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Journal of

MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk and Food Sanitarians, Inc.

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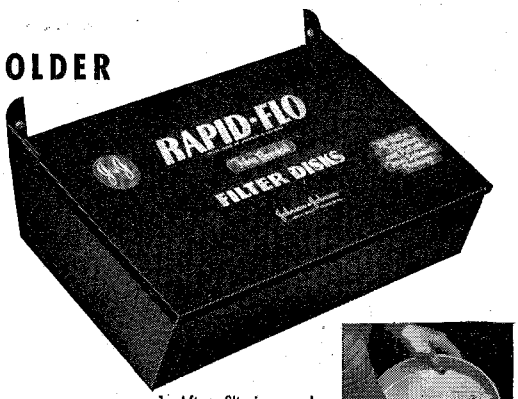

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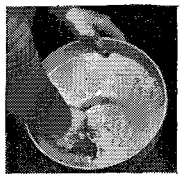

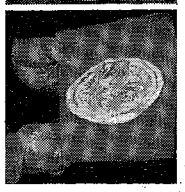

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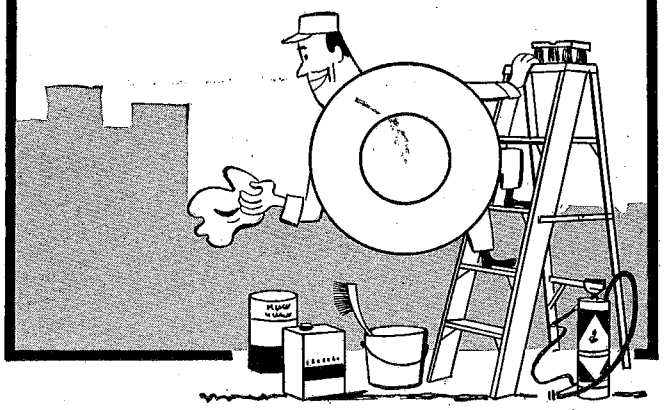

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Journal of

MILK and FOOD TECHNOLOGY

INCLUDING MILK AND FOOD SANITATION

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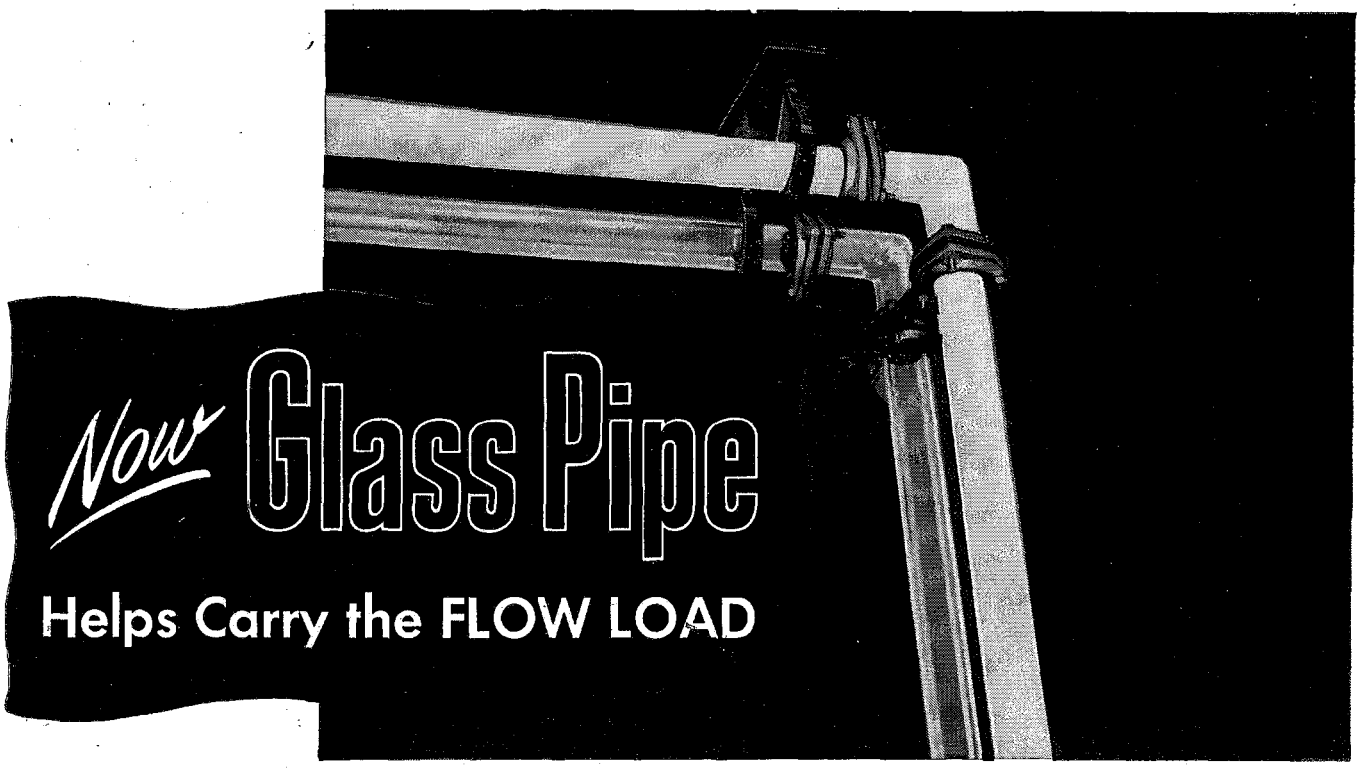

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EDITORIAL NOTES

WILLIAM B. PALMER

When William B. Palmer died suddenly on Friday, May 25th, the milk and food industry suffered an irreparable loss. To all who knew him the news brought profound sorrow.

"Billy" Palmer's accomplishments in public health, in our Association, in industry, in his church, and in his personal life have earned him the highest regard of his fellow men. His outstanding rugged honesty was only matched by his courage, kindliness, and his conscientious devotion to duty. He had a rare inborn sense of fairness and reasonableness. He upheld the law and was exact in its application with a mind which was always open to logical reasons. He knew how to temper the letter of the law with justice so that the spirit of the law would be maintained.

His administration was progressive and forward looking. By studious application of his wide knowledge he kept sanitation at a high level, while avoiding needless expense, thus performing an outstanding service by bringing top grade milk into his area at a reasonable price. His official actions gained him the respect, esteem, and firm friendship of councilmen, milk dealers, farmers and consumers alike.

He was a leader in the church and his personal life was wholesome and clean. As a son and a brother he carried the heaviest of family burdens, and remained always cheerful, generous, self-sacrificing, considerate and kind.

To sanitarians he will always be an inspiration. His devotion to the work of our Association and especially his unstinting contribution of his personal time in behalf of the *Journal of Milk and Food Technology* (unknown except to the small group associated with him in this work) mark well his capacity for self effacing whole hearted service.

While we have lost a friend and a leader, he has given us his greatest gifts—his example and his precepts.

F. C. Baselt

PUBLIC HEALTH SERVICE DISEASE REPORTS, 1949

Let's start, this time, with that old, familiar tabulation. It purports to show numbers of outbreaks by years, starting with 1944 and now including 1949. Figures for Water, Ditto suspected and Undetermined vehicles, for 1944, obviously are missing. The explanation is that, when the tabulation was started in 1945 these figures were not at hand, not having been noted when the 1944 reports were available to the writer.

