VOLUME 17 NO. 8
August, 1954

Journal of

MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk and Food Sanitarians, Inc.

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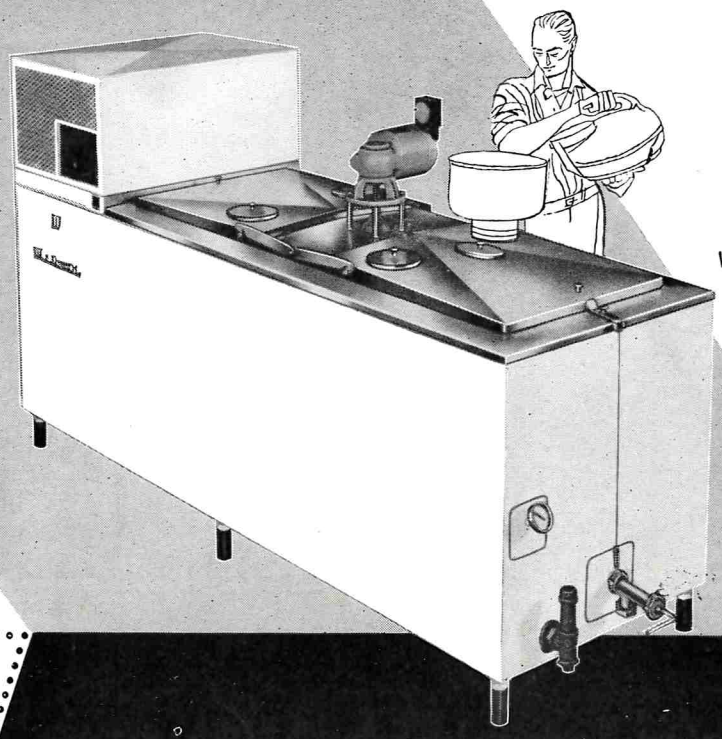

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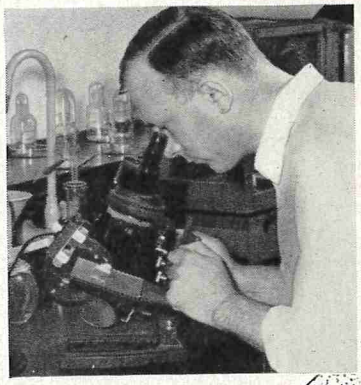

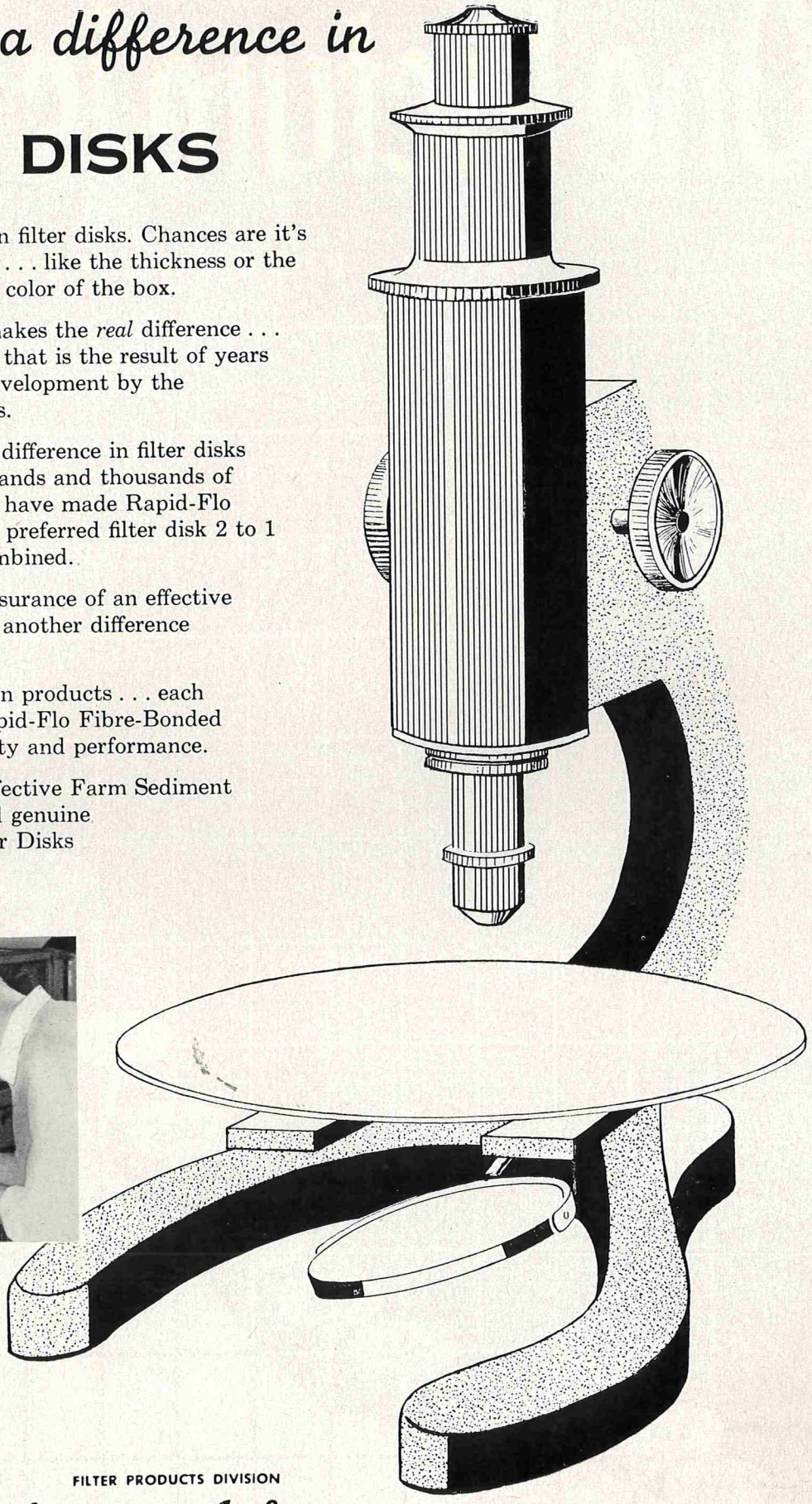

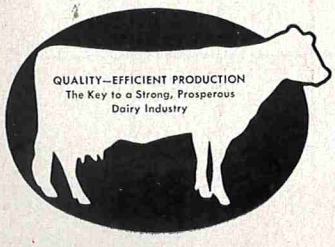

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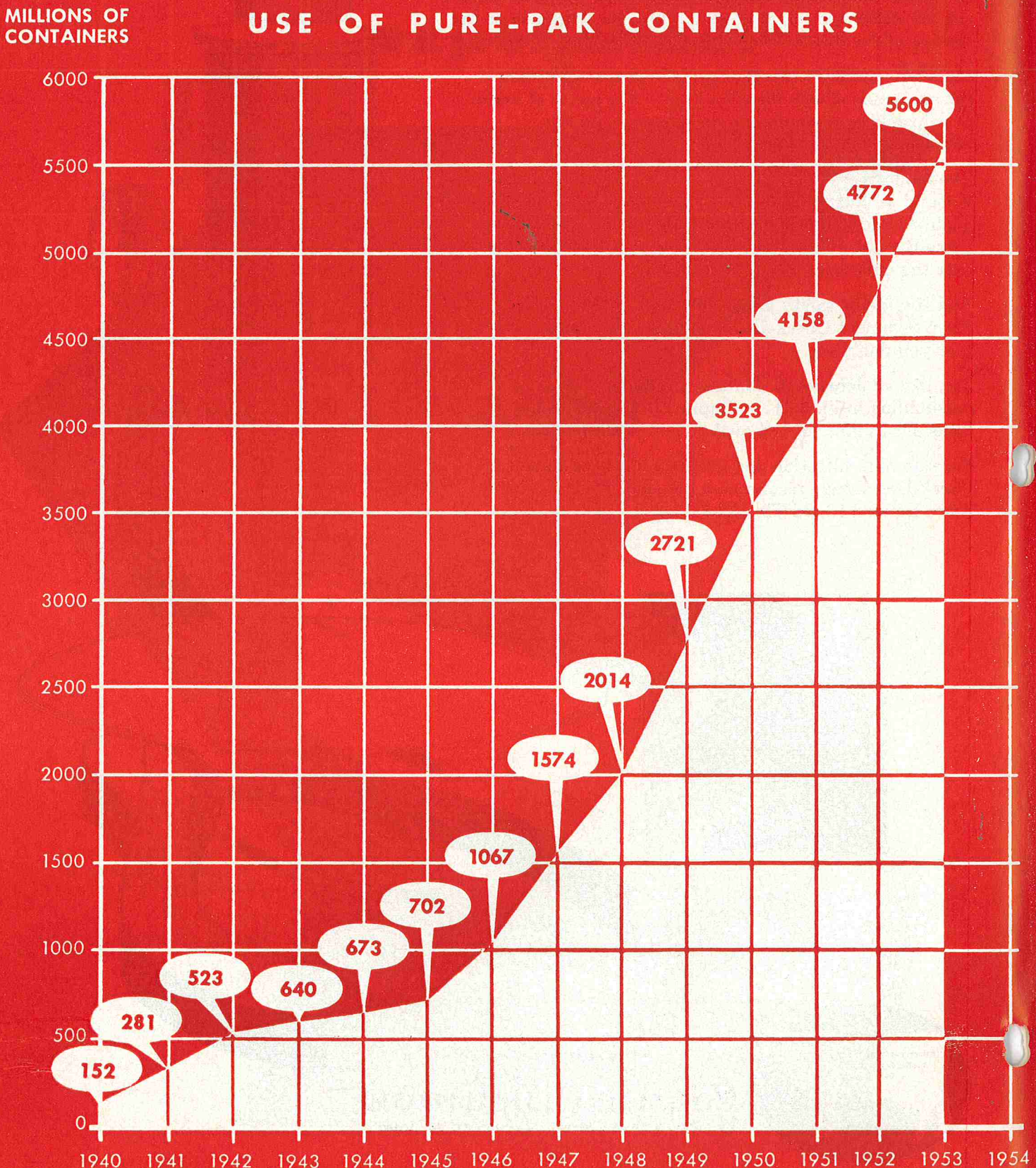

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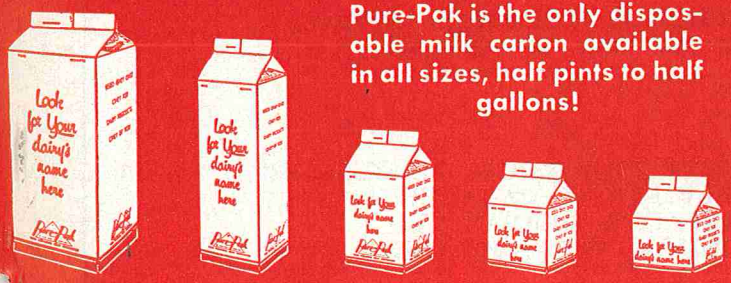

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RESERVATIONS

41ST ANNUAL MEETING—INTERNATIONAL ASSOCIATION MILK AND FOOD SANITARIANS, INC.

HOTEL MORTON*

150 South Virginia Avenue, Atlantic City, New Jersey

The 1954 Annual Meeting of the International Association of Milk and Food Sanitarians, Inc. is meeting in Atlantic City October 20th to 23rd, with Headquarters and all meetings in Hotel Morton.

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Lunch	1.00	Banquet on Friday, October 23rd	3.50

*Send all reservations direct to Hotel Morton.

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Dear IAMFS Member:

5 Minutes, Please?

1 Minute to think of the names of a few people who should be members of IAMFS.

3 Minutes to jot down their names and addresses.

1 Minute to mail.

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Editorial Notes

HEALTH CAREER HORIZONS*

It is a privilege to join with you in launching Operation Health Career Horizons. I count it an honor to meet with the officers and guests of the National Health Council—and it's a great added pleasure to see Mr. Dent again. His words of appreciation for Equitable's share in this joint project are particularly gratifying, coming, as they do, from a man and an organization for whom I feel so much respect.

Operation Health Career Horizons seems to be getting off to a very good start—and for a number of reasons:

the good will and teamwork of all concerned;
the urgency of the health recruitment problem;
the solid groundwork already laid down by the health professions in taking the full measure of health personnel shortages;
the promptness and vigor with which they have acted to plug some of the most critical of these gaps.

I feel a very genuine sense of humility when I consider all that has been, and is being done by those who are so much closer to this problem than I am. I have not lived with it, as you have. I have no pretension to your professional insight into its full implications for the Nation's health services, or to your experience in devising ways and means of dealing with it.

But in joining with you in this new endeavor, I am helping to satisfy a longstanding interest in the health of our citizens. Such an interest should be shared by all of us, even those of us who are outside the health professions. For to work for good public health is demanded by a sense of good citizenship and by the kind of enlightened self-interest which we in America have made our own.

This is the justification for our share in the partnership. And this is what I want to talk to you about. I shall speak—

as a "consumer" of health services,
as a citizen,
as a businessman who has spent a lifetime in the insurance field,
and, if I may, as a representative of corporate management in our American economic system.

These are interlocking roles. But for a moment I would like to do here what I cannot do in day-to-day living; I want to stand off and take a look at each of these roles separately.

Consider first my consumer-interest, as an individual, in health services. Like every man, woman, and child in the country, I have a vital stake in how adequately these services are staffed. My life, and the lives of all who are dear to me, may very well depend on them.

The tremendous advances of medical science during my life-time have repeatedly reinforced this conviction. The alertness of the press in sensing the news value of new drugs, new diagnostic skills, new precentive and remedial measures, new hospitals and health centers has intensified this interest. The collective impact of these and other forces has created a truly unprecedented public demand for what the health professions have to offer.

This is what makes so intolerable the fact that all these gains will be frustrated by any shortage of people in the health professions. It is intolerable because it need not be. The challenge is to close the gap between what we know and *what* we are staffed to *do*, to save lives and to endow them with that measure of health which is our common birthright.

As a consumer, I have a claim upon this birthright. But my concern for the adequate staffing of health services is not limited to this selfish interest. I am a citizen, and take the responsibilities of citizenship seriously. We in the United States are fortunate that our forefathers, in establishing the Nation, placed so much emphasis on individual responsibilities along with personal rights. Surely, as a citizen, as well as a consumer, I must stand with you, and work with you, to close the gap between what we know and what we are staffed to do for health. I count it a great privilege of citizenship to participate with the National Health Council in this nationwide effort.

But even civic duty is not the sum total of this obligation. Because of the kind of business I am in, concern for health services is not unrelated to my daily work. It is not just something we turn to after hours. In the insurance field, concern for adequate, accessible health services is a full-time interest. As a matter of fact, we have done our share in helping to bring about today's unprecedented popular demand for adequate health services. The Equitable Society has been one of the pioneers in adapting individual and group insurance to cover essential medical and health services. We have helped to devise a business system which enables millions of people to finance their own health-service needs. Hence, by implication, we share with the health professions the responsibility to see that everything possible is done to the end that there will exist adequate professional staff —physicians, nurses, technicians and others—to furnish the best of health care.

You, and we, can honestly plead that any health-personnel shortages which now exist are due to circumstances beyond our control. But to the public, this may sound unconvincing and certainly ineffective, unless and until we have demonstrated that we are really standing together and tackling the problem together. Who else has a more direct obligation than we have?

Anyone who may be looking for some specific "angle" which brings The Equitable Society into

*Address by Mr. Ray D. Murphy, President, the Equitable Life Assurance Society of the United States, at the National Health Council luncheon to announce "Operation Health Career Horizons," Statler Hotel, New York City, June 16, 1954.

Operation Health Career Horizons can stop hunting right here! The Equitable cannot, in good conscience, stand idly by when such a situation threatens our policyholders' interests. The insurance we offer them is sound. But it will not profit them much if their hospital and medical protection pays off in a vacuum. Their benefit-dollars cannot buy medical service that isn't there. Our sense of public responsibility does not permit us to ignore these facts.

This would be reason enough for making your problem our concern. But it is not the only reason. I think it is fair to say that the insurance business has always been a leader in recognizing the social responsibilities of management. When we point out, for example, that good health is good business, we do not stop with counting the dollars-and-cents cost of absenteeism. We were among the first to point out that management's responsibility for health and welfare cannot stop at the office door or the plant gate. We have been among the first to interpret the obligations of corporate citizenship as extending to the community and to the national interest.

This is the conviction—the philosophy, if you will,—which The Equitable Society brings to Operation Health Career Horizons. I can assure you that we shall demonstrate this conviction in the character of our participation.

As I see it, we are all in this together. The very make-up of the National Health Council speaks for this fact. Your 48 member agencies—each representing a broad national sector of professional and service concern for health—give the Council a special status. Throughout your more than 30 years of experience you have represented the principal of partnership in working for related goals. This membership and this experience make it uniquely fitting that the Council should serve as the sponsor and focal point for Operation Health Career Horizons.

But we are all in this together on a still broader front—not just medical and health professions and organizations but also educators and counselors in our schools, business and labor, families and communities — and most important of all, our young people.

In all that I have said, I have not forgotten them. I have not forgotten that they are the country's main hope and resource for the future if the pool of manpower for health is, in fact, to be broadened and deepened.

Though I know it is just an accident of timing, I think it is a happy coincidence that Operation Health Career Horizons should be getting under way right now. For June is Commencement month. I have just made a trip to the West Coast, and I am very sure that every town enroute was witnessing this familiar and always moving event—was proudly reading the long lists of graduates that are an annual feature in every local newspaper.

I wish I could send a message to every one of this year's million and a half high school graduates, and to their older brothers and sisters in college or university. It would be the message of Health Career Horizons. I would ask each of them to explore those horizons—to find out what each as an individual could bring to some one of the many health callings, and what that calling could bring to them, in terms of both job-challenge and personal satisfaction.

As a guide to their exploration of Health Horizons, I would pass on to them some very wise words which came across my desk this week. What I would quote was published last February in the Bulletin of the National Association of Secondary-School Principals. And it is by Miss Marie Tinker of Eugene, Oregon,—who clearly knows young people and their world. This is what she has to say about "First Steps Toward Vocational Choices" [I quote:]

"To choose work [that will bring] personal satisfaction [as an] integral part of a well-rounded life of service is by no means an easy task. The boys and girls making their choices [today] are part of a generation fraught with conflicts and problems known to no other generation . . . A world of tomorrow which has for its foundation-stones peace, understanding, and an earnest desire for satisfactory and happy living depends on many things. But there is none as far-reaching in its significance as the responsibility which young people must assume in finding work which will bring them personal satisfaction and make them desirable citizens of their own communities."

To such wise counsel, I can add only this: I would not claim that health service is the only field where these goals can be attained. But I would claim that—

if all our young people have a chance to take these goals into account in taking their first steps toward a career decision—

if we can help to alert them all—

then young America will find inspiration in the opportunity to help keep our Nation healthy and strong.

NOTICE TO MEMBERS

PLEASE, SEE RESERVATION BLANK FOR ANNUAL MEETING OPPOSITE TABLE OF CONTENTS AND PROGRAM IN THIS ISSUE PAGE 263.

