); *(c)* contamination of a food that is capable of supporting the growth of the organism (food must not be too acid and must be relatively free of competing organisms); *(d)* a temperature level for a length of time sufficient to permit adequate multiplication of the organism and toxin production; and *(e)* consumption of a sufficient amount of enterotoxin by a susceptible person. Successful control measures must eliminate one or more of these factors. At present, little can be done about the first and last factors, and only limited control can be imposed on the second and third factors. The most practical control measures prevent growth of staphylococci by adequate chilling or hot holding of foods.

Any foods that are touched by hands are subject to contamination by infected persons. Foods most likely to be involved in staphylococcal intoxications are cooked products contaminated by handling and allowed to remain at room or inadequate refrigeration temperatures for periods of 8 hr or longer, usually overnight.

Hodge *(17)* reported that 99% of the staphylococcal outbreaks that he surveyed were caused by cooked, high protein foods. In such foods, staphylococci grow without check from their normal competition and may build up to extremely high numbers. Leftover foods were responsible for 94% of the outbreaks, and foods containing a mixture of two or more ingredients were responsible for 67% of staphylococcal outbreaks. High levels of salt and sugar in foods inhibit many organisms, but not staphylococci. In the United States, foods incriminated in outbreaks of staphylococcal intoxication include ham and other meat products, poultry and poultry dressing, sauces and gravies, potato salad, custard-filled pastries, bread pudding, hollandaise sauce, cheese, and milk.

Most of the staphylococcal outbreaks reported in England and Wales are associated with processed meat handled after cooking *(32)*. Pressed jellied meat, frequently involved in outbreaks, is often cooked and then trimmed by hand while still warm, placed in a large mold with gravy or gelatin, and allowed to stand at room temperature for hours. Meat pies are often contaminated, after baking, during the addition of gelatin. Tongues are skinned by hand after boiling and often not reheated. Cooked meats such as ham and tongue are often contaminated during slicing or during the preparation of sandwiches. Jay *(20)* isolated coagulase-positive staphylococci from approximately 39% of market meat samples and in all of 11 chicken samples.

Canned foods have been associated with outbreaks reported in England and Wales. Most of these cans have become contaminated after they were opened, but sometimes the contamination entered through minute defects in the seam when the cans were handled while still wet after cooling or during labeling.

Detection of Staphylococci and Their Toxin

Plating is generally used to determine the total number of staphylococci per g of foods. Tellurite, tellurite-polymyxin B, and staphylococcus 110 agars are frequently used to plate homogenates of foods and their dilutions *(6)*. Egg yolk is often added to each of these media because there is an excellent correlation between egg yolk reaction (a zone of opacity around each colony caused by a lipase) and production of coagulase. When small numbers of staphylococci are expected in foods, as when monitoring for quality control or detecting staphylococci in the environment of a food establishment, enrichment is useful. Cooked meat broth containing 10% sodium chloride is usually used. When using this procedure, the most probable number of organisms can be calculated.

There is no precise or practicable method of differentiating strains of S. *aureus* serologically, so bacteriophage typing is used. Because of the ubiquity of S. *aureus*, the finding of coagulase-positive staphylococci in food, and isolating them from the nares or on the skin of food handlers does not fix either source as the cause of an outbreak, even if these organisms are found in vomitus or stools of the victim. Phage types of strains from all 3 sources (carrier, food, and patient) must correlate to prove an association between carrier and an outbreak. In phage typing, a basic set of 21 phages is used. These phages are divided into 4 groups and 2 miscellaneous phages *(2)*. The organism being tested is often lysed by more than 1 phage from the same group and occasionally by phages from another group; thus, a phage pattern results. Most enteropathogenic strains are lysed by group III phages, although phages in groups II and IV also occasionally lyse enterotoxinogenic strains.

The essential requirement to incriminate a food is demonstration of enterotoxin in the food. The presence of enterotoxin in foods can be detected through the reactions of human volunteers who ingest the suspected food, by animal assays, and by serological precipitations. In human and animal testing the organism is grown in pure broth culture; the broth filtered to remove cells; and other toxins are deactivated by formaldehyde treatment, by boiling for 15-30 minutes, or with hemolysin antisera. Treated filtrates may then be injected into the veins of test animals (cats or monkeys) and the animals observed for emesis. Monkeys may be given 50 g of crude, treated filtrate through a stomach tube. Humans, cats, and monkeys can also be fed the suspected foods. Enterotoxigenic strains of staphylococci will cause vomiting. The expense and other difficulties associated with human volunteer and animal assays has led to the development of a laboratory method for detecting enterotoxin. Antiserum is made from purified enterotoxins, and a gel-diffusion procedure is used to detect the toxin.

In the single gel-diffusion test, a food extract is layered over an agar column containing antitoxin, and the enterotoxin diffuses through the agar and forms a band of precipitate. The band moves down the agar column at a rate corresponding to the concentration of the enterotoxin and the concentration of the antitoxin. The double gel-diffusion tube test has a neutral zone of agar between the enterotoxin and the antitoxin. As the 2 reagents diffuse through the neutral zone, they form a band of precipitate where the 2 substances meet in optimum proportion. Another method of performing the double gel-diffusion test uses a petri dish containing agar or a microscopic slide covered with a thin film of agar. Antitoxin is put in a central well in the agar and suspect toxin is added to peripheral wells. Both reagents diffuse through the agar and form lines of precipitation where they combine in optimal proportion.

Control

The principles of preventing staphylococcal intoxication are: limitation of contamination, inhibition of growth, and destruction of organisms.

Limitation of contamination

For practical purposes, the main reservoir of staphylococci is man, and there is no practical way to remove S. *aureus* from its widespread and usually benign association with man. So, it is extremely difficult to prevent contamination of foods with staphylococci. Both nasal and skin reservoirs of S. *aureus* can be temporarily eliminated by topical application of antibiotics to the anterior nares; however, organisms of the original phage type often reappear in a few weeks after treatment is stopped. Antibiotic resistant strains may also develop as a result of such treatment.

Washing and desquamation of outer layers of skin are the main ways of removing staphylococci, but washing does not necessarily free hands from staphylococci. Soaps, in dilutions comparable to their concentration in lather, show little, if any, bactericidal action on S. *aureus (29)*. Their action, primarily, depends on mechanical removal of microorganisms from the washed surface by emulsification of the lipids on the skin. It is doubtful that germicidal soaps contact organisms long enough to have much effect *(13)*.

Contamination can be minimized by strict practices of personal hygiene and sanitary food preparation. Persons who have open lesions, recurrent boils, or sinus infections should not prepare foods. Hands, even when washed, should be deemed contaminated and should not be allowed to touch foods which are served without being cooked subsequently. Utensils that prevent hand contact with foods should be used wherever possible.

Day-by-day supervision of food operations is the key to preventing staphylococcal intoxication. The public health sanitarian, however, cannot provide this daily supervision; it is the responsibility of food service or food processing managers. These supervisors must know, and accept, the principles of sanitation before they will advocate and demand safe food preparation techniques, and storage practices. Food workers at all levels must be trained, but before managers can train or supervise others to follow basic procedures of sanitation, they must thoroughly understand these procedures. It is axiomatic in industrial training that the training of managers should always precede the training of workers. Sanitarians should employ all means at their disposal (consultation, training courses, and seminars) to train food establishment managers.