Numbers of Outbreaks

	1944	1945	1946	1947	1948	1949
Milk and milk products	36	24	12	17	13	11
Ditto suspected	5	5	6	5	4	4
Other foods	288	272	287	292	304	331*
Ditto suspected	10	3	12	24	22	34*
Water		20	25	20	16	24
Ditto suspected		6	7	4	5	1
Undetermined vehicles		12	6	27	10	9

This tabulation is presented, again, "for purposes of rough comparison". And it may be added: it is a very rough comparison; so rough, in fact, that the figures have no statistical value. But a news release from the Public Health Service, dated April 6, 1951, might leave a different impression with indiscriminating readers.

Figures for 1949 were cited as follows: "Water, 25 outbreaks . . . 3 deaths; milk and milk products, 15 outbreaks . . . no deaths ('there were 2 deaths in 1948'); other foods, 367 * outbreaks . . . 11 deaths." Quoting further: "Three persons died in 1949 from drinking tainted water, a decrease of one over 1948. There were 919 fewer cases traced to 'other foods' in 1949 than . . . in 1948 and six fewer deaths . . ."

A reader not familiar with the reports and with the content of the totals might well gain the impression that a few hundred cases or a few deaths, one way or the other, were of considerable significance. He would be less likely to be over-impressed if he read, further on, the comment attributed to the Surgeon General. "The summary of disease outbreaks", he said, "unfortunately reflects only a fraction of the true picture. . . . For example, we are certain that reported outbreaks and cases resulting from foods other than milk and milk products represent no more than 10 to 15 percent of the true number of occurrences."

* It will be noted that our tabulation shows only 365 outbreaks. It was the best we could do, after several recounts.

Nevertheless it is stated, still further on, that "outbreaks attributed to water and milk have declined by more than 50 percent in the past 10 years, whereas outbreaks traced to other foods have shown a steady increase. These facts", he added, "offer an obvious challenge to health officers and sanitarians to (italics ours) *control the cause* of food-borne disease." From studies already made, we would add, the common causes have been well established. As for the steady increase in outbreaks attributed to "other foods", it seems rather likely that the increase has been in increased attention to the discovery and investigation of this class of outbreaks, rather than in the number of outbreaks. In fact it might be assumed that actual increase in outbreaks in some areas would be offset by declines in others where intelligent, organized efforts are being made to eliminate the well-known causes. If that assumption is incorrect it would seem rather discouraging.

Now, with the news release in mind, suppose we examine a few of the facts. The Public Health Service continues to include in its totals outbreaks "suspected of having been conveyed" through the various mediums. As shown in our tabulation these were, in 1949: milk etc. 4; other foods 34; water 1. It has long been our contention that to charge to milk, for example, and to include as milkborne, merely on suspicion, outbreaks not reasonably proven to have been milkborne is unfair confusing and misleading. A change in this procedure would seem overdue.

One-case "outbreaks" have nearly disappeared from the reports. The single exception for 1949, apparently, was one case of brucellosis reported as an outbreak from Philadelphia. It probably was correctly attributed to raw milk but on "hearsay" evidence. The waterborne list included 5 cases of gastroenteritis listed (without explanatory note) as 3 outbreaks. Is 1.7 cases an outbreak? Two waterborne outbreaks were listed, one as "Food infection", the other as "Food poisoning". Is water classified as a food? In the "other foods" report was an outbreak of 20 cases of "botulism". Symptoms: nausea, vomiting, abdominal tenderness and diarrhea. No deaths. Does that sound like botulism?

These and other more or less similar items suggest two needs: (1) Some clear Public Health Service Standards to which reporting agencies will be required—or at least urgently requested—to conform and (2) more discriminating selection, classification and editing of local outbreak reports before they are included in reports to be published.

Yes, this comment appears to have resolved itself quite largely into criticism: criticism of the reports and of Public Health Service procedures in handling them. That seems, at the moment, more needed than a detailed discussion of outbreaks. There were many interesting outbreaks but, as a whole, they were "run of the mill", with none unusually striking or spectacular. The causes, in general were the usual ones, with about the usual distribution. A detailed discussion would have contributed nothing of importance not already known. Whether anything will have been gained by critical discussion of procedures remains to be seen. In any event I would like my friends in the Public Health Service to know that I still respect and admire their great organization and that such criticism as has developed in this discussion is designed to be friendly, constructive and helpful.

PAUL B. BROOKS

REORGANIZATION PAINS

The sudden death of our Managing Editor, Mr. William B. Palmer (see last issue) has necessitated a reorganization of the management and publication of this JOURNAL. As a result, the next several issues will be smaller than usual and will not carry certain features. However, as quickly as possible, the JOURNAL will be back to its full size, and then onward to its appearance as a monthly.

J. H. SHRADER

EFFECT OF PREHEATING TIME ON THE INACTIVATION OF PHOSPHATASE IN MILK*

S. A. Lear and H. G. Foster

Department of Dairy Industry, Rutgers University, New Brunswick, New Jersey

The authors consider the incongruities encountered when the phosphatase test is applied to milk and offer a practical mathematical solution for some of them. Experiments are described wherein it was possible to evaluate the individual effects of the preheating, holding and cooling segments of the heating (pasteurizing) curve on the inactivation of phosphatase in milk. Thus experimental data were obtained that satisfied the requirements of the mathematical equations used currently in the food canning industry to calculate the total lethal heat effect of a process.

The authors report that when one minute preheating time with straight line heating is used, it will contribute 0.40 percent and 29.91 percent of the total lethal heat respectively when the holding temperatures are 146.3° F and 163.4° F.

THE process of pasteurizing milk may be divided into three parts, called the preheating, holding, and cooling times. These periods usually are of unequal duration for a given pasteurizing process as well as for different pasteurizing units. The holding time and temperature are legally defined in the pasteurization standards but, since these are not constant, the heat treatment of the milk during the holding period may be a variable in different pasteurizers. Consequently the total amount of heat to which milk is subjected in commercial milk plants is peculiar to the particular process. Experience has indicated that current pasteurization standards are adequate, although some question may exist concerning the magnitude of the safety factor involved because of the differences in the total heat treatment of the milk.

The phosphatase test is used to determine whether or not milk is properly pasteurized. The interpretation of data obtained from this test, which is based upon the heat treatment of milk, must be considered carefully because of the variation in the total treatment. It is generally accepted that a positive phosphatase test indicates that the milk was insufficiently heated. But a negative test does not necessarily mean that the milk has been legally pasteurized, because the enzyme may be inactivated under time and temperature conditions other than those defined in the pasteurization standards. To evaluate correctly the significance of a negative phosphatase test from a public health viewpoint, it is necessary to know and be able to compare the effects of the total lethal heat produced by the various pasteurization processes on the enzyme and pathogenic bacteria. In addition, these results must be expressed so that everyone interprets them in the same way. Fortunately, we have available the total lethal heat concept for this purpose. It has been used successfully in the canning industry for the last 25 years and thoroughly explained by Ball.[1] Lear and Foster[3] used this method to show the correlation between their results on the rate of phosphatase inactivation in milk and the data obtained in similar studies in two other laboratories.[2,6] The significant thing is that this method enables direct comparisons of inactivation rates with respect to the enzyme with different phosphatase tests. Close agreement was obtained in the above studies[2,3,6] because, under the experimental conditions in the three different laboratories, the preheating and cooling times were so short that their lethal heat contributions to the total lethal value were not measurable by the phosphatase test. It is the object of this experiment to determine the effect of preheating time on the destruction of phosphatase in milk by several different processes.