FORTY-FIRST ANNUAL MEETING

HOTEL MORTON — ATLANTIC CITY, N.J., OCT. 21-23, 1954

COMPARISON OF ESCHERICHIA COLI AND STREPTOCOCCUS FAECALIS AS A TEST ORGANISM TO DETERMINE THE SANITARY QUALITY OF FOOD

PART II*

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Department of Bacteriology and Public Health
Michigan State College, East Lansing, Michigan

Part II

Six strains of E. coli and two strains of Strept. faecalis were seeded into 12 different foods having a pH range of 2.8 to 6.7. Viability tests were run at different time intervals to study the viability of these organisms in the different foods under normal conditions. The results showed that the growth curve of E. coli in the foods depended upon the food and that the height of the curve was determined by the initial inoculation. E. coli var. communis was more viable in the foods than were the other strains. Strept. faecalis remained viable longer in some of the acid foods such as orange juice with a pH of 3.5 and mayonnaise with a pH of 3.7 than did any of the strains of E. coli. There appeared to be little difference between the viability of the two organisms in the less acid foods within the time limits studied.

Experimental Work

The first set of canned foods studied were those commonly used in the household which had a wide pH range. The cans were opened aseptically and foods of large particle size were ground in a sterile Waring blender. Approximately 75 ml portions were placed into dilution bottles and autoclaved for 15 minutes at 121°C.

The pH was determined with the Cenco pH meter using a glass and calomel electrode combination. A 1.0-ml sample plate check was made to determine the presence of mesophilic and thermophilic bacteria using tryptone glucose extract agar and nutrient agar. The autoclaved food was then inoculated with an actively growing 24-hour culture of *E. coli* strain *communior*. The food was plated in serial dilutions to obtain the initial inoculum of bacteria per ml. Distilled water blanks and tryptone glucose extract agar were utilized for this procedure.

The semi-solid food and the first 99-ml dilution blank to which one ml of sample was introduced were shaken with a mechanical shaker oscillating 180 times per minute. The best mixing was obtained by having the bottles in a horizontal position with the long axis of the bottle in line with the direction of shaking. All subsequent decimal dilutions were shaken manually.

Five agar plates were prepared for each dilution. Three plates out of the set of 5 were prepared by placing a thin layer of TGE agar upon the bottom of the sterile Petri plate and allowing it to harden before the dilutions were added to the plates. The dilution water containing the food was then added, and another thin layer of agar was poured into the plates. The two liquid elements were thoroughly mixed. The other two plates were made in the usual manner without a base layer of agar. They were shaken like the first set of three plates. It was found that there was closer correlation between the counts in those plates to which a thin base layer of agar had been added first, since they gave more uniform counts than plates made in the usual manner.

Colonies were counted on the Quebec colony counter after a three-day incubation period at 30° C. The graphic results are given in Figures 1, 2, 3, and 4.

The second set of foods was run in a slightly different manner. Foods were placed aseptically in sterile dilution and wide-mouth bottles. These foods were not autoclaved, but controls were run with each food using lauryl sulfate tryptose broth and lactose broth. Each type of food was then inoculated with 7 strains of *E. coli* using 0.2 ml of the 24-hour culture prepared as described previously. They were incubated at 30°C, and each day for 7 consecutive days a 0.1- to 1.0-ml sample of liquid food and 0.2- to 1.0-gm sample of dry solid food were inoculated into lauryl sulfate tryptose broth and lactose broth in which inserts were placed. The minimum transfer was used at the beginning of the seven day test, and when it was seen that the percentage of gas at 12 hours was decreasing, a larger inoculum was used. More inoculum was used for the dryer foods and a lesser amount for foods with liquor present. The liquor from semi-solid foods seeded with *E. coli* was transferred to the broth medium by pipetting. Examples of this type of food are peaches with syrup, tomatoes with juice, apricots with syrup, apple-sauce with hominy. Solid foods such as beans, meat, and sauerkraut were weighed to determine the relative amounts in 1.0- and 0.1-gm samples respectively, and approximate amounts used for inoculum.

Prior to transfer of the inoculated foods into the two broths, all samples were shaken for 10 minutes at 180 oscillations per minute, After 16 and 36 hours incubation, the percentage of gas present in the insert vials of the tubes were read. Positive tubes were confirmed by using the confirmatory test which is used for water samples. This test was initiated on the first, third, and seventh days. All brilliant green bile broth tubes, which were inoculated with three standard (4 mm) loops of lauryl sulfate tryptose broth, yielded confirmatory tests.

A duplicate set of the same twelve foods was inoculated with *Strept. faecalis* and transfers of the foods were made daily for seven consecutive days into dextrose azide broth. Turbidity was read at 16 and 36 hours at the beginning, but since the 36-hour reading gave the best results, the 16-hour reading was discontinued. A Gram stain of the broth was made at three days and studied.

Results

The growth curve of *E. coli* var. *communior* was influenced by the medium in which it grew. This is illustrated in the graphs shown in Figures 1, 2, 3, and 4.

Hominy with a pH of 7.2 supported rapid growth of *E. coli* reaching a count of about one billion at 24 hours which was the

*The Part I section was published in this Journal, July '54 issue, page 204.

*Since this work was completed, Litsky *et al.*[1] found that ethyl violet was selective for gram-negative bacteria. Later they (Litsky *et al.*[2]) used glucose azide broth as a presumptive medium and ethyl violet azide broth as a confirmatory medium for the detection of enterococci in water, thereby doing away with the necessity of using the microscope and also placing the test on the same basis as the coliform test.

*The "bacterial food factor" was calculated from data in 12 tables not given here since these data were too voluminous but may be obtained from the original thesis.

greatest number in any of the foods tested. Figure 1 shows that this organism remained viable for a long time since there were four hundred thousand organisms per ml still present at the end of 19 days.

Figure 1 also shows how *E. coli* grew in canned peas at a pH of 6.0. With an initial seeding of one hundred thousand organisms, they had increased to 96,000,000 in twelve hours. They reached their maximum numbers in 48 hours when the count was 240,000,000 per ml. They died off rapidly, reaching 42,000 in six days when mold contamination caused discontinuance of the experiment.

Corn, with a pH of 6.2 (Fig. 2), fostered quick growth of *E. coli* which increased from an initial number of 100,000 at two hours to 400,000 at 24 hours. The logarithmic decrease was gradual for the 15 days of the test at the end of which time a count of 400,000 organisms per ml still persisted.

Chicken soup with a pH of 6.4 (Fig. 2), showed increase of *E. coli* from the initial amount of 660,000 to 51,000,000 in six hours. At 15 hours the count had increased to 290,000,000. The number of bacteria remaining showed but slight variation from the first until the 14th day when there was a gradual decrease. At the 7th day, 10,000,000 *E. coli* were present, but by the 14th day, the count had decreased to 140 organisms per ml.

E. coli was seeded into two samples of beef gravy (Fig. 3). One sample was inoculated with 75,000 organisms and the other with 750,000. The bacteria grew rapidly in both samples for the first 12 hours. Their numbers leveled off after reaching a peak of 40,000,000 and 77,000,000 respectively at 36 hours; 1,250,000 organisms remained viable in food determination No. 1 after 32 days, and 18,000,000 remained viable in determination No. 2 at 20 days. Organisms were present in large numbers up to 46 and 28 days when plating was discontinued. These data indicate that the amount of the original inoculum influences the number of organisms which are subsequently present.

E. coli inoculated into tomato soup having a pH of 4.6 (Fig. 4), did not multiply to any great extent. The initial amount of one million for the first set and about 2,000,000 per ml for the second set did not rise above 3,000,000 organisms per ml upon incubation and were in a state of sharp logarithmic decrease at 12 hours. There was a general leveling off of this decrease after five days, and less than 100 and 300 coliform organisms per ml were present after 30 and 35 days when determinations in this food were terminated.

Inoculum in excess of 100,000 organisms per ml reached the limit of their increases in from 24 to 48 hours. Of the foods used within the pH range of 4.6 to 7.2, all contained more than 10,000 organisms per ml at the end of 7 days incubation at 30° C.

Foods seeded with coliform organisms were inoculated into lauryl tryptose broth and lactose broth to determine the most promising common broth medium for rapid detection of coliforms. Lauryl tryptose broth gave 706 positive tubes to 630 for lactose broth. These results are the sum of 12- and 36-hours gas positive tubes. The food in which *E. coli* produced the most gas at 12 hours and remained viable for the longest period of time in one ml quantities were beef, hominy, beans, peaches, applesauce, and tomato with juice. The order was determined by calculating both lauryl tryptose broth and lactose broth fermentation with the production of gas at 12 and 36 hours.

Apricots showed a slowing of fermentation at 12 hours of incubation the third day after the food had been inoculated. Although the amount of food placed into the broth tubes was increased after the third day, the strain of *E. coli*, w-52950, isolated from a contaminated water sample, and strain 0-111 died out on the third and fifth day respectively. The fourth day after seeding the food, the coliform organisms were less viable since in the first 12 hours little gas was formed in the broths by any of the strains.

In orange juice with a pH of 3.5, the gas formation in the fermentation tubes lessened in quantity after it had been incubated one day. Gas appeared in lauryl tryptose broth from one to three days after the organisms failed to ferment the lactose broth. *E. coli* var. *communis* evidently was the hardiest strain of all since it was the only strain surviving to show continued fermentation after five days.

In potato salad with a pH of 4.8, 24 hours after food inoculation, all strains of *E. coli* fermented both lauryl tryptose broth and lactose broth at the 12-hour interval. By the second day after food inoculation, it was necessary to incubate the broth tubes 36 hours to get gas formation and the third day, after mixing coliform bacteria with the food, only five of the seven strains gave positive results; on the fourth day only three of the seven. On the sixth and seventh days, a heavier inoculum of potato salad in the broth tubes yielded positive results in lauryl tryptose broth for the human strain HS-04.

In sauerkraut with a pH of 3.8, two strains of *E. coli* gave negative tests at one day, and five of the seven strains gave negative tests at two days. Only *E. coli* var. *communis* remained viable to the fourth day with a positive test in lauryl tryptose broth after 36 hours of incubation.

Mayonnaise with a pH of 3.7, proved to be very bactericidal, yielding 6 out of 7 positive coli tests at 1 day, and only 1 positive coli test at 2 days after inoculation in the food. There were no positive tests after 48 hours even though the amount of food inoculated into the broth was increased.

Cranberry sauce with a pH of 2.8, showed positive tests after the first day and then in only 5 of the 7 strains. There were no positive tests the second day with 1 gram samples, and although 1 gram of the material was used as inoculum into the broths the third day, all sampling remained negative.

The foods used fell into three general groups in regard to the viability of *E. coli* in them and are arranged accordingly.

Group I presents the best possibility for using tests for *E. coli* to determine the sanitary quality of food. In this pH range of 6.7 to 4.6, bacterial growth is favored while the inhibitive action of the organic acids is the least. Organisms in this group of foods remained viable for the 7 days of the test. Gas was discernible within 16 hours in the test broths. In Group II foods with pH ranges of 3.5 to

TABLE 1—FOOD FACTORS OF VARIOUS FOODS GROUPED ACCORDING TO THE MAGNITUDE OF THE FACTOR.

Food	*pH*	*Total titratable acidity*	*Lauryl tryptose factor*
		Group I	
Beef	5.9	0.074N	93
Peach	4.2	0.0498	93
Hominy	6.7	0.0125	92
Bean, navy	6.2	0.0664	92
Applesauce	3.6	0.0581	88
Tomato	4.6	0.0664	88
			Lactose factor
Beef	5.9	0.074N	97
Hominy	6.7	0.0125	94
Beans	6.2	0.0664	89
Peaches	4.2	0.0498	86
Applesauce	3.6	0.0581	83
Tomato	4.6	0.0664	78
			Total lauryl tryptose + Lactose factor
Beef	5.9	0.074N	190
Hominy	6.7	0.0125	189
Beans	6.2	0.0664	181
Peaches	4.2	0.0498	179
Applesauce	3.6	0.0581	171
Tomato	4.6	0.0664	166
		Group II	
Food	*pH*	*Total titratable acidity*	*Lauryl tryptose factor*
Apricots	3.8	0.0872N	52
Orange juice	3.5	0.166	40
Potato salad	4.8	0.0498	35
			Lactose broth factor
Apricots	3.8	0.0872	41
Orange juice	3.5	0.166	30
Potato salad	4.8	0.0498	19
			Total lauryl tryptose + Lactose factor
Apricots	3.8	0.872N	93
Orange juice	3.5	0.166	70
Potato salad	4.8	0.0498	54
		Group III	
Food	*pH*	*Total titratable acidity*	*Lauryl tryptose factor*
Sauerkraut	3.8	0.0913	12
Mayonnaise	3.7	0.1577	6
Cranberry sauce	2.8	0.166	4
			Lactose broth factor
Sauerkraut	3.9	0.00913	4
Mayonnaise	3.7	0.1577	2.5
Cranberry sauce	2.8	0.166	2
			Total lauryl tryptose + Lactose factor
Sauerkraut	3.9	0.0913	16
Mayonnaise	3.7	0.1577	9
Cranberry sauce	28	0.166	6

4.8, *E. coli* organisms did not grow as well as they did in Group I foods. Organisms in Group III foods with pH's of 3.8 to 2.8 showed little gas production at 16 hours and yielded gas positive reactions for only a day or at the most, 2 days.

Strept. faecalis, as seen in Tables 2 and 3 remained viable for a longer period of time in mayonnaise and orange juice than did *E. coli*. Turbidity should not be used as a criterion for the presence or absence of streptococci. Non-turbid-appearing tubes showed the presence of streptococcus when observed by Gram's stain. Applesauce and apricots appeared turbid, but Gram's stain revealed the presence of a large gram-positive bacillus. Aside from mayonnaise and orange juice neither the *E. coli* nor the streptococcus method showed any advantage over the other in determining sensitivity of the test, or longevity of organisms in the foods used.

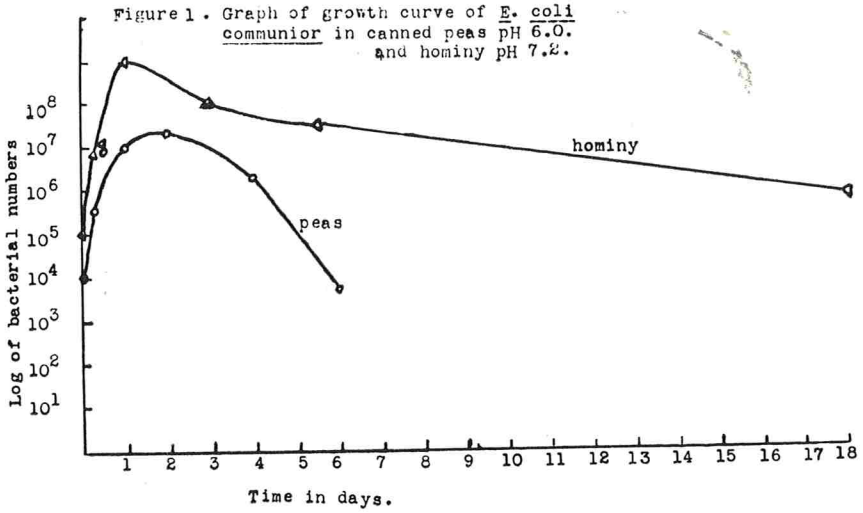
DISCUSSION OF RESULTS

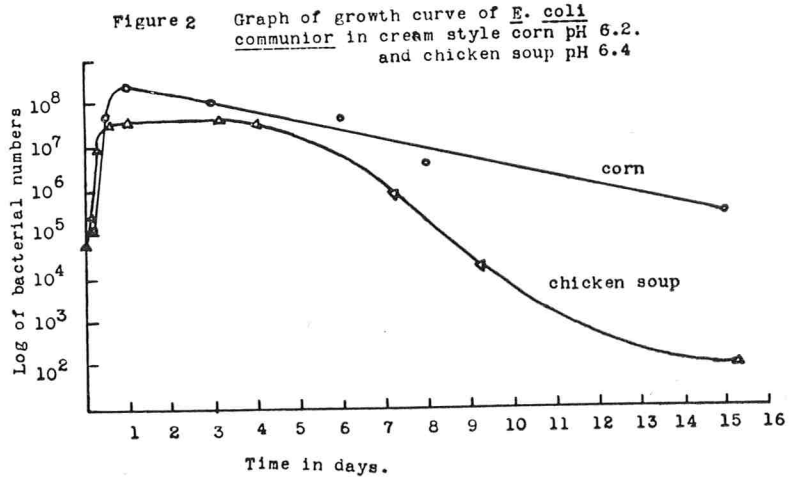
Plate counts of *E. coli* inoculated into foods having a wide range of pH values showed that this organism remained viable in them for long periods of time. During this time the food would show chemical changes or odor. It was found that in the foods with a pH of 6.2 to 3.8, the total plate count of organisms did not exceed one billion bacteria per ml. The growth curve of the organism used varied from food to food. Obviously no one curve could be said to be the representative growth curve for *E. coli* when considering their relationship to the entire field of food products.

Positive tests for the presence of *E. coli* in food were obtained with reasonable rapidity using methods of coliform detection developed for water analysis. The lauryl tryptose broth and lactose broth used as a presumptive test for *E. coli* proved to be more practicable in regards to the ease of observation, the use of a minimum of equipment, and quicker results than the present dextrose azide method and Gram's staining for the detection of streptococci. Lauryl tryptose broth proved to be superior to lactose broth in the more acid foods. Lauryl tryptose broth fostered a greater number of positive gas tubes when the coliforms were attenuated and

TABLE 2—STREPTOCOCCUS FACTOR FOR VARIOUS FOODS

Food	*pH*	*Titratable acidity*	*Streptococcus factor*
Hominy	6.7	0.0125	14
Beans	6.2	0.0664	14
Beef	5.9	0.074	14
Peaches	4.2	0.0498	14
Mayonnaise	3.7	0.01577	14
Orange juice	3.5	0.166	13
Tomato	4.6	0.0664	12
Apricot	3.8	0.0872	9
Applesauce	3.6	0.0581	8
Potato salad	4.8	0.0498	7
Sauerkraut	3.9	0.0813	7
Cranberry sauce	2.8	0.166	3





showed a higher percentage of gas positive insert tubes at 12 hours than lactose broth.

The *E. coli* detection was limited to the presumptive and confirmatory test used in finished water analysis.

Strept. faecalis showed no advantage in viability in the different foods except in the more acid foods especially orange juice and mayonnaise. However, its presence was more costly to determine since it necessitated the use of a microscope, glass slides, staining materials, and time to make and examine the stains after incubation. At times, better turbidity and subsequently better slides of gram-positive streptococci were obtained by using dextrose azide broth after the incubation time had been extended to three days.* Compared with this, the coliform presumptive test took 12 to 36 hours, and the brilliant green bile broth confirmatory test an additional 12 to 24 hours. Minimal time is important in detection of contamination of consumable and perishable products.

BACTERIAL FOOD FACTOR

An attempt was made to calculate the bacterial food factor on fermentation with gas production to see if pH or total titratable acidity could be used to indicate the longevity of coliform bacteria in foods.*

If a bubble of gas or more were present in the insert tube at 12 hours, a value of two points was given to that tube. If gas was present only at 36 hours, one point was assigned to that particular tube. If no gas was produced, the score was zero. The value thus determined for each tube was individually totaled at the end of seven days. Each total was added for each of seven strains. The reaction total was the grand total of the seven strains for seven days in one broth. This yielded an individual number for lauryl tryptose broth and one for lactose broth for one food.