Inhibition of growth

Contemporary practices of personal hygiene and environmental sanitation do not insure that the ubiquitous S. *aureus* will be kept out of foods. Therefore, foods must be treated as if they are contaminated, and precautions must be taken to keep pathogens from multiplying. Potentially hazardous foods, if stored for only a short time (3 days or less), should be kept at temperatures of 45 F or below; if stored for longer periods of time, lower temperatures should be used.

Storage temperature, considered alone, can be misleading. The rate of cooling a food (and hence the interval during which the food remains at temperatures suitable for the growth of staphylococci) is influenced by the characteristics of the food container. The larger the container—and consequently the greater the volume of its contents—the farther heat must travel from the center of the food to the wall where it is taken up by the cooling medium. The internal temperature of food cooled in shallow pans falls faster than that of foods cooled in large, deep containers. Cooling rate is also affected by the material of which the container is made. Good conductors of heat, such as stainless steel, cool faster than crockery, glass, or plastic. Movement of air around containers takes heat away faster than still air. Free air circulation around foods and forced air circulation speeds cooling.

Prompt cooling of leftover foods is essential for preventing staphylococcal outbreaks. Hodge *(17)* reported that during a 2-year period 79 of 83 staphylococcal outbreaks were attributed to foods that were inadequately cooled. Foods should never be permitted to cool to room temperature before being put in a refrigerator; they should be refrigerated while they are still hot (140 F). Techniques of rapid cooling, such as putting containers in freezer compartments, packing them in ice, immersing them in running water, or mechanical stirring of contents are of particular importance in insuring against staphylococcal growth.

The rate at which foods cool is influenced by their composition, state, geometry, bulk, and viscosity. Solid foods cool by conduction, which is slow cooling. Liquid foods cool by convection; convection currents are sluggish in highly viscous foods. Sandwiches, potato salad, stuffing, bread pudding, custards, croquettes, and meat loaf—all of which are potentially hazardous foods—cool slowly.

Processing should be carried out during the bacterial lag period (the period before rapid geometric growth); thus, foods should not be held between 45-145 F for more than 3 cumulative hr, including chilling time.

In reviewing the effect of foods as substrates for staphylococci, Longree *(22)* concluded that all foods containing much protein are potentially hazardous unless the pH of the mixture is less than 4.5. In most dishes this pH value is hard to attain, requiring a relatively large proportion of acid ingredients, and that the ingredients be finely divided to allow penetration of acid.

Destruction of the organism

The effectiveness of thermal processing in controlling staphylococcal intoxications depends on when the process is applied and how the food is held after the process has been applied, as well as time and temperature employed. Heat must be applied to destroy contaminating organisms before they have an opportunity to produce enterotoxin. A temperature of 165 F is lethal to staphylococci, but enterotoxin remaining in food is not destroyed by conventional methods of cooking or heat processing of foods. In custard and chicken à la king, more than 10 million cells of food poisoning strains of S. *aureus* were reduced to nondetectable levels at temperatures of 140 F in 53 min and at 150 F in 6 min *(1)*.

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REPORT ON THE INTERSTATE MILK SHIPPERS CONFERENCE[1]

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Since 1950, when representatives of industry, state departments of health, and state departments of agriculture from 26 states attended the first meeting of the National Conference on Interstate Milk Shipments, this Conference has grown in stature and in attendance with representatives from all 48 contiguous states. The program has grown and is now of considerable significance both to health authorities and to the dairy industry. Therefore, it is appropriate and important at this time to review the objectives and purposes of the National Conference, the accomplishments, and more specifically, the Eleventh National Conference and some of its implications.

DEVELOPMENT OF CONFERENCE

The National Conference on Interstate Milk Shipments was a natural outgrowth of circumstances and necessity. The sanitary quality of milk shipped interstate as well as intrastate varied considerably and was of concern to health authorities in many areas. Efforts had been made to reconcile differences between areas, but lack of a uniform approach to the problem made it difficult to accomplish much on a nationwide basis. This lack of a uniform approach resulted in the creation and continuance of a confusing situation. Consequently, officials in receiving areas insisted on making inspections of milk plants and dairy farms in the producing areas. This system of supervision created a multiplicity of inspections and the application of a wide variety of requirements, which in turn led to more confusion and misunderstanding. Industrialization and urbanization during and following World War II and advances in dairy science and technology further complicated the already existing problems. It became obvious, therefore, that a proper solution to the problem was necessary to afford an acceptable quality of milk for all, to permit greater utilization of milk supplies available throughout the country, and to increase materially the incentive for greater production of high-quality milk. The more economical administration of interstate shipments of milk would reduce the actual cost of supervision and the complexity of maintaining satisfactory supervision of interstate milk supplies; this would give the confidence necessary to provide a good working agreement between States.

Recognizing these conditions and the need for a proper solution, several organizations requested the U. S. Public Health Service to devise a plan that would facilitate the certification of interstate milk supplies, and to assist the States in developing working agreements to implement such a plan. As a result, the first meeting of the National Conference on Interstate Milk Shipments was held in 1950. From this Conference came the voluntary State-Public Health Service program for the certification of interstate milk shipments. Although technological advances and new knowledge in the area of milk control have necessitated some changes, the fundamentals of the agreements developed by this Conference remain basically the same.

OBJECTIVES OF CONFERENCE

The principal objectives of the Conference can be summarized as follows: (*a*) the use of uniform ordinances, regulations, or standards that will permit and assure a free flow of high quality milk between states; (*b*) elimination of interstate barriers, intentional or unintentional, through cooperation, better understanding, and effective supervision; (*c*) to provide industry and regulatory personnel with information that will lead to mutual understanding and respect for each other's problems; and (*d*) to provide states and municipalities with reliable information concern-

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[1]Presented at the 54th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., Miami Beach, Florida, August 14-17, 1967.

ing the sanitary status of outside sources.

The plan to accomplish these objectives embodies the following basic principles:

(*a*) The program is entirely voluntary. Milk plants and state and local agencies may participate.

(*b*) *The Milk Ordinance and Code—1965 Recommendations of the U. S. Public Health Service* is used as the common criterion for evaluation of interstate milk shippers' supplies.

(*c*) To be eligible for certification, a shipper's supply must be under routine supervision and laboratory control by an official agency.

(*d*) The Public Health Service must evaluate and endorse the rating and laboratory procedures of participating states.

(*e*) Sanitation compliance ratings of each shipper's supply must be made at least once every 2 years by the state in which the milk source is located. Evaluation of the raw milk supply, receiving stations, processing plants, and local enforcement agency must be included in such rating.

(*f*) Ratings made by participating states are certified to the Public Health Service, which publishes a list of these ratings quarterly; a shipper's rating, however, is not published without his written permission. This list is given wide distribution.

(*g*) Ratings submitted by the participating states are subject to periodic check ratings.

A Planning Conference

The National Conference on Interstate Milk Shipments is a *planning conference*. Through group discussion and constructive *joint planning*, the participants strive to reach basic conclusions or agreements that are used as guidelines in the organization and administration of state programs so that these programs will be in agreement. Therefore, the purpose of the Conference is to work out a plan that is right in content and practical and fair in administration so that the quality of trustworthiness is instilled in the supervision of interstate milk shipments.