Experimental Methods

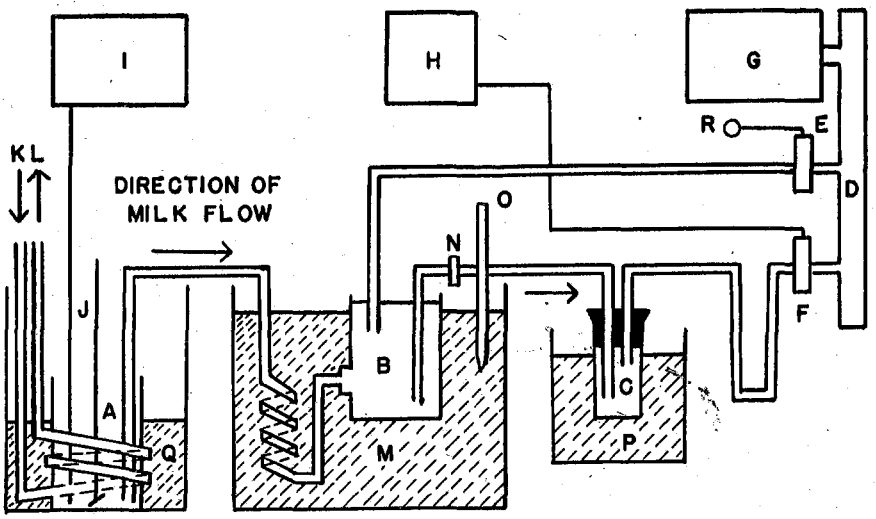
To determine the effect of preheating time on the destruction of phosphatase in milk it is necessary to subdivide the heating process into the preheating, holding, and cooling phases and control each part as desired. This was accomplished with the equipment shown schematically in Figure 1.

Dr. Samuel A. Lear received the B.S. degree in Dairy Manufacturing from the Pennsylvania State College in 1935, his M.S. degree from the University of Minnesota in 1938, and his Ph.D. from Penn State in 1942. After working for one year as an instructor in dairy manufacturing at West Virginia University, he entered the U. S. Public Health Service and was assigned to Milk Control work for 3¼ years. Dr. Lear accepted a position at Rutgers University in 1946 as an Associate Professor and Associate Research Specialist in Dairy Industry.

A stainless steel beaker (A) containing approximately 100 ml of milk was placed in a water bath (Q). The bath was heated by passing steam through copper tubing wrapped around the beaker and submerged in the water. The steam entered the tubing at K and left at L and was controlled by means of a hand-operated needlepoint valve. The milk was agitated with a stirrer (J) and time and temperature changes during the preheating period were automatically recorded on an electronic strip chart recorder (I) available through the courtesy of the Brown Instrument Company, Philadelphia. In addition, these relationships were determined with a stop watch and a thermometer accurate to within ±0.1° C. Air pressure forced the preheated milk through ten feet of ¼" copper tubing in the direction of milk flow into a holding chamber (B) when a solenoid valve (E) opened into the vacuum header (D). Experience in using the equipment showed that it was necessary to start the preheated milk through the copper tube to the holding chamber about three seconds before the end of the preheating time or about two degrees centigrade below the predetermined holding temperature. When this procedure was followed, the milk attained the proper holding temperature ±0.1° C while passing through the copper coil submerged in the water bath and entered the holding chamber at

* Paper of the Journal Series, New Jersey Agricultural Experiment Station, Rutgers University—The State University of New Jersey, Department of Dairy Industry.

FIGURE I



A—Container for holding milk during the preheating period. B—Container for holding milk during the holding period. C—Container for holding milk during the cooling period. D—Vacuum header. E—Solenoid valve manually operated. F—Solenoid valve operated by the timing device. G—Vacuum pump. H—Electric timing device. I—Strip chart recorder. J—Stirring rod. K—Steam inlet. L—Steam outlet. M—Constant temperature water bath. N—Shut-off valve. O—Thermometer. P—Ice water bath. Q—Water bath for preheating. R—Electric switch.

the correct temperature without having exceeded it at any time. The milk was preheated to a desired temperature at a predetermined rate in this manner.

The holding chamber (B) was a covered stainless steel beaker placed in a constant temperature water bath (M) thermostatically controlled to within ±0.1° C. The length of the holding period was controlled by use of an electric timing device (H) which is capable of producing electric impulses ranging from one to forty-three seconds or from one to forty-three minutes. The electric impulses activated four solenoid valves (only one shown in Figure 1) which controlled the air pressure in the holding chamber when a vacuum was maintained on the other side of the valve. Thus it was possible to draw four samples at one second, one minute, or at desired intervals. Air pressure forced the milk from the holding chamber (B) to the sample jar (C) when the solenoid valve (F) was open to the vacuum header (D). The milk was immediately cooled, since the jar rested in an ice water bath (P). Each of the four milk sampling lines contained a hand-operated shut-off valve (N) to control the size of the sample and to prevent fluctuations of the milk level in the lines.

The phosphatase test developed by Sanders and Sager [5] was used, together with a Pfaltz and Bauer fluorophotometer, Model B, with a 660-mu filter, to determine the degree of phosphatase destruction. Photometer units were converted to micrograms of phenol by reference to a prepared standard phenol curve.[4] The endpoint was determined by multiplying by the dilution factor 1.2, and results were expressed in micrograms of phenol per 0.5 milliliter of sample. Samples with endpoints greater than 2.00 micrograms per 0.5 ml sample of milk were considered "underpasteurized."

RESULTS

It was decided to preheat the milk so that it required one minute for the temperature of the milk to rise from 86° F to the predetermined pasteurization temperature. This time interval was selected because it was the shortest period that was feasible to control accurately with the experimental equipment and, also, it approached practical preheating times in some commercial high temperature-short time units. Conditions were such that straight line preheating was accomplished. Temperature data were originally determined in degrees centigrade, but to facilitate their use with those previously published,[2, 6] they were converted to the Fahrenheit scale and are presented with the other experimental data in Table 1.

These data were used to plot the experimental curve in Graph 1. The following time and temperature relationships of 37.5 minutes at 143° F, 30 minutes at 143.7° F, 24 seconds at 160° F, and 15 seconds at 161.8° F, as published by Sanders and Sager,[6] were used to locate their curve. The theoretical curve in the same graph is based on points calculated by Ball's [1] formula.

According to Ball,[1] the time during which the milk must be held at holding temperature to inactivate phosphatase when time is consumed in the rise and decline of temperature of milk for constant rates of heating and cooling is given in the following equation:

$$T_{hss} = U - \frac{0.01\ ArTra}{HT - IT} - \frac{0.01\ AcTca}{HT - FT}$$

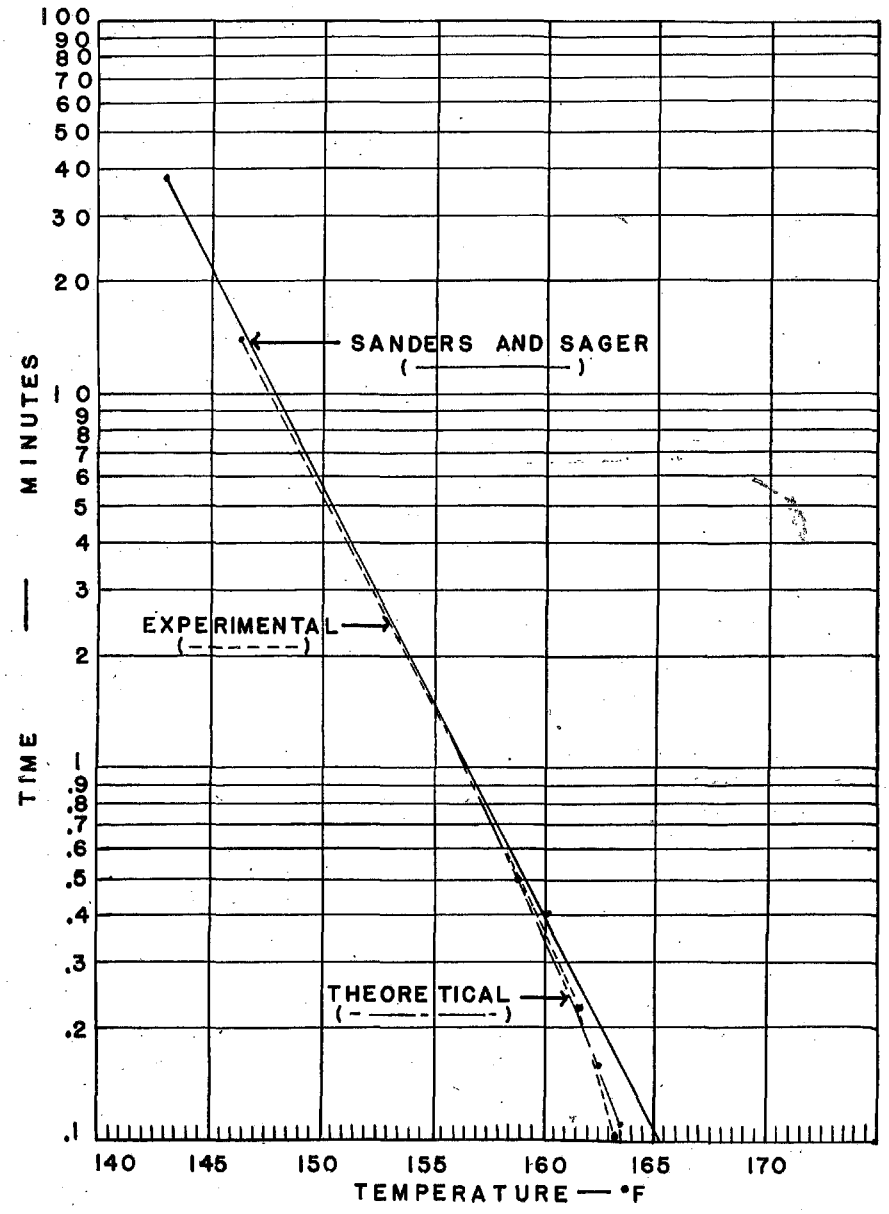
The second and third terms in the right-hand member of the equation express lethal values of heating and cooling periods, respectively, as minutes of heating at the holding temperature. The lethal heat value of the cooling period was calculated and found to be in the range of one ten-

TABLE 1

TIME AND TEMPERATURE REQUIRED TO INACTIVATE PHOSPHATASE IN MILK

Number of determinations	*Preheating time*	*Holding temperature*	*Holding time*	*Phenol*
	Seconds	° F	Minutes	mmgs per 0.5 ml sample
3	60 ± 2	163.4	0.10	1.2
5	59 ± 3	161.6	0.23	2.0
4	67 ± 5	153.5	2.25	1.8
3	60 ± 2	146.3	14.00	2.0

GRAPH I



thousandth of a minute, which was considered negligible under the conditions of this study. Therefore, the equation

$$T_{haa} = U - \frac{0.01\,ArTra}{HT - IT}$$

was used to calculate the holding time in minutes required to inactivate phosphatase at selected temperatures and a one minute preheating period where:

T_{haa} = time milk is held in minutes at holding temperature, HT, under different combinations of heating.

U = time necessary to destroy phosphatase at holding temperature in minutes.

Ar = arbitrary constant.

Tra = time consumed in rise of temperature of milk to holding temperature in minutes.

HT = holding temperature of pasteurization process.

IT = initial temperature of milk.

The following calculations are an example of determining T_{haa} at 163.5° F when Tra equals one minute and U equals 0.158. The U value was obtained from Sanders and Sager's curve in Graph 1.

$$T_{haa} = U - \left[\frac{(0.01)\,(376) \times 1}{163.5 - 86}\right]$$

$$= 0.158 - \left[\frac{3.76}{77.5}\right] = 0.1095$$

DISCUSSION OF RESULTS

Ball [1] states that when the holding period is 3⅓ minutes or less, the heat applied during coming-up and cooling periods may be a major portion of that required for pasteurization. Therefore, the amount of lethal heat contributed during preheating is particularly significant in the commercial pasteurization of milk by the high temperature-short time methods. Sanders and Sager [6] report that the Public Health Service standards allow considerably less margin of safety at 160° F than at 143° F, and that it seems desirable to increase the margin of safety at 160° F. The question arises then as to the absolute value of the margin of safety used in commercial pasteurizers. It is known that the margin of safety is not equal in all high temperature-short time units because of differences in basic construction and operation. The preheating time may be as short as a few seconds or longer than forty-five seconds. The amount of lethal heat contributed by preheating to the total lethal heat value of a process may be calculated and expressed as a percentage of the total lethal heat value if the rate and time of preheating are known. The preheating time was 1 minute and the rate was constant under the conditions of this study. Therefore it is possible to modify the previous equation to calculate the lethal effect of the preheating time and express it as a percentage of the total lethal heat.

Thus:

$$P_{ra} = \frac{ArTra}{U\,(HT - IT)}$$

where P_{ra} = percentage of required lethal heat.

These calculated values are presented in Table 2.

TABLE 2

PERCENTAGE OF TOTAL LETHAL HEAT CONTRIBUTED BY ONE MINUTE PREHEATING TIME FROM PHOSPHATASE INACTIVATION DATA

Holding temperature	*Total lethal heat*
° F	%
163.4	29.91
161.6	18.77
153.5	2.75
146.3	0.40

The data in Table 2 show that the effect of preheating time becomes more important as the process hold-

(Continued on page XI)

THE GERMICIDAL EFFECTIVENESS OF A NEW CHLORINE COMPOUND*

C. K. JOHNS

Division of Bacteriology and Dairy Research
Science Service
Canada Department of Agriculture, Ottawa, Ontario

Superior germicidal activity has been claimed for a new organic type of chlorine germicide, Antibac 25, and also for LoBax 21, a hypochlorite powder containing a wetting agent. Laboratory tests, employing three test organisms and two methods, have not shown their products to be superior to two other hypochlorites included for comparison.

VARIOUS workers [2, 3, 5, 6, 8, 9] have shown that the germicidal activity of chlorine disinfectants decreases with increasing alkalinity. It is generally accepted [1, 4] that the undissociated hypochlorous acid is the active component and that its concentration varies with the hydrogen ion content. Recently, a new type of powdered chlorine germicide called Antibac-25 † has appeared. This product contains Dactin ‡ (dichlorodimethyl hydantoin) as the germicidal ingredient. It is said to be very stable in powder form and to be completely soluble in hot or cold water in use dilutions, giving a slightly acidic solution with all its available chlorine effective in the form of un-ionized hypochlorous acid. It is claimed that "Antibac-25 is over 50 percent more effective a bactericide than any other dry chlorine type germicide commercially available today." To verify these claims, the tests reported below were undertaken.

METHODS

As a basis for comparison, two other powder-type hypochlorites, B.K and LoBax 21, and one liquid type, Dalglish Liquid Bleach (containing around 12 percent available chlorine), were included in the studies. Both the Weber and Black [10] and the glass slide [5, 7] techniques were employed, using *Micrococcus pyogenes* var. *aureus* (F.D.A. 198), *Escherichia coli* and *Pseudomonas aeruginosa* as test organisms. The glass slide technique was modified slightly in that the suspension of test organisms was not filtered, while the action of the germicide was checked by plunging the treated slide into sterile water containing thiosulphate at the end of the exposure period. Destruction or removal of 99.9 percent of the test organisms was taken as the end-point with this method, and of 99.9999 percent in the Weber and Black method.[11] All tests were run at approximately 25° C. Based on preliminary studies, concentrations of germicide were selected which would best show up differences in bactericidal speed.