The reaction total of lauryl tryptose broth, using all seven strains of *E. coli* for the seven days was calculated for each food. The reaction total of lauryl tryptose broth and lactose broth was added to get the total number depicting bacterial action for each food. This is called "bacterial food factor".

By separating the foods where the food factor takes the greatest proportionate jump, we find we have a naturally occurring set of three groups of foods.

Since there is no correlation

*Since this work was completed, Litsky *et al.*[1] found that ethyl violet was selective for gram-negative bacteria. Later they (Litsky *et al.*[2]) used glucose azide broth as a presumptive medium and ethyl violet azide broth as a confirmatory medium for the detection of enterococci in water, thereby doing away with the necessity of using the microscope and also placing the test on the same basis as the coliform test.

*The "bacterial food factor" was calculated from data in 12 tables not given here since these data were too voluminous but may be obtained from the original thesis.

TABLE 3—LONGEVITY OF TWO STRAINS OF *Strept. Faecalis* IN FOODS OF VARIOUS pH'S AS DETERMINED "PRESUMABLY" BY TURBIDITY AND CONFIRMED BY GRAM'S STAIN.

Food	pH		ATCC 1325 Days 0	1	2	3	4	5	6	7	ATCC 6057 Days 0	1	2	3	4	5	6	7
Hominy	6.7	Turbidity at 36 hrs.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−
		Gram smear of strept.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Beans	6.2	Turbidity at 36 hrs.	+	+	+	+	+	+	+	+	+	+	+	−	−	+	−	−
		Gram smear of strept.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Beef	5.9	Turbidity at 36 hrs.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−
		Gram smear of strept.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Potato Salad	4.8	Turbidity at 36 hrs.	+	+	+	+	−	−	−	−	+	+	+	−	−	−	−	−
		Gram smear of strept.	+	+	+	−	−	−	−	−	+	+	+	+	+	−	−	−
Tomato	4.6	Turbidity at 36 hrs.	+	+	+	+	−	−	−	−	+	+	+	+	+	−	−	−
		Gram smear of strept.	+	+	+	+	+	+	+	−	+	+	+	+	−	+	+	+
Peach	4.2	Turbidity at 36 hrs.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
		Gram smear of strept.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Apricots	3.8	Turbidity at 36 hrs.	+	+	+	−	−	−	−	−	−	−	+	+	+	−	−	−
		Gram smear of strept.	+	+	+	−	−	−	−	−	+	+	+	+	+	+	+	+
Sauerkraut	3.8	Turbidity at 36 hrs.	−	−	−	−	−	−	−	−	−	−	+	−	−	−	−	−
		Gram smear of strept.	+	+	−	−	−	−	−	−	+	+	+	+	−	−	−	−
Mayonnaise	3.7	Turbidity at 36 hrs.	+	+	+	+	+	−	−	−	+	+	+	+	+	+	−	−
		Gram smear of strept.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Orange Juice	3.5	Turbidity at 36 hrs.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−
		Gram smear of strept.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	−
Cranberry Sauce	2.8	Turbidity at 36 hrs.	+	−	−	−	−	−	−	−	+	−	−	+	+	−	−	−
		Gram smear of strept.	−	−	−	−	−	−	−	−	+	−	−	+	+	−	−	−
Applesauce	3.6	Turbidity at 36 hrs.	+	−	+	−	−	−	−	−	+	+	−	+	+	−	−	−
			+	−	−	−	−	−	−	−	+	+	+	+	+	+	+	+

between pH and titratable acidity and since these two factors or a combination of them is doubtful (the chief factors responsible for the longevity of not only *E. coli* but any other bacteria in foods) it is apparent that *E. coli* is inadequate to serve as a basis to determine the longevity of coliform bacteria in all kinds of food. However, they do serve to make a general grouping of foods with respect to the longevity of bacteria of which *E. coli* is representative. Furthermore, it demonstrates the possibility of the transmission of infectious disease by the enteric group of bacteria of which *E. coli* is representative, in certain types of foods such as in Group I, and under certain conditions in Group II and the improbability of enteric disease occurring in persons eating food classified in Group III.

Group I, because of high pH and correspondingly low organic acid content, readily permitted *E. coli* detection since these bacteria grow readily in these foods. The transitional group of foods is not as ideal a medium of growth as is Group I, consequently small initial contamination in foods listed in Group II might not be detected. Finally Group III seemed to be still less suitable for the growth of the coli-

form organisms. In fact these foods were bactericidal to these strains of coliform bacteria. Gas positive tubes in Group III foods would indicate recent or an extra large *E. coli* contamination.

The data obtained with *E. coli* in mayonnaise were in agreement with that obtained by Wethington and Fabian[3] who found that enterotoxigenic strains of food-poisoning staphylococci remained viable in commercial mayonnaise having a pH of 3.8 for 96 hours. Species of *Salmonella* survived one hour or less in samples of mayonnaise. It is therefore evident that these foods are not the ideal habitat of intestinal organisms of this type.

A totaling of the number of gram-positive streptococcus tubes for the seven day test yields a different sequence for the foods from that of the *E. coli* scheme.

There is no correlation between the viability and food factors of *Strept. faecalis* with pH or total titratable acidity.

Additional experimental work is needed to secure a more solid basis for defining degree of sanitary significance of positive reactions within a general grouping. Field samples should be taken and tests run for both *Strept. faecalis* and *E. coli* in order to establish a standard method and to interpret better the results. Each type of food to be indexed should be individually studied in the laboratory; carbon dioxide, oxygen, and surface tension studies should be in relationship to the biochemistry of the organisms; and the shelf life of food types should be ascertained so as to permit limitations of work.

SUMMARY

Studies of the growth curve of *E. coli* in a variety of foods indicated that the curve was dependent upon the food in which the organisms were grown and that the height of the curve was determined by the amount of initial inoculum.

More positive coliform tests were obtained using lauryl tryptose broth than with lactose broth. Lauryl tryptose broth gave more positive tests at 16 hours than did lactose broth.

E. coli var. *communis* showed slightly greater viability in the foods than did other strains of this organism. Strain 0-111, credited with causing infant diarrhea, was the least viable.

By arbitrarily establishing a bacterial food factor based upon the fermentation of lactose or lauryl tryptose broths, all foods studied could be divided into three groups. This general grouping of foods reflects the ability of coliform bacteria to survive in the respective groups and indirectly the possibility of these respective groups of food causing bacterial disease.

Strept. faecalis remained viable longer in orange juice with a pH of 3.5 and mayonnaise with a pH of 3.7 than did any of the strains of *E. coli.*

There appears to be little difference between the viability of *E. coli* and *Strept. faecalis* in the less acid foods within the time limits studied. However, the latter organism remained viable longer than *E. coli* in the more acid foods especially orange juice and mayonnaise.

Figure 3. Growth curve of duplicate determinations of E. coli strain communior in canned beef gravy.

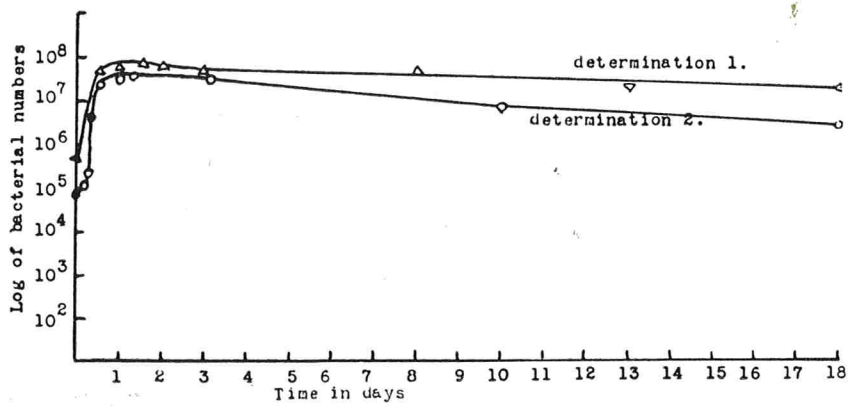
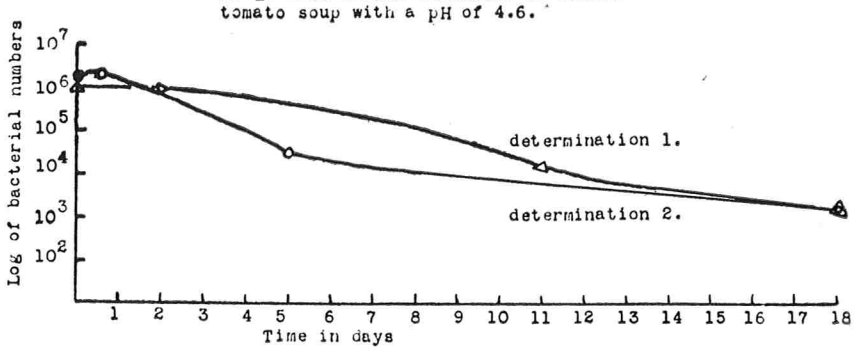


Figure 4. Growth curve of duplicate determinations of E. coli strain communior in canned tomato soup with a pH of 4.6.



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MISSING "LINKS"

Our office file of the proceedings and papers that have been presented at the annual meetings of our Association is not complete. This writer's personal set began with the 1928 volume. Dr. J. A. Gamble generously presented us with the volumes from the beginning of the Association in 1912 through the year 1919 inclusive.

The years 1920 to 1927 inclusive are missing.

If there are any "old-timers" who would like to help us close the gap, we should appreciate any of these volumes that they could furnish.

—J. H. Shrader

CONTROL OF MASTITIS*

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The control of mastitis in dairy cows requires the cooperation of the dairyman. He should have adequate knowledge of the symptoms and means of detection of the disease, and the interpretation of the laboratory examination of the milk samples, to enable him to understand how the disease is spread and controlled.

Mastitis is one of the major problems of the dairy industry. It not only causes loss of milk production and valuable cows but is potentially dangerous to the health of human beings. The following is an outline of a mastitis control program.

I. *Full co-operation of the dairyman.* Without his co-operation the program fails completely. He should know what the causes of mastitis are so that he can better understand the measures needed to stop infection in his herd.

A. *The causes of mastitis*:

1. Predisposing or initiating causes.

a. Injuries such as wounds, bruises from high door sills, stepping on teats, cows mounting each other during heat periods, running through fences, and faulty milking machines.

b. Incomplete or irregular milking causing excessive distention of the udder.

c. Temperature changes such as freezing or chapping the teats.

d. Poor sanitation. An insanitary milking barn. Cows may have to walk through sloppy or muddy barnyards to get to the milking barn. Improper cleansing of the cow before milking. Not cleaning the milking machine sufficiently between milkings. Failure to dip the teat cups of the machine between each cow while milking.

e. Physical abnormalities as warts, "spiders," the teats which drip milk, and the udder which has broken down or has low hanging hind quarters.

f. The period of lactation. Cows are more prone to acquire mastitis at the beginning and at the end of lactation when the udder is too full. This fullness tends to injure the sensitive tissues.

g. Hereditary factors. Some cow families are more susceptible to mastitis than others.

h. Age of cow. Year after year the cow becomes exposed to many of the above factors. This increases the chances of acquiring mastitis.

i. Many other possibilities exist.

2. Infectious causes. The organisms commonly found are:

a. Streptococcus. At least one type may cause septic sore throat in humans.

b. Micrococcus, which is found in soil, air, and water.

c. Corynebacterium, one of the common organisms of pus.

d. The coliform bacteria which are frequently present in manure of normal animals and scouring calves.

e. Other agents, as the calf diphtheria and foot rot organisms, spore-forming bacteria, and yeasts.

II. *A correct diagnosis.* In most cases mastitis can be detected early if the dairyman routinely uses a strip cup, black bakelite plate in a bucket, or brown paper towel for the foremilk. Milk changes are more easily seen before placing the machine on the cow. A veterinarian can assist in the diagnosis by examining the herd to determine those animals which have an infection. He may use a number of methods.

A. Physically examining the milking and dry cows in the herd. By this examination he determines:

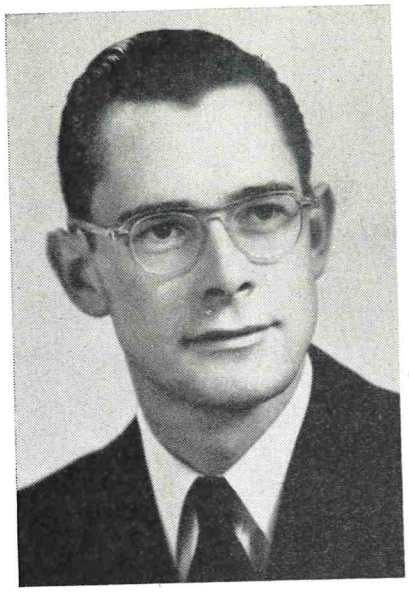
1. The general health of each cow.

2. The feel of the udder. There may be lumps of scar tissue indicating a past or present infection, or certain irregularities which may lead to mastitis.

B. Collecting milk samples from each cow in the milking string. The samples can be checked at the farm and then sent to a laboratory to determine which bacteria are causing the mastitis. Also determined are:

1. The cows which harbor bacteria in the udder and are a source of spread to others. These animals may not show evidence of mastitis.

2. The cows which are in the early or late stages of mastitis.



Dr. L. K. Wayt, a native of Colorado, received his D.V.M. degree in 1946 from the Colorado A. & M. College. He practiced veterinary medicine for four years. Since 1950 he has been Assistant Professor of Medicine in the above College.

C. In badly infected herds a routine examination should be made once or twice a month until the economic loss is no longer a factor. Then, a check-up once every three months helps to keep mastitis cases at a minimum.

III. *Segregation of infected animals.* When practical, all cows with mastitis should be isolated from the healthy ones and milked by someone other than the regular milker. One method of handling the mastitis herd is to divide it into groups to help prevent spread of the disease. If they are milked in the following order, healthy cows are less likely to contact diseased cows during milking.

Group A—Cows with well-balanced udders and having no mastitis or mastitic bacteria present in the milk samples.

Group B — Cows with normal udders but shedding mastitic bacteria as shown by bacteriological culture of milk samples.

Group C — Cows with physical deformities of the udder showing evidence of mastitis and/or scar tissue, indicating mastitis in the past.

Group D — Cows with badly damaged udders as a result of severe infection. These include those cows which have one or more

*Delivered at meeting of the Colorado Dairy Fieldmen's Association, Fort Collins, January 12, 1954.

quarters completely lost from mastitis. They should be sold for slaughter as soon as possible.

IV. *Strict sanitation.*

A. Avoid sloppy and muddy barnyards. Filth and manure on the udder may lead to infection.

B. Have a good milking procedure.

1. Clean machines regularly and keep them in good repair.

2. Keep the udder trimmed of long hair as mud and manure cling to it.

3. Wash udders with a warm chlorine solution containing at least 200 parts per million available chlorine about one minute before milking. The solution should be at a temperature of 110 to 120 degrees Fahrenheit. It is best to use a separate towel for each animal and not dip a dirty used towel back into the chlorine solution again. Paper towels can sometimes be used.

4. Milk regularly. Milk each cow as quickly as possible taking the machines off in 3 to 4 minutes. Strip the quarters as any milk left helps bacteria to grow if they enter the teats. Do not wet-hand milk.

5. After milking dip the teats in a shallow pan containing chlorine solution, quarternary ammonium solution, or wipe the ends of the teats with cotton saturated with rubbing alcohol Do not use creosote or coal tar solutions as these flavor milk.

6. Disinfect the milking barn two or three times every week with a hot 2 to 5 percent lye solution and rinse with plain water. To help keep the barn floor dry sprinkle it with lime or super phosphate.

V. *Maintain a good herd management program.*

A. Use home-raised heifers as replacements. A purchased animal is a potential mastitis carrier and should be examined carefully before being placed in the herd. Each new replacement should be tested for brucellosis and isolated until she is known to be free from mastitis.

B. Treatment is essential in mastitis but is only part of the program. Early medication is advised for infected animals, and is best carried out when the bacteria causing the infection have been identified by a laboratory. Most treatment is not maintained long enough at one time. Periodic treatment every few days or use of medicants in the wrong manner cause bacteria to build drug tolerance. This means that when bacteria are not killed during a course of treatment they soon become resistant to that treatment. If a medicine is used which affects some bacteria and not others, a resistance may develop and the mastitis cannot be treated successfully.

C. Reduce the concentrated feed intake of a cow with mastitis. High protein feed tends to increase milk production and makes the udder work harder.

D. Cows should be dried up properly to prevent overdistention of the udder. Heavy producers should have their grain and water intake reduced several days before the procedure is started. Then, stop milking and relieve the udder only when it seems to be too full. If mastitis is present in a quarter keep the pus or infection milked out. The quarter should be treated. Allow a dry period of about 8 weeks or more.

E. Remove cows which are in heat from the herd. Cows mounting each other bruise the udder and this may initiate mastitis.

F. Do not feed calves mastitis milk. There is always the possibility they may harbor bacteria in the system and develop mastitis later. Prevent calves from sucking each other at feeding time by placing them in separate pens or providing muzzles.

G. Disinfect stalls where mastitis cows are kept. First, remove the bedding and burn it. Then apply a 2 percent lye solution to the floor and walls. Rinse it off after 24 hours, if possible.

H. Construct the milking barn to allow plenty of standing room. Doorways should have no steps or only low steps. Keep the barnyard clean and free from debris.

I. Have milking machines checked regularly. Working parts wear out permitting the vacuum to become too high or pulsations to increase and injure the sensitive udder tissues.

J. Other factors are important in individual herds. It is advisable for the dairy man to check periodically each point in his control program. The control of mastitis requires constant effort if losses are to be kept at a minimum.

MINNESOTA MILK SANITARIANS ASSOCIATION HOLDS REGIONAL MEETINGS

A series of four meetings are being sponsored in various sections of the state by the Minnesota Milk Sanitarians Association. The subject matter covered at these meetings include discussions, demonstrations and interpretations of laboratory methods used in grading raw milk and in the evaluation of finished products. Three such meetings have been held in the New Alm, Fergus Falls and Grand Rapids areas with a fourth meeting in the southern part of the state, scheduled for some time in August. Members of the Dairy Bacteriology staff at the University and regulatory personnel from the Department of Agriculture, Dairy and Food are cooperating with the Association in this work. These meetings have been open to all dairy plant and field personnel. The afternoon programs have been directed primarily to laboratory and field personnel concerned with improving the quality of milk for manufacturing purposes. Since the grade A milk program has become extensive in Minnesota, the evening programs have been devoted primarily to discussions, demonstrations and interpretations of laboratory procedures used in evaluating raw and finished market milk products including cottage cheese. Emphasis is being placed upon proper laboratory techniques and the efficient utilization of the results by industry field service personnel and by management. The rather rapid increase in the number of laboratories in Dairy Plants throughout the state and the increased use of commercial laboratory service by the state and the increased use of commercial laboratory service by the industry has made the subject matter of the regional meetings very timely.