The Conference consists of representatives of state milk control agencies—those agencies responsible for the enforcement of state milk sanitation requirements and the certification of milk supplies. A Board of Directors administers the functions of the Conference and appoints the chairman for each Conference, which convenes every 2 years. Prior to a Conference, the participants are asked to submit problems concerned with the agreements of the Conference and the movement of milk from one State to another. Task forces, consisting of a chairman, co-chairman, secretary, and consultants, are assigned various problems submitted. Each problem is considered by the task forces in open sessions and after sufficient deliberation, recommendations are made for conference action. Through this system of task forces, the problems and proposed solutions are brought before the Conference in a general session on the final day of the Conference for consideration and modification, rejection, or acceptance by the voting delegates (the state representatives). It is at this point, and this point only, in the Conference proceedings that the decisions are made and the official delegates determine the changes to be made in the agreements that govern this voluntary cooperative program for the movement of interstate milk supplies.

A development in task force deliberations that has caused concern will now be mentioned. One of the purposes of the task forces is to provide the voting delegates of the Conference with a consensus of all groups participating in the Conference. Recent Conferences have shown a growing tendency for task force recommendations to reflect only the opinions or attitudes of perhaps one group. It is hoped that this situation can be corrected at the next Conference; in fact, it must be corrected so that the task forces can carry out their functions as intended. Their findings and recommendations should reflect the attitudes of all those participating at the Conference.

Activities of Eleventh Conference

Thus far the development and philosophy of the Conference has been described. The activities of the Eleventh National Conference on Interstate Milk Shipments, which was held this past April in Miami will now be reviewed. A variety of problems was considered at this Conference ranging from simple editorial changes intended to clarify sections of the agreements to more complex subjects such as the scope of the agreements and control of abnormal milk.

Single-service containers

One of the more important actions was the acceptance of the report of the committee on standards for single-service containers and enclosures. This committee had developed the guidelines for the sanitation standards for the fabrication of single-service containers and closures for milk and milk products. These standards have been published by the U. S. Public Health Service and are now being used in the certification of plants that fabricate single-service containers. In addition, the Conference established an effective date of January 1, 1969, for the inclusion of a list of certified single-service and closure manufacturing plants as an addendum to the quarterly publication, "Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers." The Conference also requested that the U. S. Public Health Service train and certify Public Health Service representatives and those of state milk control agencies to inspect these plants. Although information can and is being provided to interested parties at the present time on the acceptability of single-service containers, the publishing of a list of certified plants will provide state and local sanitarians with reliable information on which they can base their acceptance of these containers.

Abnormal milk

The report of the committee on abnormal milk probably received more attention and resulted in more discussion than any of the problems considered. The Conference came up with a 3-phase program for the control of 1 type of abnormal milk. The limited "1 type" is used because the term "abnormal milk" is all inclusive and includes any abnormality such as pesticide contamination, radioactive contamination, and mastitis. The specific action taken by the Conference takes into consideration *only* mastitis.

The details of this program are too numerous to discuss here. Essentially, phase 1 of the program requires that effective July 1, 1967, 4 laboratory examinations or screenings for the detection of leucocytes shall be made during each 6 mo period of all raw milk before pasteurization. Phase 2 sets a limit of 1,500,000 leucocytes per ml and outlines procedures to be followed when this limit is exceeded. It also provides that after July 1, 1968, only those interstate milk shippers that have been certified as following an adequate program shall be listed in the "Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers." Phase 3 includes a penalty for noncompliance with the prescribed leucocyte standards and the method by which the penalty is invoked. This phase is to become effective July 1, 1970.

This abnormal-milk program will have a definite impact on state and local milk control programs. Several areas have this program in operation, but in many areas the program will be new. Training of personnel will be necessary, and budgets will need to be adjusted. Therefore, it is necessary that all areas start now to implement a mastitis-control program.

Other products

In view of the success of the interstate milk shippers program, it has been the thinking over the years that this program could be made applicable to other products not covered by the pasteurized milk ordinance. This has become a vigorously debated issue concerned basically with dry milk and frozen desserts. No action was taken by the Eleventh Conference to bring these products into the program inasmuch as the Public Health Service Grade A Condensed and Dry Milk Ordinance had not been published and the Frozen Desserts Ordinance had not been revised. The Conference *did* request the Public Health Service to publish the Dry Milk Ordinance.

A task force recommendation that the Frozen Desserts Ordinance and Code of the Public Health Service should not be revised but that a study should be made to determine the feasibility of adopting the U. S. Department of Agriculture's proposed regulations was rejected by the voting delegates.

The Conference also recommended that a committee be appointed to study whether the structure and organization should be changed, and if so, how, if products now covered by the Pasteurized Milk Ordinance are to be included.

Other actions

Other actions by the Conference included (*a*) tabling of recommendations that *Salmonella* testing and pesticide testing be prerequisites to listing in the "Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers"; (*b*) endorsement of the tolerances of DDT in milk recommended to the Food and Drug Administration by the California Departments of Health and Agriculture; (*c*) tabling of a recommendation for the certification of fluid Grade A sterile milk and milk products on the basis of the Pasteurized Milk Ordinance; (*d*) a recommendation that the ratings of shippers appearing in the "Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers" be listed to the nearest whole number (this will be done); and (*e*) resolving of questions involving administrative procedures of the interstate milk shippers program most of which have already been implemented by the Public Health Service.

ACCOMPLISHMENTS OF CONFERENCE

To date, the accomplishments and successes of the National Conference on Interstate Milk Shipments have, for the most part, resulted from the willingness of representatives of receiving and shipping states to sit down together and cooperatively work out solutions to their problems, and, then, upon returning home, to conscientiously put the agreements into effect. Thus, a feeling of confidence in the work of others has developed that has, for the most part, replaced the feeling of distrust that once prevailed.

Since implementation of the interstate milk shipper program there has been continuous growth in this unique Federal-State operation. During its 16 years, the program has gained in prestige and national stature, which has facilitated its utilization and acceptance. The first publication of the "Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers" listed only 160 shippers located in 17 states. Today, the current list of certified interstate milk shippers includes the names and milk sanitation ratings of over 1,600 shippers located in the 48 contiguous states and the District of Columbia and representing approximately 175,000 dairy farms. Various federal agencies use this quarterly rating list. The Veteran's Administration uses the list when purchasing milk and milk products for the 166 veterans' hospitals throughout the country. Milk from sources approved under this program is served aboard interstate carriers. Public Health Service hospitals, Indian Health Service hospitals, and schools purchasing milk and milk products under Federal specifications now utilize the program. The Department of Defense drafted into their joint regulations, recently, specifications for the purchase of fresh whole milk that include the requirements of the interstate milk shippers program.

The Interstate milk shippers program has amply proved itself. Today it fulfills a useful purpose in improving milk quality and in providing milk control authorities with reliable information as to the sanitary status of fluid milk and milk products offered for sale in interstate commerce. Because the program is voluntary, it has not yet completely reached its objective—the elimination of health regulations as trade barriers. It has, however, reduced multiple inspections and facilitated the movement, both intrastate and interstate, of high-quality milk supplies.

AMENDMENT TO 3-A SANITARY STANDARDS FOR MILK AND MILK PRODUCTS FILTERS USING DISPOSABLE FILTER MEDIA

Serial #1002

Formulated by
International Association of Milk, Food and Environmental Sanitarians
United States Public Health Service
The Dairy Industry Committee

The "3-A Sanitary Standards for Milk and Milk Products Filters Using Disposable Filter Media," dated June 5, 1950, Serial #1000, are hereby further amended by adding the following to subparagraph 1. of Section A. Material:

In addition to filters made with metal parts, in-line filters which are intended to use disposable filtering media in a disk form whose diameter does not exceed six inches, may be made with a clear plastic body, a plastic filter disk support and connections or the filter disk support and/or one or both connections may be made of rubber or rubber like materials.