RESULTS

Series 1. Escherichia coli

(a) *Glass Slide Technique*

After several preliminary runs, results were obtained of which those shown in Tables 1 and 2 are representative. The superior germicidal activity claimed for Antibac-25 is not in evidence here.

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(b) *Weber and Black Technique*

Results obtained with this technique are presented in Table 3. Irregularities in the results here can be attributed to faulty manipulations, since much more uniform results have been obtained in subsequent work with this method. Nevertheless, the slower action of Antibac-25 is again evident.

Series 2. Micrococcus pyogenes var. aureus

(a) *Glass Slide Technique*

Table 4 is representative of the results obtained by this method.

TABLE 1

SURVIVAL OF *Escherichia coli* AFTER TREATMENT WITH 20 PPM SOLUTIONS AT 25° C

(Glass slide technique, duplicate runs, Oct. 6/50)

	Exposure periods (seconds)				
	2½	5	10	20	40
Antibac 25	+	1,200	67	*12*	12
	+	1,200	30	*15*	23
B.K.	74	*8*	4	6	3
	72	20	*1*	5	0
Dalglish	*9*	9	2	3	2
	20	*9*	3	0	1
LoBax 21	31	*5*	3	1	2
	7	8	7	2	0

N.B. 99.9% reduction leaves 17 colonies.

* Contribution No. 320 (Journal Series) from the Division of Bacteriology and Dairy Research, Science Service, Canada Dept. of Agriculture.

† Manufactured by Paulen Chemical Co., Washington, D. C.

‡ A product of E. I. duPont de Nemours & Co., Inc., Wilmington, Del.

TABLE 2

SURVIVAL OF *Escherichia coli* AFTER TREATMENT WITH VARIOUS CONCENTRATIONS OF AVAILABLE CHLORINE AT 25° C

(Glass slide technique, duplicate runs, Oct. 11/50)

		Exposure period (seconds)				
	Ppm	2½	5	10	20	40
Antibac 25	40	380	*8*	2	4	0
		340	*4*	3	2	0
	20	3,000	75	14	10	*6*
		1,700	70	12	20	*5*
	10	++	512	21	18	12
		++	272	42	29	*6*
B.K.	40	10	*3*	0	0	0
		13	*6*	0	1	0
	20	22	*0*	0	3	0
		21	*2*	0	0	2
	10	664	22	*4*	2	0
		84	*6*	5	2	2

N.B. 99.9% reduction leaves 9 colonies.

TABLE 3

SURVIVAL OF *Escherichia coli* IN WEBER & BLACK TECHNIQUE

(Using 10 ppm solutions, Oct. 6/50)

	Exposure periods (seconds)				
	15	30	60	120	300
Antibac 25	++++	120,000	280	*<10*	<10
B.K.	*10*	10	10	10	20
Dalglish	*<10*	<10	<10	10	<10
LoBax 21	3,000	4,200	5,800	4,200	*10*

N.B. 99.9999% reduction leaves 174 colonies.

Although a higher chlorine concentration was necessary against this organism, Antibac-25 appears to better relative advantage than against *E. coli.*

(b) *Weber and Black Technique*

Data obtained are shown in Table 5. Despite irregularities, the results are in moderately good agreement with those in Table 4. Antibac-25 is again relatively more effective against this organism than against *E. coli.*

Series 3. Pseudomonas aeruginosa

(a) *Glass Slide Technique*

The data presented in Table 6 indicate that Antibac-25 is only slightly slower than the hypochlorites in the destruction of this organism. Here, too, a higher chlorine concentration was necessary. Both in general resistance to destruction by chlorine and in the relative effectiveness of Antibac-25, the general picture resembles that obtained with *M. pyogenes* var. *aureus* more than that with *E. coli.*

(b) *Weber and Black Technique*

As will be observed from the results recorded in Table 7, Antibac-25 behaved much the same as in the tests with the glass slide technique.

pH Values of Solutions

The pH values of both distilled water and tap water solutions of the several products were determined with a Beckman Model H potentiometer using the regular glass electrode. No attempt has been made to correct for the sodium ion error in the more alkaline solutions. The results, shown in Table 8, indicate that Antibac-25 is definitely acidic in reaction.

DISCUSSION

The results reported here indicate that Antibac-25, instead of "being 50 percent more effective as a germicide," is no better and is sometimes slower-acting than the hypochlorites tested. This is most evident where *E. coli* is used as the test organism. This is surprising in view of the very low pH values obtained with this product. With hypochlorites at these acidic values the available chlorine would be present as almost 100 percent undissociated hypochlorite[4,5] and this should be reflected in a greatly enhanced germicidal activity.

TABLE 4

SURVIVAL OF *M. Pyogenes* var. *aureus* AFTER TREATMENT WITH 50 PPM SOLUTIONS

(Glass slide technique, duplicate runs, Oct. 5/50)

	Exposure periods (seconds)				
	2½	5	10	20	40
Antibac 25	111	*16*	10	10	2
	486	19	*16*	16	3
B.K.	1,300	528	18	*8*	10
	1,500	782	28	*10*	8
Dalglish	96	*5*	5	4	1
	314	*6*	5	6	4
LoBax 21	++	+	202	*9*	5
	++	+	238	*12*	11

N.B. 99.9% reduction leaves 16 colonies.

TABLE 5

SURVIVAL OF *M. pyogenes* var. *aureus* AFTER TREATMENT WITH 25 PPM SOLUTIONS

(Weber & Black technique, duplicate runs, Oct. 5/50)

	Exposure periods (seconds)				
	15	30	60	120	300
Antibac 25	23,600	260	*90*	<10	10
	930	260	*50*	30	10
B.K.	9,300	*50*	30	30	<10
	36,000	3,060	1,240	370	..
Dalglish	150	510	*30*	<10	<10
	70	18,600	10	10	<10
LoBax 21	3,800	*50*	20	10	10
	6,100	170	*50*	<10	<10

N.B. 99.9% reduction leaves 113 colonies.

TABLE 6

SURVIVAL OF *Ps. aeruginosa* AFTER TREATMENT WITH 50 PPM SOLUTIONS

(Glass slide technique, duplicate runs, Oct. 10/50)

	Exposure periods (seconds)				
	2½	5	10	20	40
Antibac 25	836	*10*	14	9	1
	2,000	*11*	29	9	1
B.K.	*26*	31	6	2	3
	236	*11*	0	4	1
Dalglish	*4*	2	0	3	1
	5	3	3	2	1
LoBax 21	*23*	25	4	5	3
	666	*11*	5	0	3

N.B. 99.9% reduction leaves 104 colonies.

That it is not, casts doubt on the manufacturers' claim that the chlorine is present in the solution in this form.

Although Antibac-25 carries on its label the claim that it is non-corrosive, preliminary tests conducted with tinned steel strips half-immersed in 200 ppm solutions of the four products employed in these studies indicated that Antibac-25 was unquestionably more corrosive than the others.

While the powder form is apparently quite stable, solutions of Antibac-25 lose chlorine rapidly at room temperature. For this reason this product was always tested ahead of the others, whose solutions were much more stable.

For convenience in these studies, stock solutions of the four products were made up at the start, and solutions of the desired concentration prepared from these as required. This may have been slightly to the disadvantage of Antibac-25, as additional experiments showed that Antibac-25 solutions freshly prepared from the powder were slightly more effective than those made up from the stock solution. Differences were too slight, however, to change the relative standing of the various products.