On September 15, 16 and 17 the University of Minnesota will hold their annual Dairy Products Institute. The program for the last day of the Institute, September 17, will cover subecjts of interest primarily to Sanitarians. This conference will conclude the year's educational activity of the Minnesota Association.

BACTERIOLOGICAL INVESTIGATIONS ON FROZEN STUFFED POULTRY[0]

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(Received for Publication, May 16, 1954)

The aerobic, anaerobic, and putrefactive anaerobe populations in the dressing of frozen stuffed chickens showed no significant changes during storage of the chickens for 12 months at —10° F. Packaging material appeared to have no significant effect on the bacteria content of the dressing. During thawing and holding at room temperature, frozen stuffed chickens had a marked increase in aerobic and anaerobic bacteria counts after 20 hours. This was accompanied by an increase in acidity and the development of off-odors. Spores of a putrefactive anaerobe inoculated into the stuffing prior to freezing showed no evidence of germination and growth under this condition. The biological picture seemed to be unaffected by packaging material.

Introduction

A relatively new development in marketing is frozen stuffed ready-to-cook poultry. In the preparation of this product, the eviscerated birds are stuffed prior to being packaged and frozen. It was believed that further information on the bacteriology of frozen stuffed poultry would aid in the achieving of good handling procedures for this product. Specifically, the objects of this study were:

1. To determine whether or not conditions in a mass of bread stuffing, such as those present in stuffed, poultry, are favorable for the growth of anaerobes.

2. To determine the effect of freezing and subsequent storage at 0° F for one year on the survival of aerobic and anaerobic bacteria and the spores of a putrefactive anaerobe in packaged stuffed poultry.

3. To determine the effect of thawing and holding at room temperature on the growth of aerobic and anaerobic bacteria and the spores of a putrefactive anaerobe in frozen stuffed poultry.

Review of Literature

Published reports on the specific subject of frozen stuffed poultry are meager. However, there are such abundant recordings of investigations on the microbiological nature and public health aspects of other frozen foodstuffs that a judicious survey of the literature yields much information that could be applied to frozen stuffed poultry. From a review of the literature associated with this particular study, the following conclusions may be summarized:

1. Certain frozen foods, including poultry and poultry stuffing, provide a good medium for the growth of microorganisms among which are those associated with food poisoning outbreaks. Frozen foods have not been implicated in any case of botulism. However, it has been suggested that improper handling of such foods will cause trouble. On the other hand, some investigators think that the growth of the usual bacterial flora with accompanying acid production would inhibit the growth of *Clostridium botulinum* in spoiled frozen foods. [3, 5, 8, 10, 11, 13, 14, 17, 18, 19, 20, 25, 26, 27, 29, 34, 36, 37, 39]

2. Freezing and low temperature storage are not effective in reducing significantly the numbers of microorganisms present. [4, 6, 15, 23, 24, 31, 33]

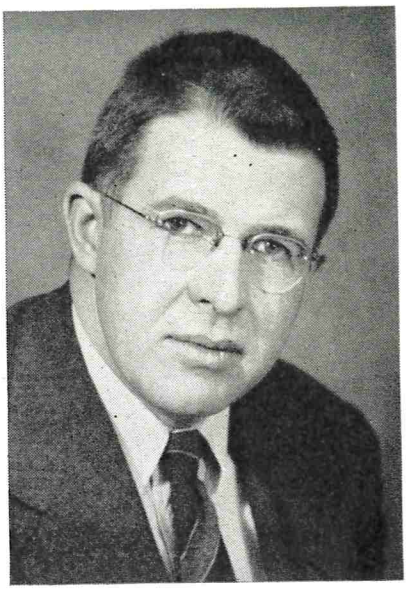
3. Good dressing and eviscerating practices and plant sanitation are essential in keeping bacterial counts to a minimum. [9, 12, 16, 28, 35, 38]

4. The rate of cooling and removal of body heat should be such that the temperature of the product is lowered rapidly enough to prevent any appreciable increase in the number of bacteria present. [22, 30, 32]

5. Prompt packaging of eviscerated poultry provides an effective means of preventing recontamination. [2, 21]

6. Frozen poultry including stuffed poultry is a highly perishable product and should be carefully handled during thawing, cooking, and subsequent holding. A temperature of 165° F should be reached in the center of the stuffing during the roasting period, [1, 7]. This temperature can be reached during the normal cooking of stuffed birds weighing less than 18 pounds. The roasting should be completed at one time.

7. In large stuffed birds, heat transfer during cooking is too slow to provide temperatures adequate to destroy potentially harmful bacteria at the center of the stuffing.[1, 7]



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Experimental Procedure

The experimental procedures in these investigations may be summarized as follows:

1. *Bacteriological Methods*

a. *Sampling*: Packages of poultry stuffing and packaged frozen stuffed poultry were opened aseptically with a sterile knife and spatula. A plug of stuffing from the outside to the center of the mass was removed by means of a sterile trier, and 10-gram samples were weighed into sterile wide-mouth dilution bottles containing 90 ml of water and glass beads. The bottles (which provided an initial 1 to 10

[0]Contribution No. 931 Massachusetts Agricultural Experiment Station

TABLE 1—GROWTH OF BACTERIA AND CHANGES IN pH OF POULTRY STUFFING PACKAGED IN CRYOVAC, PLIOFILM, AND CELLOPHANE DURING STORAGE AT ROOM TEMPERATURE

Time (hrs.)	Log of bacteria count per gram of stuffing					
	Control			Inoculated with P.A. 3679		
	Cryovac	Pliofilm	Cellophane	Cryovac	Pliofilm	Cellophane
			Aerobes			
0	6.02	6.02	6.02	5.96	5.96	5.96
24	8.11	8.32	8.24	8.08	8.17	8.10
48	8.00	8.16	8.07	8.18	8.04	7.94
72	8.25	8.21	8.31	8.17	8.34	8.12
96	8.40	8.26	8.45	8.32	8.30	8.26
118	8.19	8.15	8.21	8.11	8.17	8.10
142	8.43	8.39	8.14	8.17	8.11	8.16
166	8.13	8.14	8.17	8.14	8.43	8.10
			Anaerobes			
0	5.82	5.82	5.82	5.57	5.57	5.57
24	7.53	7.53	7.52	7.53	7.53	7.57
48	7.84	8.00	7.84	8.00	8.00	7.84
72	8.60	8.00	8.57	8.57	8.00	8.57
96	8.00	7.60	8.57	8.00	9.53	8.60
118	7.84	8.84	7.84	8.60	7.84	9.53
142	8.00	8.74	7.74	8.00	8.00	8.00
166	8.00	8.00	8.60	8.60	8.60	7.84
			pH			
0	5.45	5.45	5.45	5.45	5.45	5.45
24	5.14	5.17	5.20	5.16	5.18	5.17
48	4.86	4.95	4.93	4.87	5.00	4.89
72	4.61	4.56	4.60	4.55	4.53	4.55
96	4.46	4.39	4.36	4.39	4.50	4.41
118	4.33	4.30	4.29	4.33	4.32	4.29
142	4.30	4.30	4.29	4.29	4.34	4.37
166	4.22	4.07	4.12	4.11	4.08	4.08

dilution) were shaken 50 times to disintegrate the stuffing thoroughly. Serial dilutions up to 1 to 10 billion were then prepared for plating.

b. *Aerobic Bacteria Count*: Fifteen-ml amounts of Difco Nutrient Agar were used with poured Petri plates for determining the aerobic bacteria count. The plates were incubated for 3 days at 92° F.

c. *Anaerobic Bacteria Count*: The anaerobic bacteria count was determined by the decimal dilution procedure wherein 1-ml amounts of the dilutions were inoculated into freshly exhausted tubes of liver broth containing 0.1 percent soluble starch. These liver broth tubes were stratified immediately with a melted mixture of two parts mineral oil to one part paraffin. The tubes were incubated at 92° F for two weeks after the last positive tube appeared.

d. *Putrefactive Anaerobe Spore Count*: A second series of liver broth tubes was prepared and inoculated according to the procedure for anaerobe counts. To destroy vegetative cells, these stratified tubes were held in boiling water for five minutes and immediately chilled in cold water. The tubes were incubated at 92° F for two weeks after the last positive tube appeared. The presence of putrefactive anaerobes was detected by gas formation, digestion of meat, and characteristic odor.

2. *Packaging*

Portions of stuffing were packaged in small Cryovac (also known as Cryorap)† bags, Pliofilm (FF 120 gauge), and Cellophane (300 MSAT 87). The stuffed poultry was packaged in Cryovac bags and Cellophane (300 MSAT 87). The Cryovac packages were evacuated with an aspirator, twisted, clipped, and shrunk in water at 205° F. Sheets of Pliofilm and Cellophane were used with the drug-store wrap and heat-sealed. These packages had only a single thickness of film, except at the folds.

3. *Bacteriological Studies on Commercial Poultry Stuffing*

Three different lots of poultry stuffing prepared in a commercial plant engaged in the packing of frozen stuffed poultry were used. The stuffing was frozen at the plant and maintained in that condition during transportation to the laboratory. Packaged one-half pound portions of the stuffing, with and without inoculation of approximately 10,000 spores per gram of Putrefactive Anaerobe 3679 (a standard test organism), were stored at room temperature (at about 72° F) for approximately one week. The total aerobe and anaerobe counts and pH values were determined at intervals during storage. The results are summarized in Table 1.

The proximate composition of the stuffing was found* to be as follows:

Constituent	*Percent*
Moisture	44.9
Protein (N x 6.25)	7.6
Fat (ether extract)	18.4
Extract matter (carbohydrate)	26.2
Fiber	0.4
Ash	2.5

†Cryovac (sometimes known as Cryo-rap) is an oriented plastic film, copolymer of vinylidene chloride and vinyl chloride. Supplied by Dewey and Almy Chemical Company, Cambridge, Mass.

*Analysis by courtesy of Prof. J. W. Kuzmeski, Mass. Agr. Expt. Sta.

4. *Survival of Aerobic and Anaerobic Bacteria and Inoculated Spores of Putrefactive Anaerobe No. 3679 in Frozen Stuffed Poultry During Freezing and Storage at −10° F for One Year.*

Stuffed broilers, prepared under commercial conditions (at about 50° F) with uninoculated stuffing and with stuffing inoculated with spores of Putrefactive Anaerobe No. 3679 (10,000 spores per gram) were packaged, frozen, and stored at −10° F for one year. Immediately after being frozen and at intervals during storage, the aerobic and anaerobic and putrefactive anaerobe counts and pH values of stuffing from the poultry were determined. A minimum of five birds each were sampled for each test period and variable. The results are presented in Table 2.

TABLE 2—BACTERIA COUNTS OF STUFFING OF FROZEN STUFFED CHICKENS DURING STORAGE AT −10° F FOR ONE YEAR

Storage time (Months)	Log of Bacteria Count per Gram of Dressing			
	Control		Inoculated with P.A. 3679	
	Cryovac	Cellophane	Cryovac	Cellophane
		Aerobes		
0	5.43	5.43	5.28	5.28
1	5.32	5.30	5.17	5.34
2	5.56	5.48	5.56	5.49
3	5.14	5.34	5.33	5.36
4	5.55	5.28	5.39	5.44
5	5.50	5.49	5.55	5.57
6	5.72	5.58	5.45	5.68
8	5.75	5.67	5.92	5.65
10	5.59	5.72	5.78	5.76
11	5.65	5.72	5.81	5.71
12	5.59	5.61	5.90	5.92
Average	5.55	5.55	5.63	5.61
		Anaerobes		
0	6.00	6.00	5.00	5.00
1	5.00	4.00	5.84	5.00
2	6.00	5.00	6.00	4.00
3	4.87	4.56	5.00	5.60
4	5.00	4.82	4.00	5.84
5	4.74	5.53	5.00	5.74
6	5.00	3.00	4.70	4.84
8	3.74	4.83	5.84	4.00
10	4.60	4.74	5.70	5.60
11	5.74	4.60	5.57	5.00
12	5.00	4.00	4.00	3.00
Average	5.45	5.19	5.52	5.35
		Putrefactive anaerobes		
0	2.00	2.00	4.00	4.00
1	2.00	2.00	4.60	4.74
2	2.00	0.00	4.00	4.00
3	1.87	.48	3.84	3.78
4	2.00	1.84	4.00	4.60
5	1.74	1.00	3.84	4.60
6	0.00	1.74	4.00	4.00
8	2.00	1.60	4.60	4.74
10	1.84	1.74	3.74	4.60
11	2.00	3.00	4.84	3.74
12	2.00	2.00	4.00	4.00
Average	1.91	2.14	4.30	4.41

5. *Effect of Thawing and Holding Frozen Stuffed Poultry at Room Temperature on the Growth of Aerobic and Anaerobic Bacteria and Putrefactive Anaerobes*

Stuffed broilers, prepared as described above, were frozen and stored at −10° F. After various storage periods, groups of birds were removed from the freezer and held at room temperature (about 72° F). Aerobic and anaerobic bacteria and putrefactive anaerobe counts, and pH values of the stuffing from individual birds were determined at six-time intervals, up to 65 hours, during thawing and holding at room temperature. The birds were also examined organoleptically for evidence of spoilage during these tests. The results of five series are summarized in Table 3. Typical data obtained are also shown in Figures 1 to 4.

DISCUSSION AND RESULTS

Bacteriological Studies on Commercial Poultry Stuffing

There was a rapid increase in the bacteria count of poultry stuffing packaged in Cryovac, Pliofilm, and Cellophane, stored at room temperature during the first 24 to 48 hours. At the end of that time the bacteria counts tended to level off until there was some evidence of a decrease in viable organisms after 100 hours of storage. Both the aerobic and anaerobic bacteria counts showed essentially the same trends. The increase in bacterial population of the stuffing during storage was accompanied by a decrease in pH value (increase in acidity). These changes were to be expected in a predominantly carbohydrate medium such as poultry stuffing. During these tests there was little evidence of growth of putrefactive anaerobes.

The data obtained showed no significant differences in the development of bacteria with the three kinds of packaging materials used. The increase in bacteria counts in the stuffing during storage at room temperature was rapid and essentially the same with all the three packaging materials.

After 3 to 4 days of storage at room temperature the stuffing, which was not in vacuumized packages, sometimes showed considerable surface mold growth; whereas, that which was vacuumized showed no evidence of such mold growth at any time. This absence of mold growth in the latter can be attributed to the maintenance of a low oxygen tension within the package and the absence of "air pockets."

The moisture content of the poultry stuffing tested (in the range of 40 to 50 percent) was conducive to good bacterial growth, and such a medium could also be very favorable to the growth of organisms of public health significance.

Effect of Freezing and Storage at −10° F on Stuffed Poultry

Examination of stuffed poultry

TABLE 3—CHANGES IN BACTERIA COUNTS AND OF pH STUFFING OF FROZEN STUFFED CHICKEN DURING THAWING AND HOLDING AT ROOM TEMPERATURE

Time (hrs.)	Log of Bacteria Counts			
	Control		Inoculated with P.A. 3679	
	Cryovac	Cellophane	Cryovac	Cellophane
	Aerobes			
0	5.63	5.55	5.61	5.71
16	5.70	5.74	6.11	5.94
22	6.35	6.06	6.10	5.92
28	6.71	7.52	7.15	7.50
40	8.28	8.15	8.31	8.33
46	8.61	8.61	8.65	8.57
64	9.41	9.45	9.28	9.48
	Anaerobes			
0	5.45	4.79	5.39	5.38
16	6.35	4.80	6.31	5.45
22	6.39	6.35	6.39	7.31
28	7.41	6.39	7.35	7.31
40	7.91	7.66	7.91	8.42
46	8.45	9.35	8.64	8.64
64	8.74	9.00	9.45	8.90
	Putrefactive anaerobes			
0	1.60	1.78	4.00	4.00
16	2.34	0.00	4.45	4.66
22	2.34	1.30	4.79	4.66
28	2.60	0.00	4.42	4.45
40	1.34	1.60	4.45	4.66
46	0.00	2.30	4.45	4.45
64	1.48	1.72	4.45	4.51
	pH			
0	5.56	5.59	5.52	5.42
16	5.54	5.45	5.53	5.40
22	5.46	5.55	5.41	5.45
28	5.46	5.41	5.45	5.45
40	5.13	5.28	4.95	5.10
46	4.86	4.89	4.73	4.87
64	4.52	4.79	4.40	4.44

during storage at −10° F showed no significant changes in the aerobic, anaerobic, and putrefactive anaerobe populations in the stuffing over a period of twelve months. The kind of packaging material had no significant effect on the bacteria content of the stuffing. It would thus appear that the vacuum process employed in the Cryovac package had no significant influence on the stuffing either from a quality or public health standpoint.

It was interesting to note that the poultry packaged in Cryovac showed little or no evidence of freezerburn even at the end of twelve-month cold storage period. This is attributed to the vacuumizing and shrinking process and the gas-tight nature of the film.

Effect of Thawing and Holding Frozen Stuffed Poultry at Room Temperature

When frozen stuffed poultry was thawed and held at room temperature (70 to 80° F), there was a slight increase in the aerobic and anaerobic bacteria counts in the stuffing during the first 20 to 24 hours after removal from the freezer storage (−10° F). Development of bacteria was slow because the temperature of the bird was suboptimal for bacterial growth, and the bacterial cells were in the lag phase of their growth cycle. When the bird had warmed to room temperature, the logarithmic growth phase had been reached, and there was a rapid increase in the aerobic and anaerobic bacteria counts in the stuffing during the period from 20 to 24 hours up to 64 hours after removal from the freezer storage.

During this 64-hour period there was no significant change in the putrefactive anaerobe spore count in the stuffing of the chickens. There was no indication that the spores of Putrefactive Anaerobe No. 3679, previously inoculated into the stuffing, germinated or grew during this period.

The acidity as measured by a drop in pH value showed a progressive increase as the bacteria count increased during holding at room temperature. For example, the pH dropped from an initial value of about 5.5 to about 4.8 in 48 hours. This increase in acidity was to be expected during the fermentation of a predominantly carbohydrate medium such as poultry stuffing.

The failure of the inoculated putrefactive anaerobe spores to germinate and grow is attributed to the development of acid in the medium and also to a rapid overgrowth of other mircoorganisms. This inhibition of spore germination by acid production and overgrowth by other microorganisms has been suggested and recognized by Prescott and Geer [26], Fitzgerald [14], Berry [4], and Perry, *et al.* [25].

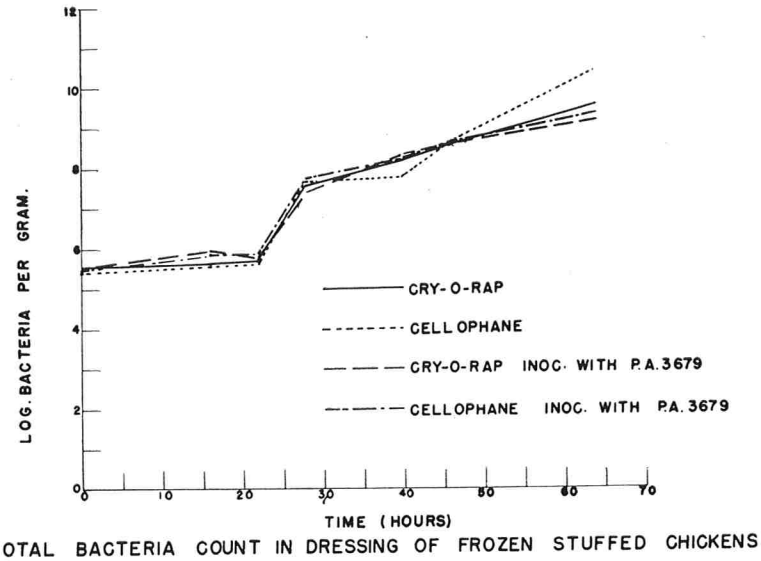
Again the kind of packaging material had no significant effect on the development of bacteria in the stuffing during thawing.