Plastic materials, when used, shall conform to the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Plastic Materials Used as Product Contact Surfaces for Dairy Equipment, Serial #2000," as amended.

Rubber and rubber-like materials when used shall conform to the applicable provisions of the "3-A Sanitary Standards for Multiple-Use Rubber and Rubber-Like Materials Used as Product Contact Surfaces in Dairy Equipment, Serial #1800."

This supplement shall become effective July 7, 1968.

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NMC ELECTS NEW OFFICERS

At its 1968 Annual Meeting at Chicago on February 14-16 the National Mastitis Council, at which a record crowd of approximately 400 attended, elected its new officers and directors for the coming year. Following are the new officers: President, C. J. Haller, Avon, N. Y.; Vice President, J. B. Smathers, Arlington, Va.; Secretary-Treasurer, J. C. Flake, Washington, D. C.

A board of some 48 directors was elected with terms expiring at varying intervals. The directors represent a broad geographical cross section of the country with no domination of any one segment of the dairy industry. A. E. Parker of Portland, Oregon, has been designated the IAMFES representative on the Board. From the directors the following were appointed to the Executive Committee: C. J. Haller, J. B. Smathers, J. C. Flake, H. G. Hodges, E. B. Kellogg, E. E. Kihlstrum, W. D. Knox, E. M. Norton, D. H. Race, G. T. Coulter, G. H. Meuwissen, R. M. Parry, P. W. Scherschel, D. E. Jasper, and John F. Tufts.

An interesting two-day program was arranged with several featured speakers. Dr. C. O. Claesson, Agricultural College of Sweden, discussed experiences in Sweden on vacuum fluctation in milking machines and its effect on udder health. Several of his statements led to controversy and discussions throughout the meeting.

Roy Olson of the Spokane Health Department reviewed the very comprehensive program on mastitis control undertaken in that community. Similar experiences in Vermont, New York and in the Southwest were fully discussed. Various committee reports covered studies and surveys operating under Council direction.

A new feature on the program was the provision for informal evening discussion periods devoted to specific areas of milking machine operation and on screening tests. All daytime and evening sessions were fully attended.

This year the proceedings of the annual meeting were not distributed in advance but will be mailed to all registrants when the job of assembly and printing is completed. Copies will be available from the National Mastitis Council office, 910 17th St. NW, Washington, DC. 20006 at $4.00 per copy for members and $5.00 for nonmembers.

The 1969 meeting of the Council will be held in Chicago on January 27-29.

ONTARIO ASSOCIATION HONORS CLAIR MERKLEY

J. L. Baker, (center) Ontario Dairy Commissioner, congratulates Clair Merkley, Ottawa, on winning the Sanitarian of the Year Award of the Ontario Milk Sanitarians' Association as Maria Battaglini, Ontario Dairy Princess, presents the Shield.

At its 10th Annual Meeting on January 31, 1968, the Ontario Milk Sanitarians awarded the Sanitarian of the Year honor to Clair Merkley, a long time member. The presentation was made by the Honorable J. L. Baker, Dairy Commissioner for the Province of Ontario.

The Citation read by Commissioner Baker was as follows:

"Our Association is very pleased to honor as Sanitarian of the Year a native of Eastern Ontario, Williamsburg to be exact, and a person who has done a great deal in that area, not only in improving milk supplies, but on behalf of his fellow workers in this profession. The recipient of this year's award grew up in a home where milk and ice cream was a way of life since his father was closely identified with these branches of dairying. He then attended the Ontario Agricultural College graduating in the Dairy Option in 1947. He served on the staff of the Department of Dairy Science at O.A.C. for a short time but later returned to the Ottawa area where his special talents as a sanitarian quickly developed. As supervisor of the laboratory and fieldman for Clark Dairy Ltd. of Ottawa he helped to develop or adopt for general use a number of improved methods which have now become widely used. Among these might be mentioned the preliminary incubation modification of the resazurin test, laboratory pasteurization of individual producer samples, single service containers for collection samples from bulk tank routes, as well as other innovations. He was frequently called on to co-operate with Dr. C. K. Johns and his colleagues of the Canada Department of Agriculture in their studies and research project relating to quality milk production and control.

The person we honor today has given a great deal of his time to foster the development of the Eastern Ontario Association of Milk Sanitarians serving in various offices but particularly as its secretary for a number of years until this past autumn.

Our award winner has recently taken on duties of a world wide character having been appointed to a position promoting trade in dairy and poultry products for the Canada Department of Trade and Commerce. While we wish him well in this field, we hope and expect that he will continue to maintain his interest in sanitarians' affairs.

It is a special pleasure for me to present Mr. Clair Merkley of Ottawa to receive the 1968 Sanitarian of the Year Award."

Members of the Association enjoyed an interesting meeting. Featured were discussions dealing with bulk transportation of milk. A provincial study and survey of tank trucks in 1967 was reviewed. The 3-A Standards applicable to bulk tanks were covered by a member of the international standards group. A representative of an operators' organization outlined the viewpoints of the milk transporters. The session concluded with a question and answer period.

A QUOTABLE QUOTE

The February 1968 issue of the Michigan Association of Sanitarian's Newsletter opens with a message from President Edward P. O'Rourke a portion at least of which is worthy of quoting:

"Legally we are now professionals. However, we will be truly recognized as professionals only when the public accepts us as professionals. The public's attitudes, and for that matter their actual acceptance of us as professionals, cannot be forced by legislation. The environmental health sanitarian alone holds the key to becoming a professional in the eyes of the public. It will take time but it will be done when all environmental health sanitarians act and perform their duties in a manner which will command the respect, confidence, admiration, and appreciation of the public we serve."

'Nuff said.

L. to R. Eugene Catron, Pres.; Ed Napier immediate Past Pres., J. Robert Miller, Kentucky Commissioner of Agriculture, C. Bronson Lane, Pres.-Elect, U. of Kentucky, H. L. Thomasson, Exec.-Sec'y., Mg.-Ed. IAMFES, Inc.; Leon Townsend, Sec'y.-Treas.

1968 KENTUCKY FIELDMEN AND SANITARIANS CONFERENCE

More than 180 representatives of the dairy industry in Kentucky attended the 1968 Kentucky Fieldmen and Sanitarians Conference at Mammoth Cave on February 27 and 28. The Conference was sponsored jointly by the Department of Animal Science of the University of Kentucky, the Kentucky Association of Milk, Food and Environmental Sanitarians and the Dairy Products Association of Kentucky.

An excellent program offered a wide selection of topics for discussion including Efficient Forage Production and Utilization, Current Nutrition Concepts,

Frank Osborne, left, receives Outstanding Dairy Industry Representative award from Leon Townsend, Sec'y.-Treas. KAMFES.

Jim Walston, right receives, "Outstanding Fieldman" award from Lyman Kneirem.

The Potentials of Freeze Drying, Food and Feed Tolerance Levels for Pesticides, Control of Mastitic Reinfections within the Herd and Practical Problems Facing the Manufacuring Milk Industry. A number of out-of-state speakers took part in the program in addition to members of the teaching and research staff of the University as well as representatives of state regulatory organizations.