LoBax 21 is another new product which is said to offer "a speed of bactericidal action greater than any other product on the market." It contains a wetting agent (sodium decyl benzyl sulphonate) which is said to ensure fast penetrating action and more rapid destruction of bacteria. The results reported here, together with others not included in this paper, fail to substantiate such claims. Even with the glass slide technique, where any advantage from the standpoint of detergency and wetting ability might be expected to reveal itself, this product has not shown any superiority over the other two hypochlorites tested. In general, the germicidal activity of the three hypochlorites has been closely correlated with the pH values of the solutions shown in Table 8.

TABLE 7

SURVIVAL OF *Ps. aeruginosa* AFTER TREATMENT WITH 50 PPM SOLUTIONS

(Weber & Black technique, Oct. 10/50)

	Exposure periods (seconds)				
	15	30	60	120	300
Antibac 25	230	*20*	80	30	10
B.K.	*10*	10	20	10	10
Dalglish	*20*	10	10	10	10
LoBax 21	*10*	10	10	10	10

N.B. 99.9999% reduction leaves 85 colonies.

SUMMARY AND CONCLUSIONS

The germicidal efficiency of a new organic type of chlorine germicide, Antibac-25, has been compared with that of three hypochlorites, employing both the glass slide and the Weber and Black techniques with *M. pyogenes* var. *aureus*, *E. coli*, and *Ps. aeruginosa* as test organisms.

Antibac-25 failed to show the superiority over the hypochlorites claimed for it.

A new powdered hypochlorite containing a wetting agent was, if anything, slightly slower-acting than the other two hypochlorites tested.

TABLE 8

pH READINGS OBTAINED ON CHLORINE SOLUTIONS

(Oct. 12/50)

	Distilled water			Tap water		
	Ppm	Available Cl.		Ppm	Available Cl.	
Product	100	50	25	100	50	25
Antibac 25	4.43	4.63	4.85	6.21	6.53	6.73
B.K.	10.55			9.75		
Dalglish	10.10			9.60		
LoBax 21	10.60			10.28		

ACKNOWLEDGMENTS

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A NOTE ON TEMPERATURE MEASUREMENT IN THE BABCOCK TEST CENTRIFUGE

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Many publications recommend a definite temperature range for the Babcock centrifuge, but do not state how this temperature should be measured. A thermometer placed in the shell of the centrifuge may show a temperature very different from that in the area wherein the bottles are placed. An ordinary six-inch stem, mercury type, maximum recording 0–220° F thermometer, suitably counterbalanced, can be placed in the centrifuge cup to measure the maximum temperature reached during the test. Examples are given of temperature measurements made by this method, compared with those shown by the thermometer regularly used in the centrifuge.

AUTHORITATIVE reference books on the Babcock test [1, 2] state that the centrifuge "shall be heated, electrically or otherwise, to a temperature of at least 55° C during process of centrifuging." In another text,[3] the directions state "maintain a temperature of 135–150° F (57.2–65.6° C) in the centrifuge." In their study of procedures used in the various states, Heinemann, *et al.*[4] found that 26 states had no specifications, others specified 120, 131, 130–140, 135–150, 140–150, or 140–165° F. Inconsistencies between authorities within a state may occur. For example, in one state the regulations call for a temperature of 130–140°, whereas the State College of Agriculture advises that the "whirling chamber must be heated to an average temperature of 130–135° F."

Although numerous references to the "proper" temperature to be attained in the centrifuge are available, the writer knows of no recommended or standard procedure for measuring this temperature. The centrifuge shell usually has an opening through which a thermometer may be inserted. This opening probably is placed arbitrarily, without proof that a given thermometer placed therein will give a reasonably accurate indication of the actual temperature of the zone wherein the test bottles are placed. Correspondence and personal observation of steam and electrically operated centrifuges indicate that the thermometer used with the centrifuge may show a very misleading reading.

The use of suitable thermocouples and recording devices would be an ideal way to measure the actual temperature within the centrifuge. This, however, is not a practical procedure. The writer has found that the ordinary six-inch stem, mercury type, maximum recording, 0–220° F thermometer can be placed in the centrifuge cup in order to measure the maximum temperature reached in the area occupied by the test bottles. Two such thermometers are used, being placed in opposite cups in order to balance each other, or a suitable counterbalance may be used. Many runs have been made in this manner, without breaking a thermometer at any time. A calculation shows that the compressibility of mercury in the thermometer at centrifuge speed is insignificant. The thermometers are used without a protecting metal shield and simply are placed, bulb down, in the centrifuge cup. The use of a clamp or other device to hold the thermometer in place is unnecessary.

Interesting findings have been made by the use of this device. On a steam-operated centrifuge, fitted with a dial type thermometer, a temperature of 150° F was shown. The maximum-registering thermometers placed in the centrifuge cups showed the temperature reached was 190° F. An electrically operated centrifuge was fitted with a liquid-in-glass thermometer, whose bulb was protected by a metal shield, about one inch long and one-half inch in diameter. When the centrifuge was in operation, this thermometer showed a reading of 145° F. This thermometer was removed while the machine was in operation and a dial-type thermometer with a four inch stem was inserted. This instrument gave a reading of 152° F. Maximum recording thermometers that had been placed in the centrifuge cups showed a temperature of 170° F. The thermostat on the centrifuge was adjusted so that the maximum recording thermometers showed a temperature of 145° F when the centrifuge was in operation. The thermometer supplied with the centrifuge was replaced by a glass "floating dairy-type" thermometer which showed a temperature of 145° F while the machine was in operation, corresponding to the temperature registered by the thermometers in the centrifuge cups. Although accurately calibrated thermometers were used in this work, the Babcock test permits of some latitude in temperature, and thermometers of ordinary laboratory accuracy may be used.

Since the procedure is simple and direct, it is suggested that Babcock centrifuge temperature be checked by placing two maximum recording thermometers in opposite cups of the centrifuge and the reading made after the machine has reached temperature equilibrium or when the tests are removed from the machine. The method described will show the maximum temperature reached by the test, whether a few samples or a full centrifuge load are being run at the time. The thermometer placed in the shell of the centrifuge should indicate substantially the same temperature. This procedure would make for better uniformity in the test, especially for control and investigational work.

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VARIATIONS IN THE CHARACTERISTICS OF *E. COLI* INDUCED BY QUATERNARY AMMONIUM COMPOUNDS

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***Escherichia coli* lost the ability to produce gas in liquid media and formed atypical small colony variants on desoxycholate agar, concurrent with induced resistance to quaternary ammonium compounds. Paralleling high resistance, the metallic sheen of colonies on confirmatory medium did not appear. The variant strains showed a decrease in growth rate, failed to reduce methylene blue, and were unable to ferment normal sugars. Thus, with induced resistance, variations occurred in *Escherechia coli* such as to reduce the value of coliform tests used to identify its presence.**

THE development of resistance in living organisms to the effects of chemicals has long been recognized. This phenomenon has been made obvious by the resistance developed by pathogens subjected to repeated dosages of sulfonamides and antibiotics.

The use of quaternary ammonium compounds in the field of sanitation has resulted in the voicing of the fear that resistant populations of bacteria, able to survive normal and customary sanitizing procedures, might develop.

Strains of bacteria capable of surviving exposure to astounding concentrations of these germicides were developed by the Canadian Department of Agriculture.[1]

It is the purpose of the paper to report the changes in normal characteristics caused by induced resistance to quaternary ammonium compounds and to confirm the ability to induce resistance as reported from Canada.