Organoleptic observations were made on these defrosted birds during holding at room temperature. After approximately 16 hours, a slight but noticeable off-odor had developed in all samples. After 24 hours the odor was quite strong and characteristic of spoiled poultry. This odor became progressively more marked and putrid as holding time increased.

CONCLUSIONS

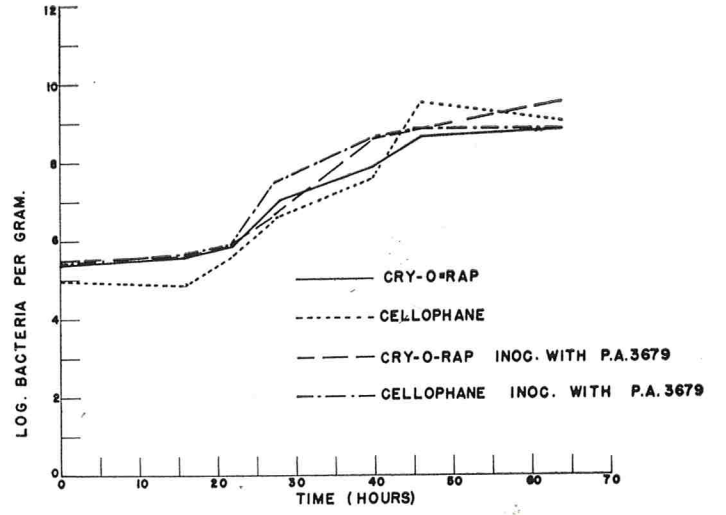
On the basis of the experimental work reported herein, it is concluded that:

1. Commercial poultry stuffing such as that used with frozen prepared poultry is an excellent medium for the growth of bacteria and, therefore, should be handled as a perishable food. The stuffing itself and poultry stuffed with it should be adequately refrigerated or frozen at all times except during the actual preparation and packing operations, when such low temperatures may be impossible to maintain. Under no conditions should the poultry stuffing be permitted to be at room temperature for more than the shortest time consistent with good packing procedures. Not more than



TOTAL BACTERIA COUNT IN DRESSING OF FROZEN STUFFED CHICKENS DURING THAWING AT ROOM TEMPERATURE. (AV. OF THREE TESTS)

Figure 1



TOTAL ANAEROBE COUNT IN DRESSING OF FROZEN STUFFED CHICKENS DURING THAWING AT ROOM TEMPERATURE. (AV. OF THREE TESTS)

Figure 2

four hours should elapse before the product is placed in the freezer.

2. Tests with poultry stuffing inoculated with spores of a putrefactive anaerobe of the *Clostridium* genus (P.A. 3679) indicate that at room temperature the rapid growth and acid production by other organisms present prevents or inhibits the growth of the former. Tests by others working with frozen vegetables have shown that this relationship between the growth of different bacteria provides an effective safeguard against the growth of *Cl. botulinum* in thawed frozen foods.

3. The growth and development of bacteria in poultry stuffing held at room temperature was essentially the same with the three different packaging materials used.

4. The observations in the present work indicate that vacuum packaging, by maintaining a low oxygen tension and absence of "air pockets" within the package, is effective in preventing or delaying surface mold growth on packaged products. Such factors in addition to gas-tightness properties and positive sealing properties are effective in inhibiting freezerburn or dehydration. Vacuum packaged frozen stuffed poultry maintained its quality during storage at 0° F for one year.

5. The aerobic, anaerobic, and putrefactive anaerobe populations in the dressing of frozen stuffed chickens showed no significant changes during storage of the chickens for 12 months at −10° F. Packaging material appeared to have no significant effect on the bacteria content of the dressing.

6. During thawing and holding at room temperature, frozen stuffed chickens had a marked increase in aerobic and anaerobic bacteria counts after 20 hours. This was accompanied by an increase in acidity and the development of off-odors. Spores of a putrefactive anaerobe inoculated into the stuffing prior to freezing showed no evidence of germination and growth under these conditions. The biological picture seemed to be unaffected by packaging material.

ACKNOWLEDGMENT

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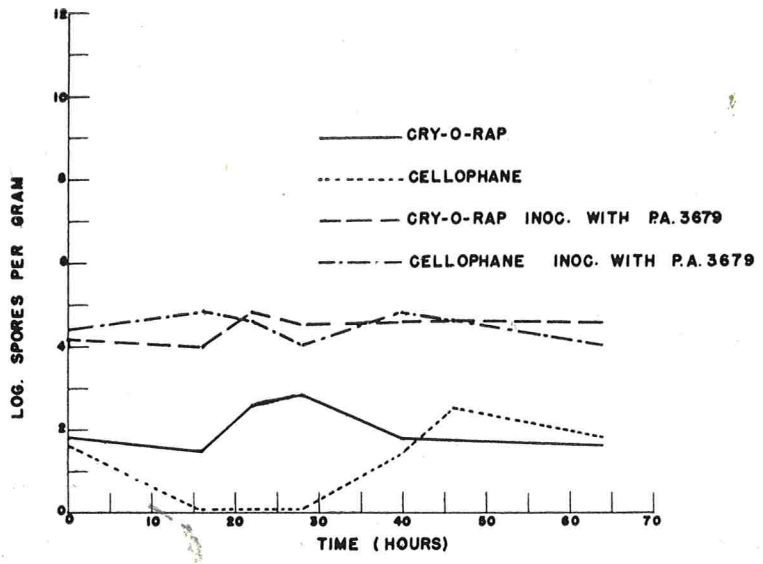
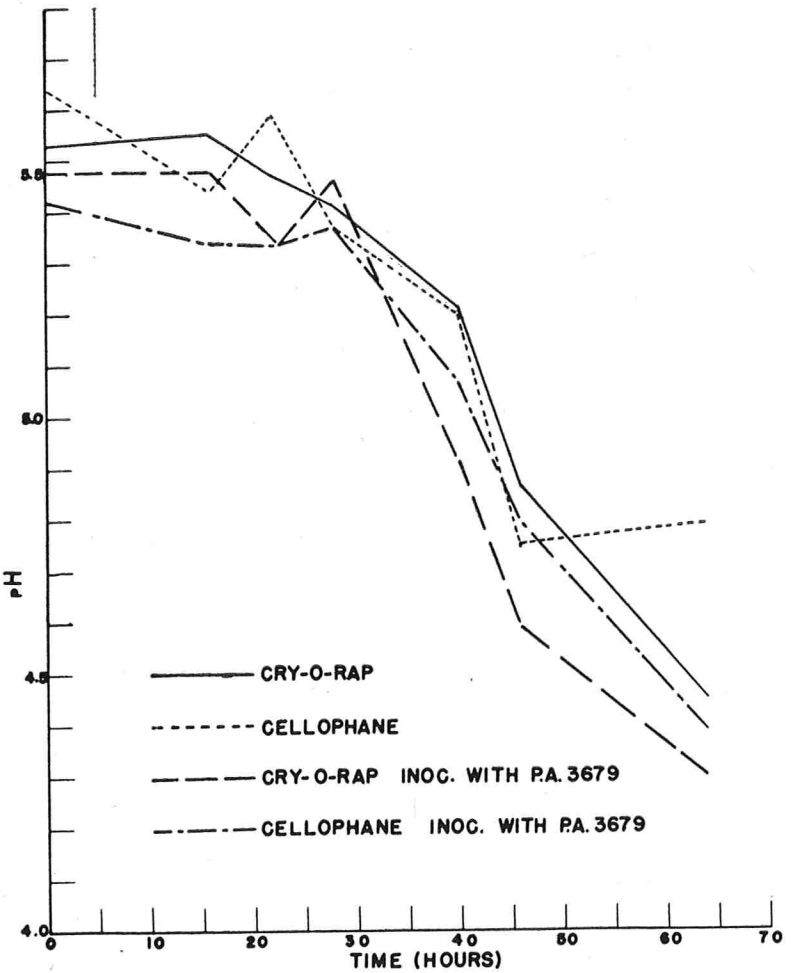


PUTREFACTIVE ANAEROBE SPORE COUNT IN DRESSING OF FROZEN STUFFED CHICKENS DURING THAWING AT ROOM TEMPERATURE

Figure 3



pH CHANGE IN DRESSING OF FROZEN STUFFED CHICKENS DURING THAWING AT ROOM TEMPERATURE

Figure 4

OPEN REFRIGERATED DISPLAY CASES[1]

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The use of open refrigerated display cases is a recent development in the field of merchandising food products on a retail level. With each new development comes many questions regarding the operation of the equipment and the ability of the new unit to perform as compared to previous ones. There is no one publication available today which covers the various questions pertaining to the usage and operation of open refrigerated display cases. Several publications were reviewed to obtain the information for this paper. There is a need for cooperation of sanitarians and engineers in the design and operation of display cases. Usually the equipment is properly designed but certain operational procedures are not followed at the retail level which make the units objectionable in some cases. There is very little difference in the operation of open refrigerated display cases as compared to the conventional refrigerated display cases. The main difference is one of procedure in using the equipment.

There is a great amount of waste and spoilage of fruits, vegetables, milk and meat at the retail level. It was recently estimated that 35 percent of the nation's vegetable production is lost between the farmer and the consumer[1a]. It is generally agreed that the losses of fresh fruits and vegetables at the retail level are from 4 percent to 8 percent[1b]. In any business the decrease of waste and spoilage accounts for an increase in efficiency with an overall saving to the purchaser and/or increased profits to the producer. The previous data regarding losses and wastage indicate that considerable spoilage occurs at places other than the retail store outlets. Improper handling and marketing practices between the producer and the retail store are probably a greater problem than the display cases from the standpoint of preventing losses. Also, it is important to note that some of the waste or spoilage that occurs in the retail stores may be due to improper handling and marketing practices used prior to the time the products are received at the store.

The growth of the self-service of meats in particular, has been dependent upon two things: (a) development of suitable package materials; (b) development of equipment for handling products at a uniformly low temperature[2].

In tests carried out in the Philadelphia area 3.5 percent of the losses of vegetables occured in stores in the summer where refrigerated display cases were used as compared to 7.6 percent losses where refrigerated units were not used[2].

CLASSIFICATION OF UNITS

Display cases can be divided into the following types:

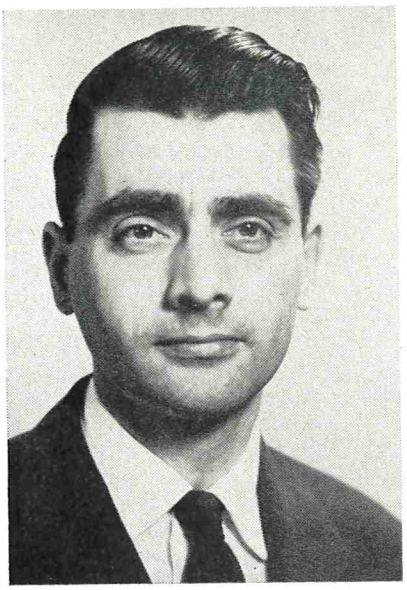
Bin type, angular
Canopy type
Magazine feed type
Multiple deck
Pigeon hole
Open-front
Open-top

Of the various types we are mainly interested in discussing the last two, inasmuch as the former types have been used for many years. They will be used as standard for comparison. Self-service cases include such features as rear loading, one-way vision mirrors, lighting, automatic defrosting equipment, and various methods of maintaining low temperatures.

The units are normally designed to maintain a low temperature product rather than to cool products. A unit would have to have much larger refrigeration capacity in order to cool the product to a low temperature. In later sections of the paper the relationships between lighting, temperature, and humidity on maintaining the quality of the product will be discussed.

The standard refrigerated boxes should be designed to maintain temperatures of from 36° to 42° F. In addition, a fairly high humidity of from 70 to 85 percent is required for all cut and uncovered foods[3]. The high humidities are required in order to avoid dehydration or drying of the product. A uniform movement of air is required in order to maintain uniform temperatures throughout the box. It is best that the air is not blown directly on the products so that excessive drying is prevented.

Open refrigerated display cases are commonly used for fruits and vegetables, milk, meat, and eggs.



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[1]Paper presented at the Dairy & Food Inspectors & Sanitarians School, Kellogg Center, Michigan State College, East Lansing, Michigan. April 5 to 7, 1954.

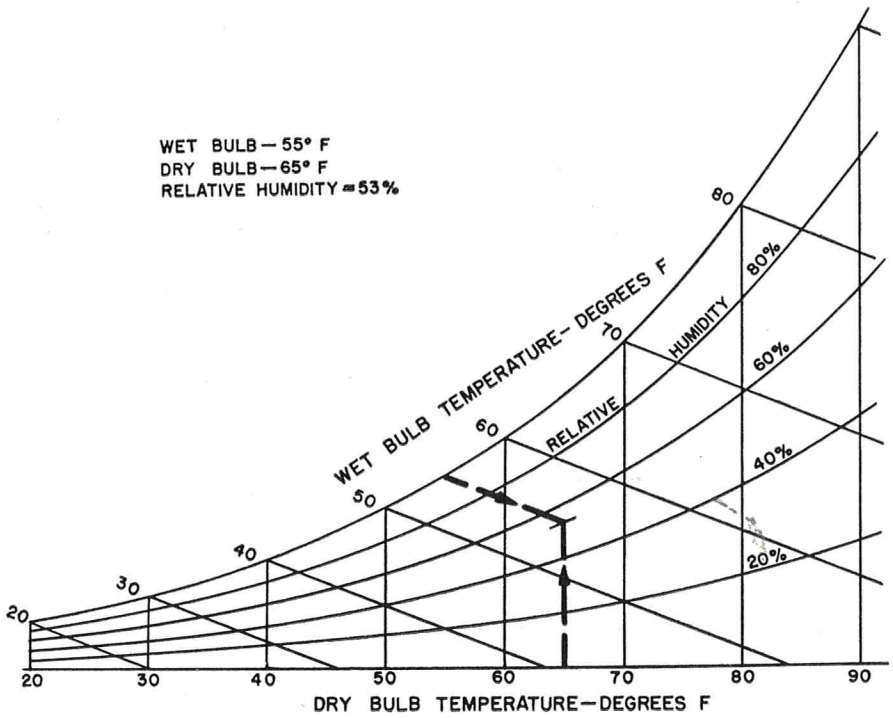

FIG. 1 HUMIDITY OR PSYCHROMETRIC CHART

LOCATION OF UNIT

One of the most important factors to consider is that the open display case should not be placed around fans or drafts. The unit should be kept away from doors. By following these suggestions foreign material will not be blown into the cooler and warm air will be kept out, thus decreasing the refrigeration load and maintaining a lower temperature in the product.

A drain must usually be available for removing water from the unit, particularly during the defrosting period. Some units do not require drain connections because they are equipped with systems of disposing of water by the use of heat from the refrigeration system [4a].

TEMPERATURES AND HUMIDITIES

From the standpoint of maintaining the quality of product in the display case, the maintenance of temperature and humidity is probably the most important item. A display unit should be equipped with a thermometer—usually a dial thermometer. A thermometer for checking refrigerated display cases should have scale divisions which are widely spaced and easy to read, probably with a scale that ranges from about 10° to 90° F. There is some variation in the temperature throughout the box. The bulb of the thermometer should be placed on a level with the highest point to which the product is placed in the case. It is important that the thermometer is not placed close to the cooling coils or cooling plate. If the thermometer has a metal back it should be mounted on a wooden surface or a small piece of wood which will act as an insulator[5].

The maintenance of the proper recommended humidity is particularly important for unpackaged produce or produce placed in ventilated packages. The relative humidity is measured by a psychrometer. The common psychrometer is composed of two thermometers, one a wet bulb and the other a dry bulb. Water will evaporate from the wet bulb of the thermometer, with the evaporation of water cooling the thermometer thus giving a lower temperature. The amount of temperature depression will depend upon the rate at which water is evaporated from the wet bulb which in turn is dependent upon the moisture in the air. The relative humidity is then obtained from a psychrometric chart (See Figure 1). Instruments are also available for reading the relative humidity directly. Some commercial companies have placed the information on the psychrometric chart on a simple slide rule to aid in rapidly obtaining the relative humidity without a chart.

a. *Vegetable and Fruit Cooler*

Considerable work has been done to determine the shelf life of various fresh fruits and vegetables in retail store display cases, by the Division of Handling, Transportation, and Storage of Horticultural Crops of the Agricultural Research Administration, the U.S.D.A.[6–12].

It is a well-known fact that with refrigeration the respiration rate of packaged produce is much lower than otherwise. At lower temperatures produce requires less oxygen and produces less carbon dioxide, e.g., strawberries respire only about 1/5 as fast at 40° as at 70° F. Apples respire only 1/14 as fast, peaches 1/9 as fast, potatoes 1/2 as fast and sweet corn 1/5 as fast at 40° as at 70° F[13].

The difficulty of obtaining desirable refrigeration at various points in the refrigerated display cases has been pointed out[14]. This was caused mainly by the fact that pre-packaged produce interfered with the circulation of refrigerated air. It was experienced to some extent for the cooling of bulk produce.

Very few stores have adequate refrigerated space in which to store all of their produce. A priority basis is needed for using refrigerated space. Table 1 lists those fruits and vegetables in three groups—those in which refrigeration is essential, those in which refrigeration is desirable, and those in which no refrigeration is desired.

Produce stored and displayed on a false-bottom rack, in a regular refrigerated case did not keep satisfactorily, and should not be recommended.

On a percentage basis the greatest losses of produce in refrigerated display cases were as follows: lima beans, 17; eggplant, 16; pineapple, 16; parsnips, 16; kale, 16; and corn, 16 percent[1].

Vegetables inside the refrigerated zone became chilled and upon chilling moisture is condensed from the room air on the vegetables. There is little exchange of air between the refrigerated box and the room. The warm air normally

TABLE 1—PRIORITY FOR REFRIGERATION SPACE[1]

Refrigeration essential		*Refrigeration desirable*	*No refrigeration desired*
Apples, summer	Kale	Apples, winter	Bananas
Artichokes	Head lettuce	Avacados	Cucumbers
Asparagus	Limes	Beans, snap	Lemons
Lima beans	Mushrooms	Beets	Onions
Berries	Pears, ripe	Cabbage	Pears, green
Broccoli	Peas	Carrots	Peppers
Brussel sprouts	Pineapples, ripe	Egg plant	Pineapples, green
Cauliflower	Radishes	Grapefruit	Potatoes
Celery	Salad mixes	Oranges	Sweet potatoes
Cherries	Scallions	Parsnips	
Chicory	Spinach	Rhubarb	
Cole slaw	Sweet corn	Tomatoes	
	Tangerines		

rises because it is lighter. In general, the temperature range for open vegetable cases will vary from 35° - 46° F.[3]

Tests by the U.S.D.A. give the variation of temperatures in a refrigerated box[6].

b. *Milk Cooler*

Pasteurized milk, if cooled properly, will keep a long time. In tests at Michigan State College, milk was held at 33° F for two to six weeks without flavor deterioration[15]. However, at temperatures higher than 33° F flavor deterioration proceeded quite rapidly.