The featured speaker at the Awards Luncheon was the Honorable J. Robert Miller, Kentucky Commissioner of Agriculture. The award for outstanding fieldman for 1968 went to Jim Walston of the Ryan Milk Company of Murray, Kentucky. Frank Osborne of Kyana Milk Producers, Inc. of Louisville received the outstanding dairy industry man award. Dr. C.

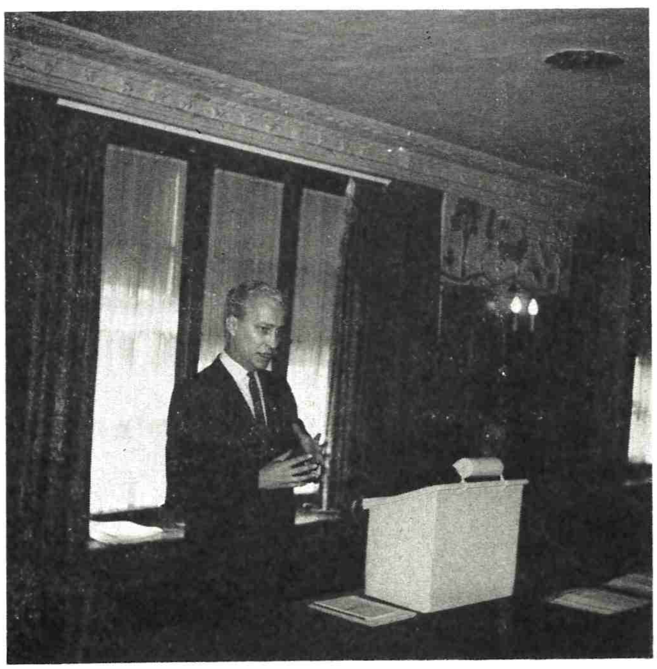
Bronson Lane, Assistant Extension Professor of Dairy Technology at the University, was chairman for the event.

At its annual business meeting the Kentucky Association of Milk, Food and Environmental Sanitarians elected the following officers for 1968: Eugene Catron, President; C. Bronson Lane, President-Elect; Jim McDowell, Vice-President and Leon Townsend, Secretary-Treasurer.

VIRGINIA ASSOCIATION OF SANTARIANS AND DAIRY FIELDMEN

This is the name of a new organization born March 7, 1968 at the Patrick Henry Hotel, Roanoke, Virginia. The birth was consumated by the union of the Virginia Association of Sanitarians, one of the oldest of IAMFES affiliates, and the Dairy Fieldmen's Association of Virginia. There is every reason to believe the new organization will be a strong healthy one. The attendance was excellent, enthusiasm and uninimity with which the merger was accomplished augurs well for the future.

An outstanding program was presented, highlighted by talks by Mrs. Joyce Short, Editor of "Plentiful Foods", Consumer and Marketing Service, United States Department of Agriculture, and David E. Hartley, Public Health Council, National Automatic Merchandising Association, Chicago, Illinois.



David E. Hartley, Public Health Council, National Automatic Merchandising Association, Chicago, Illinois.

Left to Right—James B. Smathers, Past-President, Virginia Association of Sanitarians, Md.-Va. Milk Producers Assn., Arlington, Va; and Glen D. Shelor, Past-President, Virginia Dairy Fieldmen's Association, Old Dominion Milk Producers Association, Roanoke, Va.

Left to Right—H. L. Thomasson, Exec.-Sec'y. IAMFES; M. K. Cook, Chairman of Va. Affiliate Section of IAMFES; William H. Gill, Secretary-Treasurer of Va. Association of Sanitarians and Dairy Fieldmen-Richmond Health Department, Richmond, Va.; A. C. Holliday, President, Virginia Department of Agriculture and Commerce, Richmond, Va.; Oren Collier, 1st Vice-President, Old Dominion Milk Producers Association Powhatan, Va. and Francis S. Shockey, 2nd Vice-President, Sealtest Foods, Christiansburg, Va.

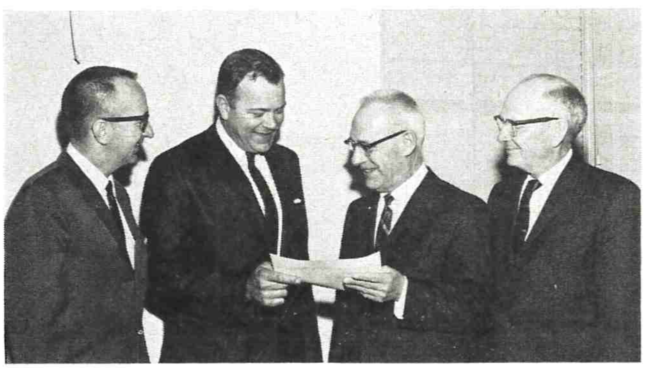
DAVID LEVOWITZ

Dr. David Levowitz, President of New Jersey Dairy Labs, died at the age of 59 on December 20th, 1967. He was an active member of IAMFES for many years.

Levowitz, who was born in New York City in 1908, received a B.S. from City College in 1927 and an M.S. from Rutgers in 1929, prior to earning a Ph.D. in 1936 from Rutgers. He worked as an Assistant in the Dairy Department at Rutgers Experiment Station in 1929 and as a Dairy Products Analyst for the N. J. Department of Agriculture in 1931. He later joined the New Jersey Dairy Laboratories in 1936 as Director and has been President since 1954. He has done extensive work in the areas of sanitation, cream separation and as a consultant to the War Production Board during WW II and the U.S.P.H.S.

Dr. Levowitz is well known for his development of the Levowitz-Weber modification of the Newman-Lampert stain solution which is now used exclusively in milk microscopic work.

DAIRY AWARD RECIPIENT



John M. Schlegel, Indianapolis, second from right, receives Indiana Dairy Industry's Distinguished Service Award certificate from Arnold Tonne, Ft. Wayne, president of Tri State Dairy Tech Club, at Joint Dairy Technology meeting at Purdue University. Witnessing presentation are Jerry Raab, left, Indianapolis, president of the Indianapolis Dairy Tech Club, and Wesley Ketcham, North Liberty, president of the South Bend Michiana Dairy Tech Club. Schlegel is chief of the production section, Division of Dairy Products, Indiana State Board of Health.

ANNUAL REPORT—JULY 1, 1966-JUNE 30, 1967

H. L. Thomasson, *Executive Secretary and Managing Editor*

This report will be unusually brief because much of the information has already been presented and most of the time at the business meeting is needed for the discussion of the proposed merger with NAS.

All the routine duties and attendance at meetings have been reported in detail in past years so it seems unnecessary to repeat these at this time. A short analysis of the results of our dues increase is important. Our direct membership showed a slight increase this year and our subscriptions to the Journal also showed a small gain. Our subscription rates were increased in line with our dues raise. Membership through our affiliates however showed a disappointing 30% drop.

It is difficult to account for this in view of the increase in direct membership and subscriptions. I believe one of the reasons for this is the failure of some affiliate secretaries to send out dues notices or, if sent, to only send one notice. Secretaries who normally do a good job in sending notices and collecting dues had very small losses, which were off set to some extent by obtaining new members. We send out three notices on direct members and subscriptions. We had only sixty dropped members and many of these were due to retirements and deaths. This was off set by over 70 new members.

In spite of this membership situation our financial situation shows a big improvement as we have come from a \$3625.15 deficit last year to \$2369.08 in the black. This is an improvement of \$5994.23. In view of our sound financial picture and the fact that considerable numbers of dropped members are being re-instated, I am optomistic about the future and sincerely feel that we have remaining a loyal group of members who are truly interested in the Association.