METHODS AND MATERIALS

The procedures employed in this study of the development of resistance were similar to those customarily followed in antibiotic resistance studies. Quaternary ammonium compound was added to plain nutrient broth in progressively larger amounts. The test organism inoculum was placed in each of the tubes, and the culture in the tube in which growth occurred in the highest concentration of quaternary was selected to inoculate the next series of tubes. The following test organisms were used:

1. *Serratia marcescens* – ATCC #274
2. *Escherichia coli* – five strains from the following sources:
   - B. Armour & Company, Chicago – Strain #40
   - C. U.S.P.H.S. – Cincinnati Strain #198
   - D. Continental Can Company – Strain #820
   - E. University of Illinois Medical School
   - F. Armour & Company, Chicago – Strain #39

All stock strains, and the resistant progeny have been maintained on Difco nutrient agar.

The quaternary ammonium compounds used were commercially available preparations of:

Compound I. Alkyl dimethyl benzyl ammonium chloride.

Compound II. Di-isobutyl phenoxy ethoxy ethyl dimethyl benzyl ammonium chloride.

RESISTANCES DEVELOPED

The progressive resistance developed by *S. marcescens* to Compounds I and II is tabulated in Table 1; that developed to Compound II is shown graphically in Chart 1. It

TABLE 1

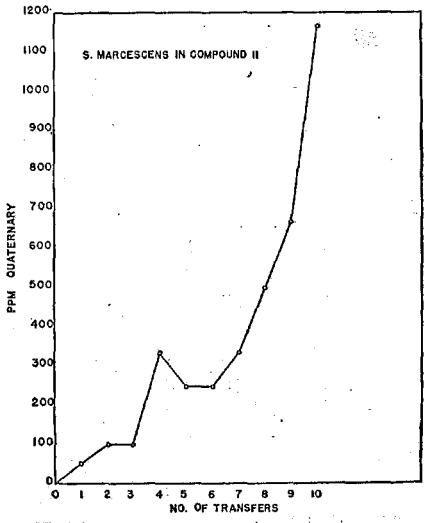
PROGRESSIVE RESISTANCE TO QUATERNARIES DEVELOPED BY SERRATIA MARCESCENS (MAXIMUM CONCENTRATION IN WHICH GROWTH OCCURRED)

Number of Transfers	Compound I: Conc. of Q.A.C. Ppm *	Compound II: Conc. of Q.A.C. Ppm
1	28.7—	50.0
2	100.0	100.0
3	100.0	100.0
4	125.0	333.3+
5	166.7—	250.0
6	166.7—	250.0
7	200.0	333.3+
8	250.0	500.0
9	500.0	666.6+
10	666.6+	1173.0—

* The quaternary ammonium solutions were added to the broth in the proportions indicated. The active germicidal strength after addition to the broth was not determined.

is to be noted that *S. marcescens* survived and grew, in broth to which nearly 1200 ppm of quaternary had been added. This degree of induced resistance developed in ten transfers.

CHART I



Tables 2 and 3 present data concerning the resistance to Compound I and Compound II, respectively, progressively developed by five and four strains, respectively, of *E. coli*.

CHART II

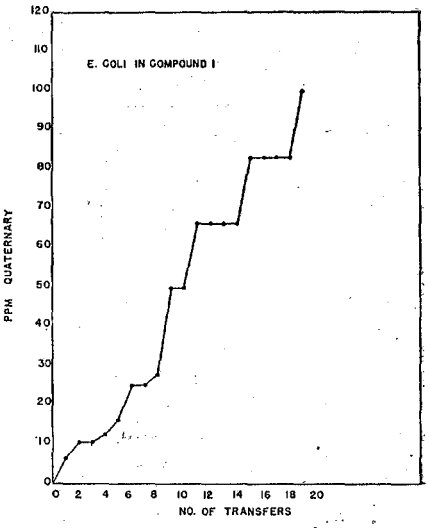


TABLE 2

SURVIVAL AND LOSS OF GAS-PRODUCING POWER OF STRAINS OF *E. coli* EXPOSED TO COMPOUND I IN BROTH

Number of transfers	Strain B		Strain C		Strain D		Strain E		Strain F	
	Conc. of Q.A.C. Ppm	Gas	Conc. of Q.A.C. Ppm	Gas	Conc. of Q.A.C. Ppm	Gas	Conc. of Q.A.C. Ppm	Gas	Conc. of Q.A.C. Ppm	Gas
1	11.1+	+	7.7+	+	10.0	+	10.0	+	7.7+	+
2	13.3+	+	10.5+	—	13.3+	+	10.0	—	13.3+	+
3	25.0	+	10.5+	—	20.0	+	12.5	—	22.2+	—
4	28.7—	—	13.3+	—	25.0	+	20.0	—	22.2+	—
5	33.3+	—	16.7—	—	28.7	+	25.0	—	28.7—	—
6	40.0	—	25.0	—	40.0	+	40.0	—	33.3+	—
7	40.0	—	25.0	—	50.0	+	66.7—	—	33.3+	—
8	40.0	—	28.7	—	50.0	+	66.7—	—		
9	40.0	—	50.0	—	105.2+	+	83.3+	—		
10			50.0	—			83.3+	—		
11			66.7—	—			100.0	—		
12			66.7—	—			100.0	—		
13			66.7—	—			100.0	—		
14			66.7—	—			100.0	—		
15			83.3+	—			100.0	—		
16			83.3+	—			100.0	—		
17			83.3+	—			111.1	—		
18			83.3+	—			117.6+	—		
19			100.0	—			125.0	—		
20							117.6+	—		
21							111.1	—		
22							105.2+	—		
23							125.0	—		
24							148.1+	—		
25							153.8+	—		

All initial inoculations were made into broth containing Compound I in the proportion of 7.1+ ppm.

TABLE 3

SURVIVAL AND LOSS OF GAS-PRODUCING POWER OF STRAINS OF *E. Coli* EXPOSED TO COMPOUND II IN BROTH

Number of transfers	Strain B		Strain C		Strain D		Strain F	
	Conc. of Q.A.C. Ppm	Gas	Conc. of Q.A.C. Ppm	Gas	Conc. of Q.A.C. Ppm	Gas	Conc. of Q.A.C. Ppm	Gas
1	10.0	+	11.1	+	10.0	+	7.7+	+
2	13.3+	+	18.2—	+	13.3+	+	13.3+	+
3	18.2—	+	25.0	+	22.2+	+	22.2+	—
4	25.0	—	33.3+	+	28.7—	+	22.2+	—
5	33.3+	—	33.3+	+	40.0	+	28.7—	—
6	40.0	—	40.0	+	40.0	+	33.3+	—
7	50.0	—	50.0	+	50.0	+	33.3+	—
8	50.0	—	50.0	+	50.0	+		
9	66.7—	—	50.0	+	83.3+	+		
10			66.7—	+				
11			66.7—	+				
12			50.0	+				
13			50.0	+				
14			50.0	+				
15			55.5+	+				
16			55.5+	+				
17			55.5+	+				

The resistance of the U.S.P.H.S. Cincinnati strain #198 to Compound I, the curve of which is typical for all strains and both quaternaries, is graphically presented in Chart 2.

It is clear from the tabulations and chart that *S. marcescens* is normally more resistant to the germicidal effects of quaternaries than are any of the several strains of *E. coli* studied. It is also to be noted, however, that all of the strains of *E. coli* studied survived concentrations of 7.7+ ppm of quaternary in broth, and that resistance to 25 ppm or higher concentrations developed within six transfers. As is depicted in Chart 2, strain C (#198) after 19 transfers, survived in broth containing 100 ppm of quaternary.