A survey of 17 states in 37 cities in which nearly 16,000 stores and 24,000 restaurants and dairy bars and 920 roadside stands were contacted, showed that 60 percent of the milk delivered to the stores was above 50° F and 16 percent above 60° F[16]. About 55 percent of the milk delivered to the restaurants was above 55° F and 19 percent above 60° F. This information points out one of the important operations which is often neglected in the handling of the products from the processor to the retailer. More attention should be given to maintaining proper temperature before the milk is delivered to the store. In the same survey it was found that over 1/2 of the milk was at least 24 hours old in the display cases. In the same area most cities set a maximum temperature of 50° F.

Other researchers have recommended that milk be stored below 50° F[17]. This is particularly important where delivery is every-other-day or three days a week, so that milk will retain its quality up to four days after pasteurization. Under home-refrigerated conditions at about 40° F, 3- and 4-day old milk tested showed 97 percent had no or slight increase in acidity, while with 5- and 6-day milk, only 64 percent and 55 percent had no or slight increase in acidity. There was also a decided increase in bacteria count with the 5- and 6-day old milk over the 3- and 4-day milk, with the refrigerator temperature varying from 37° to 52° F[17].

In the closed-type dairy cases, temperatures of 36° to 45° F are considered satisfactory[3]. The same should apply to open display cases inasmuch as milk is enclosed in a moisture-proof carton and the effect of humidity would not apply as for vegetables and fruits which are not packaged.

c. *Meat Cooler.*

The lowest temperature which can be provided without freezing the meat is desirable. The practical range is from 32° to 34° F. The relative humidity may average as low as 60 percent in mechanically refrigerated self-service cases. Fresh meats are in equilibrium with about 95 percent relative humidity[2]. Meat placed in the refrigerated air stream would normally dry out. Therefore a moisture-proof wrap is required to prevent dehydration of meat. When stored at 40° F, package fresh beef can be kept on display for three days, while at 50° F two days, at 72° F one day, before the color of the product becomes unsatisfactory because of high temperature[2]. It was found that air movement across steak samples for one self-service case under self-service conditions was about 25 ft. per minute[18], in a room of about 70° F and 30 percent relative humidity. The relative humidity in the box varied from 50 to 71 percent. Temperatures varied up to 5° F from the front to the back of the box, with the highest temperature in the middle. When the meat was not stacked, the upper edge of the steak placed in the display box was 2° to 4° F warmer than the lower surface. On keeping quality tests, much better quality was obtained at 32° F than at 34° or 40° F. In two days at 40° F mold development on the packaged steaks hit the logarithmic spiral, while at 34° F six days were required. Other changes which might be caused or speeded by bacterial growth would be discoloration, slime formation, and off-odor, any of which could render the meat unsalable.

The average inlet air temperature on a commercial meat cooler for one model is 24° to 30° F[19]. The meat products should be placed in a ribbon display so that air will be circulated around the product from the refrigeration coil to get as much cooling as possible.

Temperatures for beef, veal, and lamb should be carefully regulated so that the minimum does not fall below 32° F in order to prevent darkening due to slow freezing action[5].

d. *Egg Cooler.*

Generally eggs are displayed unrefrigerated or if refrigerated, placed in the same unit in which milk and cheese are stored. In retail stores in New York state, 32 percent of the eggs were refrigerated[20]. It is generally considered that the proper temperature for egg storage is between 45° and 60° F. At temperatures below 45° F, condensation often occurs on the eggs when they are removed from the refrigerated area, giving an undesirable product. The humidity chart discussed previously can be used to determine if condensation will take place. A special open egg display case has been developed to maintain the proper temperature. The refrigeration for cooling eggs will come from plates extending along the sides of rows of cartoned eggs rather than from the rear of the eggs. Thus, cold air will circulate directly from the coils to the egg cartons, and maintain proper temperature more easily without a variation in temperature

from the bottom to the top of the display case[20].

e. *Frozen meats and juices.*

These products require temperatures of from −5° to +5° F[3]. It is important that frozen foods in these cases should be stored low enough to prevent being affected by the higher temperatures which occur in the buffer area at the top of the display space and the room temperature above. Some units have lids which can be closed at night and over weekends.

With rapid air movement over meat about 50 percent of the time, and stored at 0° F, 21 different packaging materials on fresh ground beef were tested[21]. It was found that fresh ground beef quality could be maintained for as long as 14 months and still have good color and no more than 1/2 percent shrink based on weight. A list of the various packaging materials was presented in the report and the value of the material on the hasis of surface dehydration given.

PACKAGING RELATIONSHIPS

Much material has been published on the relationship of various materials for packaging meats and vegetables. In fact, an entire monthly periodical entitled *Modern Packaging* is available for those interested. If properly packaged with a material such as MSAT cellophane, bacterial growth will be retarded if the refrigeration unit holds the product in the display case at a temperature of from 34° to 40° F. Color deterioration is a major problem encountered with packaged meats[22].

LIGHTING

Oftentimes, discoloration of meat is attributed to lighting when the actual difficulty might be because of too low a temperature. Fresh meats should not be maintained below 32° and smoked meat should be kept at 38° to 40° F for best color retention[23].

Also, discoloration of meat might be caused by darkening of the surface due to dehydration which usually can be corrected by using a higher humidity around the meats. This can be accomplished by lowering the velocity of the air.

If the light on the meat is of great intensity or of long duration, the meat will fade quite rapidly. The light changes the color pigment. If the light intensity is above 35 footcandles [4b], fading of meat may take place in commercial units. The footcandle light intensity can be measured by an exposure meter similar to or the same as a meter used in photography. It was formerly thought that the effect of ultraviolet light caused meat, particularly pork, to become rancid and therefore the flourescent lights which contain a greater amount of ultraviolet light were less desirable. However, it has been found that the fading of color was due to light intenstiy and exposure time regardless of whether an incandescent lamp or fluorescent lamp was used, as long as the intensities of the two lights were the same [24, 25]. An intensity of 60 footcandles for one hour was the minimum exposure which caused fading[25]. It was also found that display in the frozen state did not alter the susceptibility to fading with different lights.

GENERAL HANDLING AND DISPLAY

It is important to emphasize again that the product should be delivered to the store in good and cooled condition before it is placed on display. For example, many city ordinances require that milk be 50° F or less when sold. It would also be important that the milk be delivered to the store at 50° F and at all steps in the delivery operation the product be held below this temperature. It would seem that sanitarians should be aware of this fact because they might penalize the retail outlet for improper handling before the retail store even received the product.

Most boxes have directions or marks regarding the amount of produce that should be placed in the display case. This is actually about 9 inches above the floor. Users of refrigerating equipment should not be permitted to place more product in the display case than recommended by the manufacturer. To do this, permits too high temperatures in the top layer of product with resulting spoilage. Bacterial action is considerably higher in improperly refrigerated products.

Tests have been conducted in which vegetables have been sprinkled four times daily as compared to non-sprinkled lots. Sprinkling with tap water four times daily had no cooling effect on the product but it kept it at tractive longer and reduced moisture loss[6].

Burlap covers for placing over the produce in the refrigerated display case are available. Prior to placing the cover over the produce, the latter should be sprayed with water and then the cover should be saturated with water[4]. This procedure keeps the product moist throughout the night and should increase the shelf life of the product.

MAINTENANCE, OPERATION, HEALTH REQUIREMENTS

With the first display boxes which had a closed glass front defrosting was not a particular problem because the cooling coil was operated at a temperature slightly above freezing. However, with the open front refrigeration equipment the necessity of using small coils because of limited space, it is necessary to operate the cooling coil at a temperature below freezing in order to maintain the proper temperature in the freezing or cooling compartment. When the cooling coil is operated below freezing, ice accumulates on that coil. The cooling coils become inefficient as an ice layer builds up on them. The following methods may be used for defrosting: (a) manual, (b) timers, (c) electrical means, (d) hot gas, (e) auxiliary heat, and (f) a timer with pressure reset.

SUMMARY

Although the open refrigerated display cases have been introduced recently they have been designed so that when properly used, food products will be adequately preserved. The principles which apply in the operation of the closed refrigerated display cases apply in almost every respect to the open cases. The amount of loss at the retail level can be reduced considerably by use of refrigerated cases. The open refrigerated display case cut the losses in one-half as compared with no refrigeration of vegetable products.

The unit should be placed where there will not be a draft. The temperature and humidity should be adjusted according to the recommendations for various products. By using the proper package material the importance of relative humidity control, especially for meat, is decreased. The intensity of light in footcandles, not the kind

of light source, that is, fluorescent or incandescent, is the criterium for determining whether or not meat will be discolored.

Sanitarians must be aware of the fact that although produce in the display case may be spoiled, it may have been caused by improper handling prior to delivery at the retail outlet. Retail men have an interest in getting a good product. Company recommendations should be followed regarding the amount of produce and placement of produce in the open display case. By using proper methods the material will be maintained at the proper temperature and humidity in an open unit and will be attractive so that maximum customer appeal will be obtained.

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THIRD REPORT OF THE RESOLUTIONS COMMITTEE of the Association of Food and Drug Officials of the United States May 21, 1954

RESOLUTION X

WHEREAS, The Association of Food and Drug Officials of the United States assembled in annual convention, Des Moines, Iowa, May 20, 1954, has carefully studied and evaluated House Bill 8368, entitled "A Bill to Amend the Agricultural Marketing Act of 1937, so as to Remove Domestic Trade Barriers Affecting Milk and Milk Products", introduced by Hon. August H. Andressen, referred to the Committee on Agriculture,

WHEREAS, It is believed that the authors of this bill, while concerned with the remedies which they sought, failed to recognize the untoward effect that the principle employed would have in depriving all states of their traditional, inherent and rightful authority in ordering their own affairs and in promoting and protecting the health and welfare of their people;

WHEREAS, It is considered apparent that the principle of this bill is wrong, that it would serve no constructive purpose in promoting the sale of milk nor in promoting the principles of public health.

THEREFORE, BE IT RESOLVED, That because of the defective nature of this Bill, both in principle and detail, this Association is not only unalterably opposed to its passage as law, but also is opposed to this principle in legislation.

(Signed) E. W. Constable
(Chairman)
J. H. McCutchen
Sarah Dugan

MILK and FOOD SANITATION

A STUDY OF MILKING MACHINE INFLATIONS MADE OF NEOPRENE COMPARED WITH THOSE OF NATURAL RUBBER*

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Several types of neoprene inflations for milking machines were compared under actual farm conditions with those of natural rubber. Physical changes in volume and weight were measured and bacteriological comparisons were made by both the swab technique and the dynamic methods. Neoprene inflations consistently outlasted rubber, and neoprene showed less distortion in shape. The bacterial population of neoprene was consistently less than that of rubber.

A study was made on the milking efficiency of neoprene inflations and rubbber inflations of similar shape. In these tests neoprene was slightly superior to rubber in speed of milking and amount of milk produced.

The synthesis of natural rubber as produced by the tree has never been accomplished in the laboratory. The so-called synthetic rubbers are elastic materials, termed elastomers, resembling the natural product in physical properties but differing from it in chemical composition. One of these elastomers is known as neoprene.

Neoprene (polymerized. 2 — Chloro—1, 3. outadiene) resists the destructive action of grease, heat, and chemicals. At present it is being used in the manufacture of many articles among which are milking machine inflations.

Since this material is fat resistant, neoprene inflations should have a longer life; and because of the greater resistance to cracking and checking would be expected to harbor fewer bacteria. Chemical and heat resistant qualities should also improve its performance.

This study was designed to compare the performance of neoprene and natural rubber inflations under similar circumstances and actual farm conditions.

Much has been written about the effect of inflation condition on the bacterial population and on the performance of milking equipment.

Claydon[1] made a microscopic and bacteriological study of used inflations in comparison with new ones to determine the effect of surface deterioration that could not be seen. He found that inflations in the early stages of surface deterioration are more susceptible to bacterial contamination than are new liners, even though they often appear to be almost similar in general physical condition. Cone[2] found that the rubber inflations and tubes of milking machines are the greatest source of thermoduric bacteria. Claydon[1] developed a test whereby sterile water was pulsated in the inflation and the bacterial population of the water determined. This physical manipulation should present a truer picture of the contamination in the inflation.

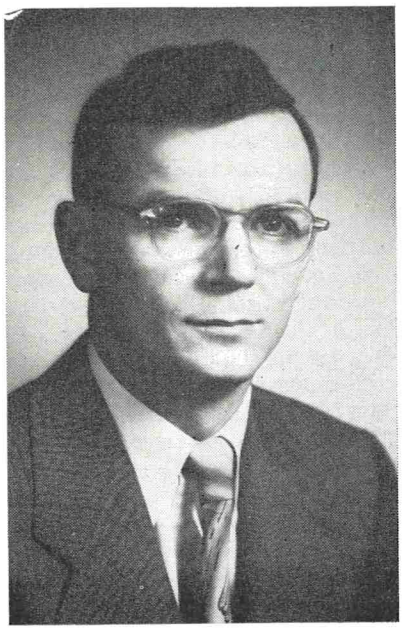
Moir[3] found discarded inflations to contain an average of 10 per cent by weight of fat. The fat was not evenly distributed, and certain parts frequently contained as high as 30 per cent. Prolonged treatment of the rubber in strong, hot, caustic soda solution is necessary to remove the fat, making the inflation fit for use again. The presence of fat in milking machine liners is probably the chief cause of their deterioration according to Gardner and Berridge[4]. The fat causes softening and swelling of the rubber and greasiness of its surface with consequent rapid deterioration and malfunction.

Experimental Procedure

Milking machine inflations made from neoprene were studied to determine their serviceability as compared with natural rubber inflations. Code letters were assigned to the inflations according to the type of machine on which they were used and according to the kind of material—either neoprene or natural rubber—used in making them.

Eight farms with a total of 25 milking units were furnished with inflations. Two neoprene and two natural rubber inflations were placed on each machine being used in the study. The farmers were told to treat the supplied inflations in the same manner they had been accustomed to treating their own. Washing and sterilizing methods on the selected farms varied widely. Most of the operators said that they did a thorough job after the morning milking although observation did not always confirm this. The evening treatment, with the exception of farm No. 3 where the equipment was thoroughly washed twice a day, usually consisted of a cold water rinse, with a few farms using a sterilizing agent. One, No. 7, did not even rinse his equipment at night if the weather was cool. The sanitation methods and facilities varied from very good on farm No. 3 to very poor on farm No. 7.

On seven of the eight farms, the



Dr. J. C. White received the B. S. degree from Cornell University in 1939 and the Ph.D. degree in 1944. From 1944 to 1946 he was associated with the Borden Cheese Company. He returned to Cornell University as Associate Professor of Dairy Science in 1946 and is now Professor of Dairy Science. He has been author or joint author of numerous articles in the fields of bacteriology and sanitation.

*This work was supported in part by the E. I. Du Pont de Nemours and Company, Inc. Neoprene inflations were furnished by D. S. Brown Co.

**Present address — Eastern Dairy Products Corp., Alexandria, Virginia.

(Received for publication June 3, 1954)

TABLE 1—SWAB TEST BACTERIA COUNTS

	RUBBER					NEOPRENE				
Farm	Type inflation	No. of counts	Log. av. count	Minimum count	Maximum count	Type inflation	No. of counts	Log. av. count	Minimum count	Maximum count
1	A	92	388	0	30,000	I	92	180	0	17,100
2	X	104	299	0	30,000	K	52	63	0	30,000
						L	52	424	0	30,000
3	F	104	163	0	30,000	M	52	75	0	1,500
4	T	24	960	150	3,400	N	52	40	0	1,070
						W	24	111	10	1,080
5	C	92	336	10	13,000	K	142	164	10	12,000
	U	92	343	20	22,700	L	142	202	0	24,600
	E	92	353	0	6,500					
6	T	32	3,427	60	29,000	W	32	1,961	50	22,100
7	B	16	17,130	460	78,000	V	16	12,890	450	58,000
ALL FARMS						Neo-				
Rubber		648	703	0	78,000	prene	656	297	0	58,000

This farmer discarded 15 rubber inflations but only one neoprene inflation during ten months of tests. Each of his units was equipped with two rubber and two neoprene inflations.

same inflations were swab tested every two weeks. For each neoprene inflation swabbed, a natural rubber inflation on the same unit was swabbed. The swab test solution was then plated, incubated, and the colonies of bacteria counted. This compared the bacterial condition of the two types of inflations, used exactly alike, under identical washing and sterilizing procedures.

Because bacteria might be harbored in minute surface crevices where they would not be collected by swabbing, a search was made for a test that would reveal the degree of retention. Claydon's technique utilized a partial vacuum and the pulsating action of the milking machine in the laboratory to determine the bacteria count of inflations but his equipment was too elaborate for use in the field. A small, portable unit consisting of a vacuum pump, a stall cock, a sanitary trap, and a vacuum controller was constructed for use on the various farms. A pulsator and a claw were connected to the stall cock and by attaching the air tube from the shell to the claw, a pulsating effect was obtained on the inflations just as in the milking operation. Sterile rubber stoppers were placed in the teat openings of the inflations and the inflations were filled with sterile water. The

TABLE 2

	RUBBER						NEOPRENE				
Farm no.	Type inflations	No. of inflations	No. of counts	Log. av. count	Min. count	Max. count	Type inflation	No. of inflations	No. of counts	Log. av. count	Min. count	Max. count
7	B	2	56	54,410	4,000	300,000	V	2	56	34,460	2,100	300,000
5	C	4	72	7,892	200	78,000	L	4	72	3,730	200	177,000

TABLE 3—AVERAGE INCREASES IN WEIGHT AND VOLUME

	Average days use	No. of inflations	Volume increase* ml	Weight increase* gm
Rubber	128	79	14.4	8.0
Neoprene	214	60	1.5	2.1

*Calculated per 100 days use

inflations were pulsated for five minutes and the water was plated, incubated, and counted.

In order to determine the amount of fat absorption, each inflation was weighed before it was placed in use. It was weighed again, when it was removed from service for any reason. To determine the amount of distortion caused by the absorption of fat, or for any reason, the volume was measured before the inflation was placed in use and again when it was removed. The volume was measured to the nearest half milliliter.

From time to time observations were made on the condition of hoses and inflations to detect cracking and checking.

Milking efficiency was also studied to determine comparative performance in terms of time to milk and amount of milk obtained. Two farms were set up for this test. On each farm, one machine was equipped with neoprene inflations and another machine was equipped with natural rubber inflations. On one farm, five cows were selected at random from the herd. The time required to milk them and the quantity of milk given in that time was measured 3 days each week for 3 weeks using the machine equipped with neoprene inflations. The machines were exchanged, and the measurements taken for the natural rubber equipped machines for the same period of time. Since the other farm had only eight cows in lactation at the start of the test (another freshened a week later and was included), the time required for milking and the quality of milk given were measured for both machines. After the 3-week interval, the machines were exchanged and another 3-week period measured.