I believe our Journal has greatly improved in the area of material of interest to all our members. Of course we can always do better and this we will continue to strive to do.

Our Foodborne Disease booklet has been revised and over 5000 copies of this edition has been sold, making a total of over 35,000 copies for the first and second edition. I am still unable to understand why every sanitarian has not obtained a copy for his personal use.

The 3-A Sanitary Standards program continues to grow and the most noticeable expansion is the use of the standards in food equipment. Over 2000 revised HTST standards have been sold and it is being used as a guide in the pasteurization of eggs in many instances. The work of our Farm Methods Committee continues to be outstanding and I am hopeful some of our other committees that have been working on projects will have some new developments soon.

My own personal feelings with respect to a merger with NAS is that there would be many advantages if it can be accomplished properly. In any event it seems to be important to decide one way or another. I feel strongly that the work and accomplishments of IAMFES in the milk and food field should be maintained. If the membership decides to consumate the merger I will do my best to see that this is done. If the membership decides against the plan then I believe we should devote all our energies in the milk and food area with extra effort applied to expanding our food program. In any event I am always happy to help you and work for your interest in any way I can.

REPORT OF THE COMMITTEE ON EDUCATION AND PROFESSIONAL DEVELOPMENT—1967

J. R. Patillo, *Chairman*

The principle activities of the Committee are as noted below:

Projecting Sanitarian's Image—Since the sanitarian profession is still not well understood by the public, this Committee desires to continue using mass media to acquaint establishment operators and other citizens with the work of the sanitarian. "Institutions" Magazine, Chicago, Illinois, was contacted and the managing editor, Mrs. Wallace, anticipates doing two stories on the sanitarian. One would describe an inspectional tour of a food establishment with a sanitarian and the other would give a profile of the sanitarian profession.

The executive producer of "Monitor", the weekend radio network program, was personally contacted, but unfortunately he did not indicate an interest in taping an interview with an officer in our Association.

Plans were worked out for aiding the Florida Association in obtaining radio, television and newspaper coverage of the IAMFES annual meeting.

Exchange Of Newsletters—Last year the committee urged affiliates to exchange their newsletters. Some immediately heeded this plea but others are not yet participating in this sharing program and therefore are not realizing the full potential of their bulletins. Another plea for this exchange was sent again this year to these associations. Affiliates were also urged to send copies to "Red" Thomasson, managing editor of the Journal of Milk and Food Technology.

Enlargement Of Committee—Because of travel fund reductions in several states, it seems unlikely that the entire committee will ever be able to meet. To cope with this problem, the committee is now being enlarged and will be divided into subcommittees. Members of each subcommittee will be in the same geographical region and should be able to meet personally from time to time to work on assigned projects. This plan will overcome most current objections of employers to expensive travel and time loss.

Solicitation Of Journal Papers—Each year a number of good papers are presented at annual meetings of affiliates, or at other meetings which our members attend, but few of these papers are ever published. A letter from this committee to affiliates urged them to submit these papers to the Journal of Milk and Food Technology for review and possible publication.

Public Requests—Most of the requests for information this year were from students or libraries desiring material on the career of the sanitarian. These requests were answered using the mimeographed sheet "The Professional Sanitarian." A subcommittee's draft of a color brochure on the career of the sanitarian is expected to be review by the IAMFES Executive Board at the Annual Meeting in August. Printing of the brochure is anticipated in the fall.

Packet Of Aids For Affiliates—A function of this committee is to supply affiliates with ideas and printed information which they can reproduce. A packet of miscellaneous aids is almost completed and is scheduled for mailing in August to secretaries of affiliates. Included in this packet is a guide for planning and conducting better meetings.

Graduate And Undergraduate Education—Much exploration and guidance is needed in the field of education for the sanitarian at both the graduate and undergraduate levels. Although a subcommittee is now considering this subject, significant achievements by the committee in this area are not expected until the ensuing year.

REPORT OF THE JOURNAL MANAGEMENT COMMITTEE

As has been the situation over the past several years, it was not possible for the Committee to meet as a unit until just prior to the annual meeting. However, during the year there has been limited correspondence between the members and one or two meetings of a number of the committee members. The Committee, as a whole, met twice on August 13th, at the Americana. Dr. K. G. Weckel was unable to attend but all other members were present.

In general, it was the opinion of the Committee that the content of the Journal has continued to improve over the past year. The use of "items of interest" has aided in the reduction of the "white space" problem. The editors have done well in obtaining "reader interest" items as well as improving the content of the News and Events Section.

Considerable time was given to briefing the Committee on the proposed merger of International and NAS by Dr. Olson and Mr. Thomasson. Many points relating to problems which will be encountered in the combining of the two journals were discussed.

Dr. Olson presented brief comments on the Journal content for 1966 which were included in his report to the Executive Board. He also reported that when he had decided it would be necessary to give up the editorship of the Journal because of his new position with FDA, he was asked by the Executive Secretary to look for and recommend a replacement. Dr. Elmer Marth, of the University of Wisconsin, was contacted and has accepted the position of Editor of the Journal. At this time, we wish to welcome Dr. Marth. We wish him success and, as a committee, offer our assistance in every way possible.

Numerous other items were discussed at our afternoon session. The Committee believes that a number of recommendations should be attempted during the interim period between now and the possible merger of the two associations.

After due deliberation on the subjects discussed by the Committee, the following recommendations are presented to the Executive Board for their consideration:

1. Since the Committee believes it is essential that the identity of the Journal be maintained for the scientific and professional advancement of the association and its members, careful study must be given any proposals relating to the combination of the present journals when the two associations merge. It is our understanding that the earliest date for any change in the journals would be January, 1969. Therefore, it is recommended that the Executive Board of International and the Executive Board of NAS immediately appoint a joint committee to study and make recommendations relative to the best method for the combination of the two journals. This study should include all aspects of the combination such as name, number of issues, content of issues, etc. It is suggested that Journal Management Procedures of other associations, such as the American Dairy Science Association, be studied and used as a guide in the development of a suitable Journal Management program for the combined journals. The joint committee should be prepared to report back to their respective associations at the 1968 annual meeting.

2. During the forthcoming interim period, it is recommended that no changes be made in the present Journal or of the Editorial Board. It is suggested that Dr. Marth as the new editor should write each member of the Editorial Board asking that he continue to serve until the proposed merger

is resolved and the effect of such a merger on the journal is determined.

3. Dr. Marth, Mr. Dixon and Mr. Thomasson should meet at the Shelbyville Office as soon as possible following the annual meeting so that Dr. Marth can become familiar with the office operations of the Association.

4. It has been suggested that the membership should be informed of the activities of the interassociation committees on which International has representation. It is recommended the Executive Board request that written reports be submitted and consideration given publication of these reports in the Journal. The Board should also consider publishing the minutes of Executive Board meetings to better inform the members as to the activities of the Association.

5. There is need to provide for a system for better reporting on committee appointments and committee reports. Committee lists and objectives have not been adequately reported and often have been too late to be of value. Also some system is needed to establish the responsibility for approval for publication of committee reports, setting due dates for reports, etc. (The decision to publish a committee report should not rest with the Editors.) It is recommended that the Executive Board consider review and approval of all committee reports designating publication of all or parts of each report.