TABLE 4—REASONS FOR REMOVAL OF INFLATIONS

Reason for removal	Rubber	Neoprene
Worn out	33	0
Accident	4	9
Replaced by other types*	16	10
Tubes enlarged & set	0	3
Total	53	22

*These inflations were still functioning well.

TABLE 5—AVERAGE TIME OF MILKING AND AVERAGE WEIGHT OF MILK PRODUCED

	Rubber—B			Neoprene—V		
	Time		Weight	Time		Weight
Cow	Min.	Sec.	Pounds	Min.	Sec.	Pounds
Trial 1						
No. 1	6	30	24.05	6	17	24.05
No. 2	4	05	15.50	3	44	16.75
No. 3	6	20	29.40	5	24	29.60
No. 4	6	31	23.50	5	39	24.90
No. 5	6	55	23.60	5	26	23.70
Average	6	04	23.20	5	19	23.85
Trial 2						
	Rubber—T			Neoprene—W		
No. 1	8	14	27.90	5	55	27.65
No. 2	5	23	21.90	4	12	22.50
No. 3	6	02	10.20	6	28	9.70
No. 4	6	11	12.90	5	39	13.60
No. 5	7	50	15.90	7	40	16.50
No. 6	6	23	9.45	6	21	8.95
No. 7	3	46	16.15	3	46	15.20
No. 8	6	24	13.20	6	32	13.25
No. 9	4	05	19.95	4	48	21.50
Average	6	10	16.15	5	42	16.45

RESULTS AND DISCUSSION

The logarithmic averages of the swab tests are given in Table 1. An examination of this table shows the wide variation in count both between the two types of inflations and between the different farms. Only one type of neoprene inflation, L, had higher bacterial counts than its rubber comparisons.

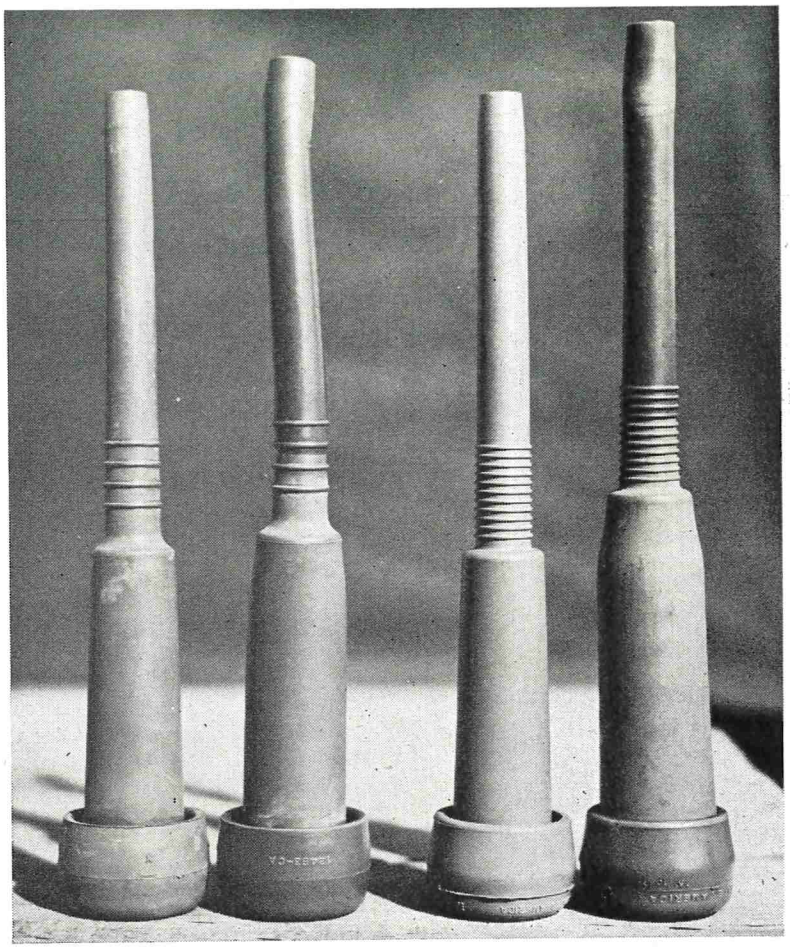
The results of the swab tests show that usually there were about twice as many bacteria removed by the swab from natural rubber as from neoprene.

The results indicate that neoprene is usually more effectively cleaned and sterilized than natural rubber under the same conditions. On the farms where the best conditions of cleaning and sterilizing prevailed the neoprene proved far superior to natural rubber in terms of the number of bacteria recovered.

Dynamic tests using the modified Claydon technique were made on 2 inflations of neoprene and 2 of natural rubber on one farm, and 4 inflations of each on another farm to determine if this method would give differing or more reliable figures. The results of these tests are given in Table 2. This table shows neoprene inflations were bacteriologically superior to natural rubber inflations in this series of tests.

A milking machine inflation absorbs fat, and, in so doing, becomes distorted. The added fat increases the weight of the inflation, the distortion changes its volume and milking efficiency. The increases in volume and weight of the inflations are shown in Table 3.

The rubber inflations averaged almost ten times the increase in volume and almost four times the increase in weight of the neoprene. It was observed that increases in weight and volume were much more marked in the later stages of use and, since many of the natural



New Neoprene Old Neoprene 231 days New Rubber Old Rubber 231 days

Relative increase in length of Neoprene and Rubber inflations after use. Note distortions of body and tube ends.

rubber inflations were removed because of malfunction in less than 100 days, the data are somewhat biased in favor of the natural rubber. A number of natural rubber inflations which were used for 170 days showed values for volume increase of more than 35 ml and weight increases of more than 15 gm.

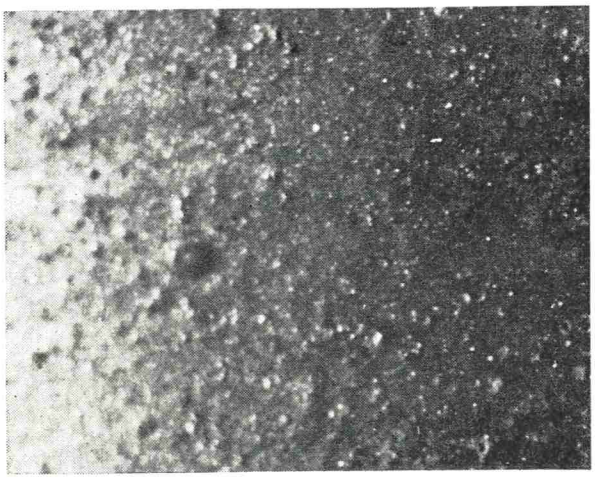
More rubber inflations were studied because their shorter life required more replacements.

During the time of this study, 53 natural rubber inflations were replaced as compared with 22 neoprene inflations. The reasons for replacement are shown in Table 4.

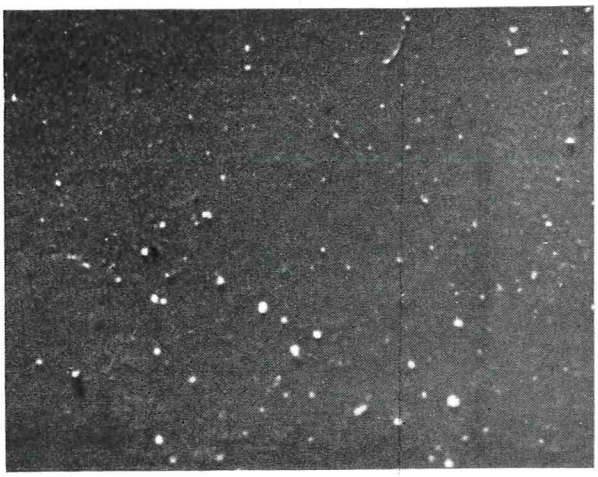
Three of the neoprene inflations, after extended use, had lost elasticity in the narrow tube, to a point where they would not cling tightly to the claw.

Farms No. 4 and No. 7 were used for the efficiency test, farm No. 7 being studied first. The average weight of milk produced per milking and the average time required to milk is given in Table 5. The weight of milk produced would be expected to remain the same or decline slightly as the test progressed. The table shows this to be true leaving the time of milking the only factor to be considered. On farm No. 7, the vacuum line became partially plugged resulting in an extremely long time of milking for cows No. 1 and No. 4. on the seventh day the machine equipped with neoprene inflations was used. Cow No. 5 required an extremely long time to milk on two occasions. No reason for this was ever determined.

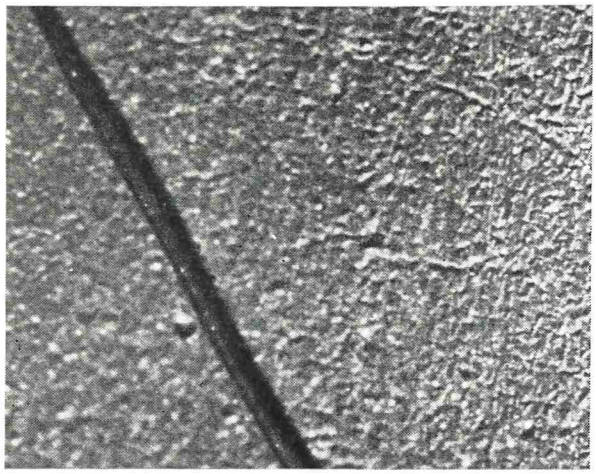
On farm No. 4, cows No. 1, No. 2, No. 4, No. 5, and No. 8 were milked with the machine equipped with neoprene inflations the first three weeks, and then with the machine equipped with natural rubber inflations. Cows No. 3, No. 6, No. 7, and No. 9 were milked with the rubber-equipped machine the first three weeks, followed by the neoprene equipped machine. As on farm No. 7, the weight of the milk produced was about as expected allowing for the natural decrease as the period of lactation advanced. There were two exceptions to this.



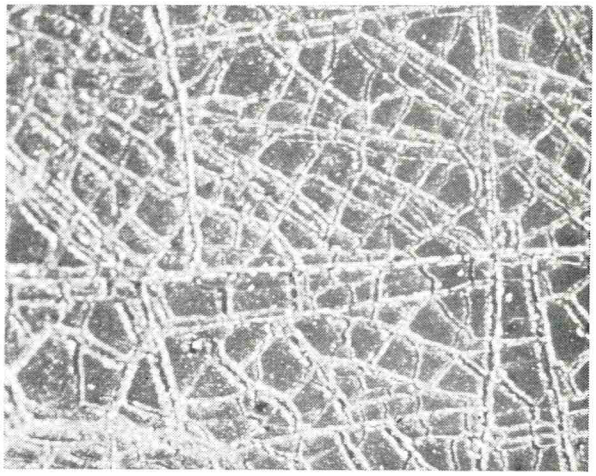
New Neoprene



New Rubber

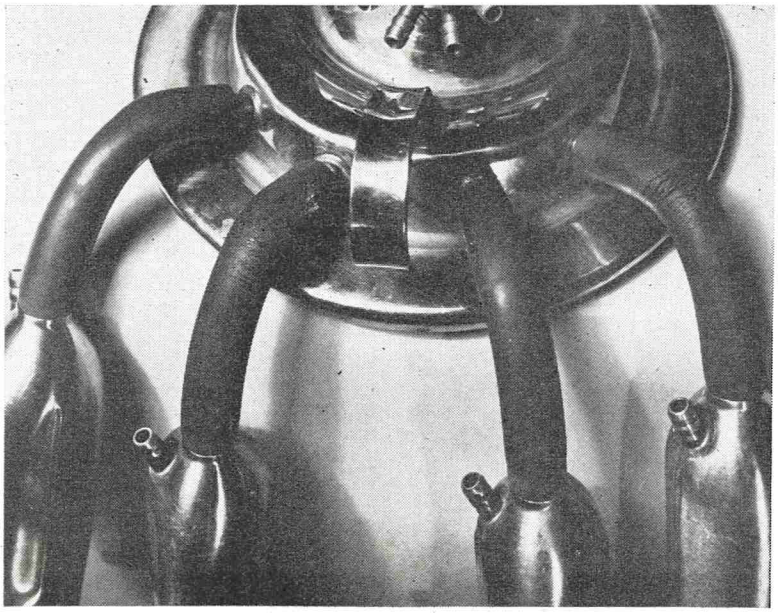


Old Neoprene (300 days use)



Old Rubber (172 days use)

A comparison of surface conditions of liners. The line across the picture of old neoprene is a human hair. All pictures 30 X magnification.



Neoprene Rubber Neoprene Rubber

Neoprene and Rubber inflations showing cracking of the material after one hundred sixteen days of regular use.

Cow No. 1 had just freshened when the experiment started, and required stripping by hand the first two weeks that the neoprene-equipped machine was used on her. Also, the last two days that each machine was used on her, she was slow in milking due to a foot-rot infection. Cow No. 9 freshened the second week of the experiment, and was hand stripped for three milkings while being milked with the rubber equipped machine.

The neoprene-equipped machine milked the cows faster on all tested on farm No. 7, ranging from 13 seconds faster on cow No. 1 to 1 minute and 29 seconds faster on cow No. 5. On farm No. 4, the neoprene-equipped machine was faster on five of the nine cows, and the time was the same on one cow. The present data give the impression that a milking machine equipped with neoprene milks faster than one equipped with natural rubber. However, these data are not extensive enough to arrive at any conclusions.

CONCLUSIONS

1. Under the same conditions of cleaning and sterilizing the bacterial counts of neoprene inflations were better than those of natural rubber inflations.

2. Neoprene inflations develop less distortion than rubber inflations in field use, because of greater resistance to fat absorption.

3. Neoprene inflations have approximately 2 times the service life of rubber inflations.

4. Neoprene inflations were more efficient in the milking operation than natural rubber inflations in a limited series of tests.

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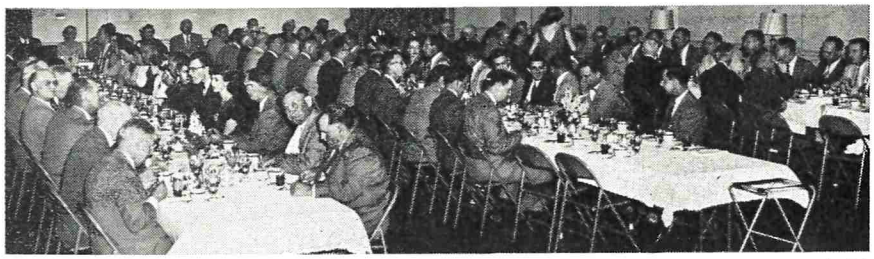
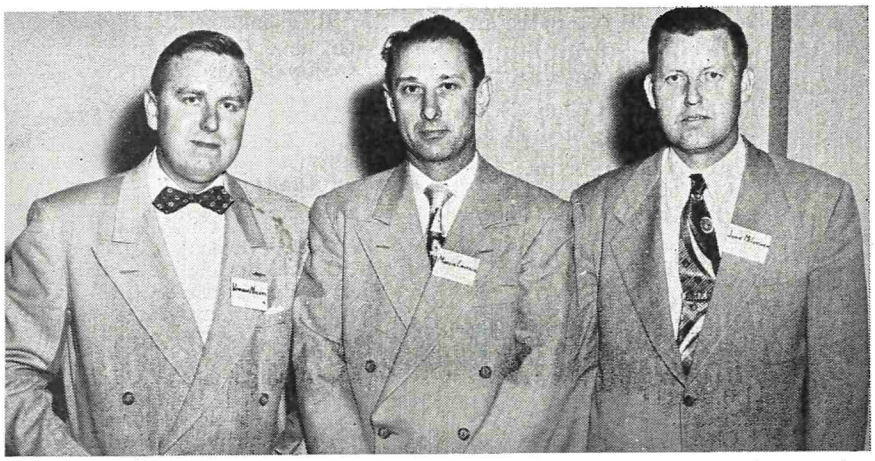


Annual dinner of the Missouri Association of Milk and Food Sanitarians held at the Annual Meeting in April.



Officers of Missouri Association of Milk and Food Sanitarians. Left to right: Vernon Nickel, Pres.; Marvin Campbell, Vice-Pres.; John H. McCutcheon, Sec.-Treas.

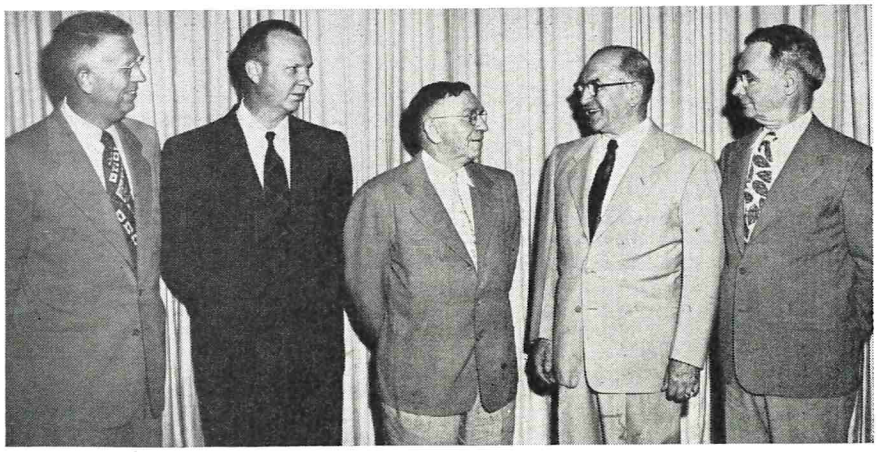
FIVE AWARDS PRESENTED AT AMERICAN DAIRY SCIENCE MEETING, JUNE 23.

Five of the nation's highest awards in dairy science were presented at the meetings of the American Dairy Science Association at the Pennsylvania State University.

J. H. McCain, secretary of the Borden Company Foundation personally handed gold medals and $1,000 checks to two winners.

The Borden Production Research award went to Dr. Lester E. Casida, a member of the genetics staff at University of Wisconsin for

Continued on Page 265



DAIRY SCIENCE AWARDS presented at the 49th annual meeting of the American Dairy Science Association at the Pennsylvania State University went to (left to right) Dr. Lester E. Casida, University of Wisconsin, Madison, Wis., Borden production research award; Dr. Paul R. Elliker, Oregon State College, Corvallis, Ore., Borden dairy manufacturing award; Dr. Carl F. Huffman, Michigan State College, East Lansing, Mich., American Feed Manufacturers Association award in animal nutrition; Charles R. Gearhart, Pennsylvania State University, State College, DeLaval extension dairyman award; and J. B. Fitch, University of Minnesota, Minneapolis, Minn., American Dairy Science Association honorary membership award, the highest award presented. Each of the first four awards included gold medals and $1,000 in cash.

Program 41st Annual Meeting — October 21 - 23
Hotel Morton, Atlantic City, N. J.
INTERNATIONAL ASSOCIATION MILK AND FOOD SANITARIANS, INC.

SPECIAL ACTIVITIES SCHEDULE

Time and place to be announced.