6. There continues to be a need for improvements in the area of communication between the Editors of the Journal. More frequent meetings between the Editors has been suggested in the past and this comment is repeated again. Such meetings are even more important with a new Editor. It is hoped that some suitable method for better communication can be developed.

7. It is noted that previous comments concerning affiliate cooperation have been included in the agenda for this year's Affiliate Council meeting. It is recommended that the importance of the cooperation of the affiliates be stressed and every effort made to expedite any suggestions made by the Council in this area.

Finally the Journal Management Committee wishes to express its appreciation to Dr. J. C. Olson for his untiring efforts as Editor of the Journal. We have a Journal of which we can be justifiably proud. We are sorry to loose Joe as Editor but we wish him every success in his new endeavors.

Committee Members

F. W. Barber, *Chairman*	W. J. Dixon
K. G. Weckel	J. C. Olson
C. K. Johns	E. H. Marth

NEWS AND EVENTS

DAIRY SOCIETY INTERNATIONAL BOOKLET ON "TONED" MILK

Toned milk is described as "a combination of fresh milk, nonfat dry milk, and water, in such quantities as are required to obtain the percentages of fat and nonfat solids desired in the finished product." The development of the product in India and its increased use as a vital food in countries of low milk production is described in an interesting Dairy Society International booklet entitled "Toned Milk – the Why and How of It."

Pointing out that 75% of the world's population lives in so-called "non-dairying" countries, the booklet lists the advantages of supplementing and extending the minimum locally-produced supply to provide increased quantities of milk of high nutritive value and utility. In countries with low consumer purchasing power, a reduction of consumer milk prices brings toned milk within the reach of a vastly greater number of people. Further, farmers can be paid increased prices for fresh milk, thus encouraging local production.

The operation itself consisting of uniformly mixing three ingredients—fresh milk, nonfat dry milk and water—requires only simple equipment designed to supply the needs of a metropolitan area or a very small village. Careful but simple quality controls can be provided for testing, mixing, pasteurizing, bottling and packaging.

The process makes possible the production of milks of varied compositions and uses in a variety of high quality manufactured dairy products. It reduces only the fat and vitamins A, C and D content of the milk. The proteins, minerals, lactose, and vitamin B content, so essential to growth and health, remain.

Many booklets on nutrition and health or on dairy products start with a maxim that "Milk is nature's most complete food, equally good for young and old", or "Milk and dairy foods are keystones to a healthy life", or "Milk must be included in the daily diet." The DSI booklet tells what can be done and what is being done in world areas to help meet the urgent need for good milk.

A copy of this 21 page booklet (DSI Publication No. 32) is available from Dairy Society International, 1145 Nineteenth St., N.W., Washington, D. C. 20036.

SPOKANE PROGRAM ON ABNORMAL MILK COVERED IN UNIVERSITY BULLETIN

The story of the Health Department of the city of Spokane, Washington, and its successful program to eliminate abnormal milk from the Spokanes milk shed's milk supply is told in a recently issued publication. The publication, "Eliminating Abnormal Milk from a City Milk Supply," was printed by the University of Idaho College of Agriculture as Current Information Series No. 60.

The narrative report explains how in 1957 the Spokane milk shed shifted to the use of farm bulk tanks on the farm and every-other day shipments. The Resazurin test formerly used to detect abnormal milk could no longer be used. Through the help of the University of Idaho dairy science department the Modified Whiteside Test was selected as a screening test for abnormal milk, and the Direct Microscopic Leucocyte Count was adopted as the official examination test for abnormal milk.

Screening tests run in 1962 were both revealing and startling. Only 57.6 per cent of all milk samples were normal, the remainder were abnormal. The situation demanded attention, and in November, 1962, the first steps were taken. A meeting was held to lay out a plan of action.

The publication "Eliminating Abnormal Milk from a City Milk Supply" reports the step-by-step plan of action that was developed, how it was initiated, the types of obstacles encountered and overcome, and the ultimate success of the program.

Copies of this report are available free by writing to: Mailing Room, Agricultural Science Building, University of Idaho, Moscow, Idaho 83843. Multiple copies are available at cost.

MICHIGAN HOLDS WORKSHOPS ON FOOD PROTECTION FOR WAREHOUSEMEN

Two workshops concerned with protecting stored food from infestations, contamination, and adulteration have been conducted for food warehousemen in Michigan. The two one-day sessions were sponsored jointly by the Michigan Department of Agriculture's Food Inspection Division and the U. S. Food and Drug Administration's Detroit District.

Topics discussed included the rat problem, infestation habits of insects, control of the bird problem, industry's responsibility in sanitation, the respective warehouse sanitation programs of the two sponsoring organizations, and the Michigan Pest Control Association's responsibility and function in warehouse pest control. Panel discussions at the two workshops covered all topics.

Further information on the sessions can be obtained from either of the sponsoring organizations.

SEVEN YEARS OF DAIRYING IN NEW YORK STATE[1]

Seven years ago, in 1960, there were 40,180 dairy farms in New York, compared to 26,340 in the year just ended. The number of cows per farm has increased from 29 to 38. The total number of cows is still a bit over a million and only 145,000 less than in 1960. Increased production per cow, from 8,150 pounds in 1960 to 9,700 pounds last year (accompanied by an increase of nearly 1,000 pounds per cow in grain fed) more than offset the smaller number of animals. Total production was about 209 million pounds higher than in 1960, although the difference was even greater in some years in between the two dates.

Dr. George J. Conneman, of the New York State College of Agriculture at Cornell, has made some projections on what the situation in the state will be in 1974, at the end of another seven-year cow cycle.

He foresees a shrinkage in the total number of dairy farms to 16,500. They will be bigger than now, in line with the past trend, and an increase in average production per cow to 11,300 pounds will offset an estimated drop of a little more than 100,000 in the total cow population. Instead of a herd averaging 38 cows, as in 1967, the average will be 50. This will not entirely result from an increase in size of herds. The tendency of small farmers to quit dairying or get bigger will continue. The largest change is expected in the farms with 20 to 29 cows, both in actual numbers and percentage-wise. More than half those in that group are likely to either grow or quit by 1974.

The least change, relative to present totals, will come with farms housing between 40 and 60 cows. The number will not change much. But is expected that there will be 280 more with between 60 and 99 cows and that the number of herds with more than 100 animals will go up from the present 700 to 1,250.

[1]From N. Y. State Association of Milk and Food Sanitarians *Newsletter*, Spring, 1968.

CDC ANNOUNCES COURSE IN PESTICIDES AND PUBLIC HEALTH

The National Communicable Disease Center at Atlanta, Georgia, has announced a four day course in Pesticides and Public Health. The course is identified as No. 2655-N and will take place on May 13-16, 1968 at facilities at the Center in Atlanta.

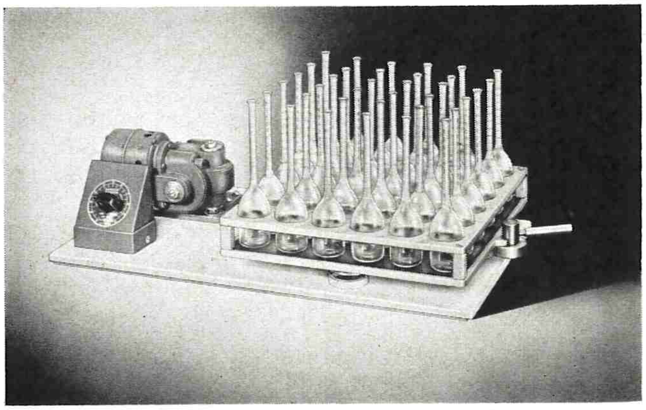
The material to be presented will be designed for personnel employed by State and local health departments, Federal agencies, arthropod control districts, conservation groups and other appropriate agencies. Biologists, sanitarians, engineers, chemists, physicians, nurses, veterinarians, other members of the health team, and individuals whose employment includes the responsibility for performing or supervising pesticide usage are invited to make application for this course.