TUESDAY, OCTOBER 19, 1954

1:30—5:30 P.M. Meeting of Executive Board

7:00—11:00 P.M. Meeting of Executive Board

WEDNESDAY, OCTOBER 20, 1954

8:30—12:00 Noon Meeting of Executive Board

1:30—3:30 P.M. Meeting of Executive Board

7:00—11:00 P.M. Meeting of Executive Board

1:30—10:00 P.M. Registration Desk Open

1:30—5:30 P.M. Individual Committee Meetings

3:30—5:30 P.M. Executive Board and Journal Editors Meeting

THURSDAY, OCTOBER 21, 1954

7:30—9:30 P.M. Affiliate Council and Executive Board Meeting

FRIDAY, OCTOBER 22, 1954

Annual Banquet

OCTOBER 21, 1954 — THURSDAY MORNING

Quarterdeck
John D. Faulkner, Chairman

8:00 a.m. Registration desk opens.

8:00 a.m. Movie—"Making the Most of a Miracle" courtesy of American Plant Food Council, Washington, D.C.

8:45 a.m. Door prizes presented by the various affiliates

9:00 am. Welcoming address—Dr. Daniel Bergsma, Sec'y. of Health, Trenton, N. J. Presented by .....?....., Atlantic City, N.J.

9:15 a.m. President's address—John D. Faulkner, Washington, D. C.

9:45 a.m. Appointment of and charge to nominating committee

10:00 a.m. Report of the Sanitary Procedures Committee by C. A. Abele, Chairman

MILK SESSION PROGRAM

Quarterdeck
Presiding—David E. Monk, Milk Control Supervisor Wichita, Kansas,
Sedgwick County Department of Public Health

10:30 a.m. The Coliform Problem in Fruit Ice Cream —Franklin Barber, Senior Scientist, Nat'l, Dairy Research Laboratory, Inc., Oakland, Long Island, N. Y.

11:00 a.m. Bacterial Problems: Psychrophilic-Thermophilic-Thermoduric William K. Mosely, Mosley Laboratory, Indianapolis, Indiana

11:30 a.m. Further Studies in the Sanitary and Economic Aspects of Bulk Milk Handling H. E. Calbert, Assoc. Prof. of Dairy Science, U. of Wisconsin, Madison, Wis.

FOOD SESSION PROGRAM

English Room
Presiding—James A. Stalbird, Chief, Milk and Restaurant Section, N. Y. State Health Dept., Albany, N. Y.

10:30—11:10 a.m. The New Ohio State Food Service Operation Program—Ray Watts, State of Ohio, Department of Health, Columbus, Ohio.

11:00—11:10 a.m. Discussion

11:10—11:40 a.m. Food Additives under the Federal Law—Ralph Kneeland, Federal Food and Drug Adm., Washington, D. C.

11:40—11:50 a.m. Discussion

11:50—12:15 p.m. The Sanitarian in a Generalized City Program, P. W. Purdom, Director, Division of Environmental Sanitation, Dept. of Health, Philadelphia, Pa.

12:15—12:30 p.m. Discussion

OCTOBER 21, 1954 — THURSDAY AFTERNOON

BUSINESS MEETING, COMMITTEE REPORTS

Presiding — John D. Faulkner

1:30 p.m. Door prizes presented by the various affiliates.

1:45 p.m. Business meeting and committee reports
Educational and Professional Development —Harold S. Adams
Milk Regulations and Ordinances —C. J. Babcock
Applied Laboratory Methods —Dr. C. K. Johns
Communicable Disease Affecting Man —Dr. R. J. Helvig

4:00—6:00 p.m. Committee Chairman and Executive Board get together

7:30—9:30 p.m. Affiliate Council and Executive Board

OCTOBER 22, 1954 — FRIDAY MORNING

Quarterdeck
I. E. Parkin, Chairman

8:30 a.m. Door prizes presented by the various affiliates.

8:45 a.m. Report of Nominating Committee

9:00 a.m. Report of Dairy Farm Methods—Chester F. Bletch

9:15 am. The Need for Salesmanship instead of Policemanship—Ernest B. Kellogg, Secy. Milk Industry Foundation, Washington, D.C.

9:45 a.m. The Worth and Domain of Applied Sanitary Science—A Rationale and a Plea N. A. Milone, Resident Lecturer, School of Public Health, Ann Arbor, Michigan

MILK SESSION PROGRAM

Quarterdeck
Presiding – ????

10:30 a.m. The National Status of Brucellosis—E. J. Perry, Prof. of Dairy Extension, Rutgers University, New Brunswick, New ersey

11:00 a.m. Farm Water Supplies—A. W. Fletcher, Director of Environmental Sanitation, New Jersey Dept. of Health, Trenton, New Jersey

11:30 a.m. Dairy Waste Disposal—R. R. Kountz, Prof. of Sanitary Engineering, Pennsylvania State University, State College, Pennsylvania

FOOD SESSION PROGRAM

English Room

Presiding—Harold B. Richie
Swift and Co., Chicago, Illinois

10:30—11:00 am. The New Poultry Sanitation Ordinance – Recommended to Industry Timothy Sullivan, Division of Food and Drugs, Indiana State Board of Health, Indianapolis, Indiana

11:00—11:10 a.m. Discussion

11:10—11:45 a.m. Relative Resistance of Meat Spoilage Bacteria to High Energy Radiatoins Dr. C. F. Niven, Jr., American Meat Institute Foundation, Chicago, Ill.

11:45—12:00 a.m. Discussion

12:00—12:30 p.m. Public Health Aspects of Shell-Fisheries, N. Y. State Conservation Dept., fish Control—Harold Udell, Bureau of Freeport, Long Island, N. Y.

Discussion

OCTOBER 22, 1954 — FRIDAY AFTERNOON

GENERAL AND BUSINESS SESSION

Presiding—John D. Faulkner

1:30 p.m. Movie — "An Outbreak of Salmonella" courtesy of U. S. Public Health Service, Washington, D. C.

2:00 p.m. Door prizes presented by the various affiliates.

2:15 p.m. Discussion of the National Conference of Interstate Milk Shipments—Richard Whitehead, Mississippi State Supervisor of Food and Milk Sanitation, State Health Board, Jackson, Mississippi

2:45 p.m. Business meeting and Committee reports
Food Equipment—John H. Fritz
Frozen Food Sanitation—Dr. V. C. Stebnitz
Membership—Hugh T. Templeton

4:00 p.m. Movie "Mastitis" Courtesy of Cornell University, Veterinary College

FRIDAY EVENING

Annual Banquet
Address "Greatest Yet" by J. Roger Deas, Public Relations Manager, American Can Company, New York, New York
Presentation of the Citation Award and Presentation of the Sanitarians Award by H. J. Barnum, Chairman Recognition and Awards Committee

OCTOBER 23, 1954 — SATURDAY MORNING

Quarterdeck

Ivan Van Nortwick, Chairman

8:30 a.m. Movie "500,000 to 1" courtesy of Sinclair Refining Co., 600 5th Ave., New York, N. Y.

9:00 a.m. Door prizes presented by the various affiliates.

9:15 a.m. Report of Recognition and Awards Committee by Harold J. Barnum

9:30 a.m. Future Trends of the Milk and Food Industry—A. L. Wentworth, The Borden Co., New York City, N.Y.

10:00 a.m. Report of Resolutions Committee by Dr. K. G. Weckel

MILK SESSION PROGRAM

Quarterdeck

Presiding—?????

10:30 a.m.—12:00 Noon Pipe line Milking Panel—H. J. Barnum, Moderator—Panel Participants: Paul Corash, N. Y. City Dept. of Health; George Watrous, Penna. State University; George Rue, Allentown, N. J.; Tom Medford, Westgrove, Pa., Wm. R. Cook, East Longmeadow, Mass.; Richard S. Guthrie, De Kalb, Illinois; A. F. Gallistel, Minneapolis, Minnesota

FOOD SESSION PROGRAM

English Room

Presiding—Jerome Trichter, Assistant Commissioner New York City Health Department

10:30—11:30 a.m. A New Look at Mechanical

Dishwashing—a panel discussion
1. Dishwashing machines — Performance standards, testing and field observation —Jack McAllister, Nat'l. Sanitation Foundation, Ann Arbor, Michigan
2. Dishwashing machine fabrication and operation from the manufacturer's viewpoint—J. B. Fox, The Hobart Mfg. Co., Troy, Ohio
3. Getting the most for detergents in mechanical dishwashing — Dr. Elwyn Mendenhall, Avril Chemical Co., Reading, Pa.

11:30—11:45 a.m. Discussion

11:45 a.m—12:15 p.m Showing of new USPHS film releases on food sanitation
1. Kitchen habits, color and sound (12 minutes)
2. Food preparation, color and sound (13 minutes

Comments

OCTOBER 23, 1954 — SATURDAY AFTERNOON

Presiding—Harold S. Adams

GENERAL AND BUSINESS SESSION

1:30 p.m. Door prizes presented by the various affiliates

1:45 p.m. Public Attitudes — Norman Myrick, Editor of the American Milk Review, New York, N. Y.

2:15 p.m. Bulk Milk Dispensers—Walter D. Tiedman, Exec. Director, Nat'l. Sanitation Foundation Testing Laboratory, Inc., Ann Arbor, Michigan

2:45 p.m. Business meeting, President John D. Faulkner
Election of Officers
Installation of Officers
Executive Board Meeting

AWARDS PRESENTED AT AMERICAN DAIRY SCIENCE MEETING

Continued from Page 262

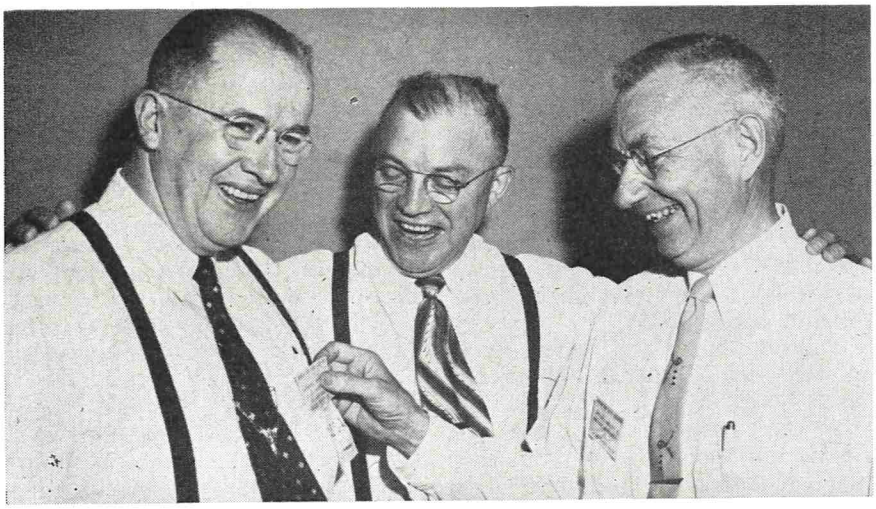
20 years, in recognition of his work in the physiology of reproduction and studies of bovine sterility. He is a native of Missouri.

The Borden Award in Dairy Manufacturing went to Dr. Paul R. Elliker, professor of dairy bacteriology at Oregon State College in recognition of his work in bacteriology for the dairy industry. He received his bachelor, master, and doctor's degrees at Wisconsin.

The American Feed Manufacturers Association Award of a gold medal and $1,000 check went to Dr. Carl F. Huffman, of Michigan State College, a former Borden award winner, recognizing his work in mineral metabolism of dairy animals. R. T. Parkhurst, chairman of the Nutrition Council, made the presentation.

C. R. Gearhart, extension dairyman of the Pennsylvania State University, won the DeLaval Extension Dairyman Award, recognizing his work of more than 30 years in dairy herd improvement association activities. Dr. George Hopson, Poughkeepsie, N. Y., of the DeLaval Co., presented the award.

The American Dairy Science Association honorary membership award, highest recognition of the Association, went to Prof. J. B. Fitch, head of the dairy husbandry at the University of Minnesota, for his efforts in behalf of the organization.



BADGE FOR BENSON — Dr. Walter V. Price (right), of the University of Wisconsin, president of the American Dairy Science Association, pins an ADSA badge on Secretary of Agriculture Ezra T. Benson following his address to the Association at the Pennsylvania State University. In center is Dr. Milton S. Eisenhower, president of the University.

SECRETARY OF AGRICULTURE EZRA T. BENSON ADDRESSES AMERICAN DAIRY SCIENCE ASSOCIATION MEETING

Secretary of Agriculture Ezra T. Benson today continued his fight for a flexible price support program.

Addressing the American Dairy Science Association meeting at the Pennsylvania State University, Secretary Benson said that high, rigid supports give the farmer not too much, but in actual practice, give him too little.

"In the long run, they take from him more than he receives. They encourage him to deplete his soil. They saddle the markets with price-depressing surpluses which give him no opportunity to realize full parity for his production," Secretary Benson said.

"They destroy the normal relationship of feed and livestock prices. They price him out of many natural markets both at home and abroad and at the same time encourage the development of competitive synthetics and substitutes which further shrink agricultural outlets.

"They place him in such a tight production straightjacket that he loses most of his freedom to make management decisions," Secretary Benson continued.

Most farm commodities in

trouble today are those which the government attempted to support at 90 per cent of parity—wheat, corn, cotton, and dairy products. More than $5 billion of the $6½ billion tied up in price supports is committed to those four items.

"Despite the emphasis which our programs place upon the six basic commodities—and the present controversy centers mainly around the question of rigid versus flexible supports for these crops—they produce only 23 per cent of the farmers' cash marketing receipts," Secretary Benson explained.

"Fifty-six percent of the Nation's farm income is derived from commodities which have no direct price supports at all. The other 21 per cent comes from products already supported on a flexible basis."

Turning to dairy products, Secretary Benson told the 1,700 dairy scientists that the dairy industry needs every push that science can give it toward increased efficiency in production and marketing.

"It needs further outlets through new products," Secretary Benson said, "and it needs critical re-examination of outmoded formulas which place too much emphasis on butterfat and not enough on nonfat milk solids."

Pointing out that "plain milk is the most nearly perfect food—and it tastes good," Secretary Benson said that the dairy industry has not done an adequate job of promoting and selling dairy products. He suggested that dairymen try automatic vending machines, such as the manufacturers of many products have done, to make milk more easily available.

Although milk production last year reached an all-time high and this year has been even higher, Secretary Benson said that if the American people were drinking as much milk per capita as they were only a few years ago, there would be no dairy surpluses. And he pointed out that in those high-consumption years, millions of our people were not getting even the minimum amount of milk required for their own welfare.

High quality food proteins, such as milk, should find a ready market in a diet-conscious America which is steadily swinging away from such traditional foods as grain products and potatoes, the Secretary continued.

"This change in eating habits is forcing changes in our agricultural production patterns," Secretary Benson said, "yet we have gone merrily on our way with a farm program tied to another generation".

"Most of our current grain surpluses stem directly from the fact that government price supports encourage farmers to produce corn and many other grains for storage, rather than for livestock feed. We continue to pile up these surpluses in warehouses—far beyond our needs—through a pricing device which discourages their conversion into the type of food the American people need and will buy."

Secretary Benson then pointed out that in the case of dairy products, it would be especially unfortunate if we were to seek a solution through higher price supports, rather than through a program of vigorous sales promotion, research and education, and sensible culling.

"We are painfully learning, through our experience with dairy products, some lessons that could have been more easily learned by a review of history," Secretary Benson said.

"We are learning that if price supports are long maintained above their natural level, certain results follow as surely as the night follows the day. Production is stimulated. Consumption is retarded. Surpluses pile up. And the costly and offensive problem of surplus disposal follows."

RESOLUTIONS ADOPTED BY 58TH ANNUAL CONFERENCE ASSOCIATION OF FOOD AND DRUG OFFICIALS DES MOINES, IOWA

SECOND REPORT OF THE RESOLUTIONS COMMITTEE
of the
Association of Food and Drug Officials of the United States
May 21, 1954

RESOLUTION IX

WHEREAS, The Association of Food and Drug Control Officials of the United States, assembled in regular annual conference, Des Moines, Iowa, May 21, 1954, takes cognizance of the fact that the indiscriminate sale of artifically sweetened foods is not in the best interest of the public health and welfare;

WHEREAS, It is recognized that such indiscriminate sales can be inimical

To the sound nutrition of children

To the welfare of the great mass of adults whose need is for a full, normal diet

To those whose need is for a special diet, but who may be mislead into false belief that synthetic sweeteners will be a cure-all for all of their difficulties

To the economic welfare of all who may not be aware that the foods purchased by them are not the customary, normal variety

Whereas, These facts have been re-emphasized to this Association by other such control Associations, through commitments similar to this;

THEREFORE BE IT RESOLVED, That in the labeling and marketing of artificially sweetened foods, this Association concurs in and supports principles as set forth in the following sections:

1. In our opinion the utilization of synthetic sweeteners such as saccharin or cyclamate sweeteners (Sucaryl) in ordinary foods is in violation of the Food, Drug and Cosmetic Act. We take no exception to the use of saccharin or Sucaryl in foods designed for special dietary purposes; provided the labeling is distinctive and informative, and provided the foods are in fact special dietary foods with properties of usefulness in the treatment or control of disease. This may alone not alleviate consumer deception; therefore, distribution controls must be enforced to prevent the indiscriminate purchase of special dietary foods by those who do not want nor need them.

2. Segregation of these special foods from ordinary foods shall be necessary and intermingling with ordinary foods would create deception; thus, special shelves so designated must be provided for the special dietary foods.

3. Shelf display and advertising material contrived to promote sales should augment the special dietary character of the articles to prevent their being confused with ordinary foods and/or beverages.

4. The label shall bear in part this statement: "Contains .....

INDEX TO ADVERTISERS

saccharin (or sulfamate or the name of other non-toxic or harmless non-nutritive artificial sweetener) a non-nutritive artificial sweetener which should be used only by persons who must restrict their intake of ordinary sweets", the blank to be filled in with the percentage by weight of the artificial sweetener in the product.

5. All foods purported to be and held out as special dietary foods shall be designated on their principal labels with the words "Special Dietary" and/or "For Dietary Purposes Only" followed immediately by the name of the product; the words "Special Dietary" and/or "For Dietary Purposes Only" to be in type of equal style and prominence with the name of the product.

6. Manufacturers and producers of foods for special dietary use shall, in addition to the above, declare the true carbohydrate, fat and protein and caloric content on the labeling of the product, as an additional informative designation.

(Signed) Earnest Constable, Chairman
Henry J. Hoffman
John McCutchen

A motion was made for the adoption of this report. The motion carried and the resolution was approved.

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ANNUAL MEETING OF THE NY STATE MILK SANITARIANS

The Annual Meeting of the New York State Association of Milk Sanitarians will be held at Albany, N.Y., on September 20, 21, and 22, 1954.

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Yours very truly

George L. Moss

George L. Moss, District Field Supervisor
The Nestlé Company Inc., Marysville, Ohio.

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Aug. 23-29

MINNESOTA STATE FAIR
Aug. 28-Sept. 6

NEW YORK STATE FAIR
Sept. 4-11

CLAY COUNTY FAIR
(SPENCER, IOWA)
Sept. 13-18

NATIONAL DAIRY CATTLE CONGRESS
Oct. 2-9

INTERNATIONAL DAIRY SHOW
Oct. 9-16

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