Among the topics to be covered in the four day program are: The Ecology of Pesticides in the Environment; Distribution of Pesticides in the Environment and Man; Pesticides and Their Use in Public Health Programs; Elementary Pesticide Chemistry; Pesticide Laws and Legal Implications of Pesticide Usage; and Clinical Effects and Treatment of Pesticide Poisonings.

The staff conducting the program will consist of individuals employed by NCDC and other agencies with responsibility in the pesticides field. In addition, consultants will be utilized to present those topics in which they have special competence.

For further information on the course and details on enrollment address: Chief, State Services Section, Pesticides Program, National Communicable Disease Center, Atlanta, Ga. 30333.

TEST BOTTLE SHAKER



The Garver Test Bottle Shaker is ideal for use wherever consistently accurate test bottle integration is required.

The machine combines a unique and exclusive ovate action (which closely simulates hand twirling) with an extremely low center of gravity to assure you complete integration of a full test load in 30 to 45 seconds—without forcing the mixture into the bottle necks.

Made in 24 and 36 bottle capacities with either a stationary or removable tray, the Garver Test Bottle Shaker features a heavy duty, variable speed, gear head motor—a shaker arm driven by a precision ball bearing—a cast aluminum shaker tray with a rubber pad in the bottom—and a 3/16" rust-resisting steel bottom plate with a heavy rubber pad cemented to the under side. All models are made to accomodate both 6" and 9" glassware. Removable tray models are secured by means of a cam action lock—and are ideal for use with extra trays to eliminate unnecessary unloading operations.

For further details, write the Garver Manufacturing Co., 109, Union City, Indiana 47390.

WISCONSIN'S MASTITIS CONTROL PROGRAM DOING A GOOD JOB

Less than 4 per cent of about 69,000 grade A herds in the state needed some help in correcting their mastitis situation, according to a report of University of Wisconsin veterinary scientist C. W. Burch. The status of manufacturing milk producers is only slightly different. A few more of them needed help in controlling mastitis. Nevertheless, the situation seems satisfactory. Over 87 per cent of manufacturing milk producers need no further assistance, and less than 13 per cent require help.

Since the mastitis control program was started, it has been substantially improved and accelerated, Burch says. Wisconsin Department of Agriculture laboratories to screen milk for mastitis are located in Madison, Green Bay and Eau Claire. Every dairyman has his herd milk tested in one of these state laboratories three times a year. These tests are made in addition to the monthly tests conducted voluntarily by dairy plants. Results of all tests are reported to dairymen.

If a producer's milk sample tests above a desired level, he is advised to take appropriate measures to improve the situation. A state veterinarian and dairy inspector visit the farm when the milk samples repeatedly test above acceptable standards. The veterinarian examines each milking cow while the dairy inspector does a thorough sanitary inspection. Such visits do not often happen. About two-thirds of all dairymen can improve their situation and do not get a second unacceptable test.

A producer who finds his milk tests high on a mastitis screening test can turn to several people for help, says Burch. He can ask his veterinarian for help in the care and treatment of individual cows. In turn, veterinarians may appeal to the State Veterinarian's office for further help. Dairy plant fieldmen can also help the producer improve his milking methods and techniques. The milking machine serviceman can help correct faults in the mechanical milking equipment.

Mastitis can be kept under control but it requires the continuous effort of the dairyman, Burch says. On the whole the dairy industry has been extremely pleased with Wisconsin's mastitis control program.

BOOK REVIEW

COTTAGE CHEESE AND OTHER CULTURED MILK PRODUCTS. *1967. Douglas B. Emmons and Stewart L. Tuckey. Chas. Pfizer and Co., New York, N. Y. 143 pp. $1.50. (May be obtained from Chas. Pfizer and Co., Inc., 4215 N. Port Washington Ave., Milwaukee, Wis. 53212.)*

This is a short, concise, and well-written book covering the theory and practices of manufacturing unripened soft cheeses and fermented milks. Although two-thirds of the text deals with Cottage cheese, the sections on buttermilk, sour cream, and yogurt are rather complete. Sections on bakers', cream, and Neufchatel cheese are brief with minimum discussion of newer techniques used in making these products. Calculations of yield for cream and Neufchatel cheeses are outlined.

Characteristics of lactic starter cultures and manufacturing procedures used for Cottage cheese are discussed in detail. Personnel using pH meters will find the section on use and care of the meters very helpful. The chemistry of buffering substances in milk which affect titratable acidity is explained in an understandable manner. Defects in Cottage cheese and fermented milks are listed with reasons for their appearance as well as preventive measures.

This book should be a useful addition to libraries of small and large firms which manufacture the products covered in the text.

Norman F. Olson

CLASSIFIED ADS

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- **Hospital and Institutional Sanitation**
- **Camp and Recreational Sanitation**
- **Food and Milk Sanitation**
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Bachelor's degree with 30 credit hours in natural science and mathematics and three year's of satisfactory professional experience in environmental health.

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Approximately $7500-$8800

Requires degree and one year of experience

Send resume or write for application to:

Sanitarian Recruitment, OPA
New York State Health Department
84 Holland Avenue
Albany, New York

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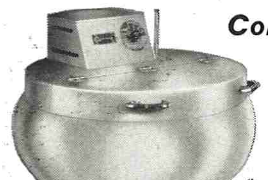

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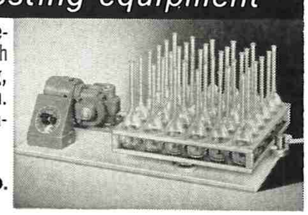

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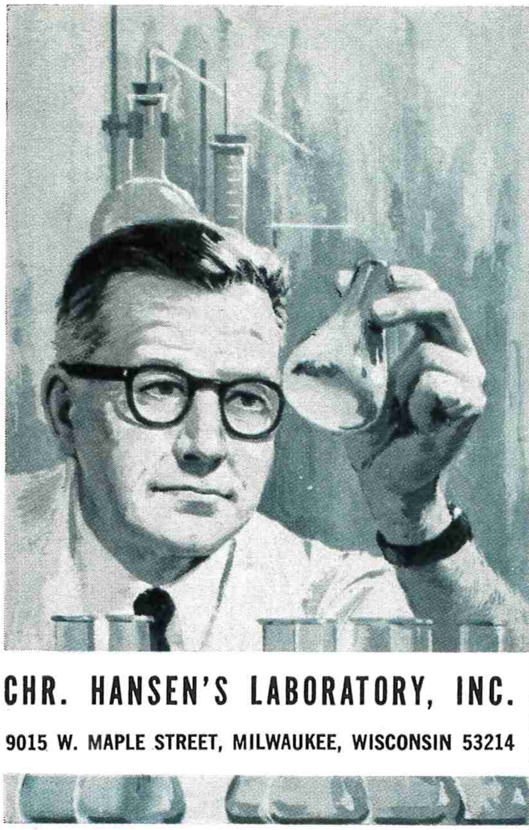

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