OTHER VARIATIONS IN CHARACTERISTICS DEVELOPED CONCURRENTLY WITH RESISTANCE

In S. marcescens:

In the case of *S. marcescens*, which normally produces vividly red-pigmented colonies on agar, it was noted that as resistance increased, there was a corresponding reduction in pigment production. Colonies of the more highly resistant strains were completely non-pigmented. Occasionally, strains of intermediate resistance to quaternaries produced both pink and non-pigmented colonies. Bunting [2] has reported that, in the presence of surface-active agents, *S. marcescens* loses its ability to produce pigment; she also infers that this may be the result of selectivity, rather than evidence of mutation.

In E. coli:

The observation of the above-described variants in *S. marcescens*, suggested the possibility that the development of resistance in *E. coli* might also result in variations in the strains of these organisms under study. Accordingly, evidence of such variation was sought.

INTERFERENCES TO PRESUMPTIVE TESTS

The first step in the examination of milk or water for the presence of coliform organisms by Standard Methods [3, 4] consists of the presumptive test—either (1) the development of acid and gas in liquid media, or (2) the production of distinctively pigmented colonies of minimum diameter on solid media.

(1) Loss of Power to Produce Gas

Each of the resistant cultures, of the five strains of *E. coli*, were inoculated into both brilliant green bile and formate ricinoleate broths. These were compared with cultures of the initial non-resistant parents as controls. It was found that as the organisms developed resistance against quaternary ammonium compounds, they also lost their ability to produce gas. Except in the case of Strain D when exposed to Compound I, and of Strains C and D when exposed to Compound II, the

power to produce gas was lost concurrently with the development of a low degree of resistance.

The loss of the power to produce gas appears to be conclusive, since inoculations which did not produce it in 48 hours failed to produce it in a week. Minning [5] reports that organisms which have lost the power to ferment lactose will revert to the parent type if grown in the presence of that sugar. To determine the reversion trend of these resistant, non-gas-producing strains of *E. coli,* several cultures were transferred daily into lactose broth. Fifteen consecutive transfers failed to restore the gas-producing power.

(2) CHANGE IN COLONY CHARACTERISTICS—ON SOLID MEDIA

Typical colonies of coliforms on violet red bile or desoxycholate agars are red, and at least 0.5 mm in diameter. To determine whether the development of resistance resulted in the production of variants, the original strain and their resistant progeny were plated on violet red bile and desoxycholate agar and incubated at 37° C for 20–24 hours. Pigmentation was normal, but the colonies formed were markedly small, as may be noted from the following comparison:

TABLE 4

COMPARATIVE DIAMETERS OF *E. coli* COLONIES

Strain	Diameters of colonies (microns) (Average of 3 representative colonies)
Original Strain B	720
Resistant Strain B	430
Original Strain C	720
Resistant Strain C	190
Original Strain E	720
Resistant Strain E	290

(0.5 mm = 500 microns)

It is clear that resistant strains produced under-sized colonies, atypical of coliforms. These small colonies, when subcultured into lactose broth, also failed to produce gas. Colwell [6] claims that the small-colony variant and its lack of gas production is caused by an interference with normal enzymic function, resulting in lowered metabolic activity. She also mentions loss of indole production, and the inability to produce gas from sugars normally fermented by *E. coli.* The quaternary-resistant small colonies subcultured did not produce gas from saccharose, mannitol, maltose, nor the previously-mentioned lactose; nor did the more resistant strains produce indole. These variants, therefore, would be considered pleiotropic; that is, there is interference with several enzymic functions.[7] Colwell also states: "Morphologically, small colony variants were usually indistinguishable from their parent strains. Occasionally a strain grew in long filaments, apparently lacking normal powers of division." Such, too, were our findings with certain of the strains that had developed resistance to quaternary ammonium compounds. Occasionally we encountered, under the microscope, a "giant" single organism which extended the entire diameter of the oil immersion field.

The foregoing findings indicate that all strains of *E. coli,* studied after developing resistance to quaternaries, did not react normally to prescribed presumptive tests.

INTERFERENCES TO CONFIRMATORY TESTS

Confirmation of the presumptive test for coliforms consists of streaking transfers from tubes of brilliant green bile or formate ricinoleate broth, in which gas appears, onto eosin methylene blue agar, and incubating. Typical coliform colonies are characterized by a greenish, metallic sheen on the confirmatory agar.[3, 4]

Cultures of *E. coli* of varying degrees of resistance developed in this study, were streaked on eosin methylene blue agar. It was found that as resistance increased, first the metallic sheen was lost, followed by loss of colony color. Results fell generally into the following categories:

1. Typical reaction—sheen developed; gas produced by the picked colony transferred to brilliant green bile broth. This is characteristic of normal *E. coli* and mildly resistant strains.
2. Typical sheen developed—but no gas produced by picked colonies transferred to brilliant green bile broth. This was characteristic of moderately resistant strains.
3. Atypical sheen developed—but gas produced by picked colonies. The color of the colonies is green, but the sheen is markedly less bright. *E. coli* resistant to Compound II most frequently produced colonies with dulled sheen.
4. Atypical colonies—colorless or wine-colored, without sheen. The entire progeny of the resistant strain produces such atypical colonies, transfers from which do not produce gas. This was typical of the highly resistant cultures.

OTHER OBSERVED VARIATIONS

Additional variations which appeared to accompany the development of resistance to quaternaries included:

a) A reduction in the rate of reproduction. Resistant strains grow more slowly than the parent strain. Lower rates of growth were confirmed by the use of a Coleman Spectrophotometer, and by the centrifuge method.[8]

b) A marked increase in methylene-blue reduction time. This phenomenon was first noted by employing the procedure of Seligmann and Wassermann,[9] which consists of adding methylene-blue dye to 24-hour cultures in nutrient broth, and comparing reduction times. The following comparative results were selected at random from the study data:

METHYLENE-BLUE REDUCTION TIMES OF BROTH CULTURES

	Parent strain Reduction time	Developed resistance	Resistant strain Reduction time
Strain E	30 min	154 ppm	Over 20 hrs
Strain F	30 min	50 ppm	Over 20 hrs

When the parent and resistant variants of Strain E were inoculated into tubes of sterile milk, at the rate of approximately 500,000 per ml, reduction times fell into the pattern presented below:

	Developed resistance	Color after 4 hours
Parent Strain E	None	Decolorized
Resistant Strain E	10 ppm	Decolorized
" " E	12.5 ppm	Decolorized
" " E	20 ppm	Blue

		Developed resistance	Color after 4 hours
Resistant Strain	E	25 ppm	Blue
" "	E	33.3 ppm	Blue
" "	E	40.0 ppm	Blue
" "	E	154.0 ppm	Blue

PERSISTENCE OF VARIANT CHARACTERISTICS

It is customary in studies of developed resistance to chemical drugs and antibiotics to determine whether the resistance and any induced variations are maintained through successive generations of the organism, in the absence of the drug or antibiotic.

Throughout this study, as resistance to the quaternaries was developed, subcultures were made on nutrient agar stabs. At approximately two-day intervals, new transplants were made until ten successive subcultures had been grown in the absence of a quaternary. The reactions of representative subcultures to the coliform tests were then determined. In every instance, a typical characteristic which had been lost was not regained.

SANITARY SIGNIFICANCE OF THE DEVELOPMENT OF VARIANTS

The attainment of complete sterility of equipment subjected to treatment by chemical bactericides is probably relatively rare in practice. Heretofore the recovery of viable bacteria from surfaces exposed to bactericidal treatment has been ascribed either to ineffectiveness of the bactericide, to contact for too short an interval, or to lack of contact. The resistance of bacteria to bactericides has not, heretofore presented itself as a serious problem in sanitation.

This problem is aggravated by the fact that variants in the characteristics of *E. coli,* by which it has heretofore been possible to identify its presence—in water, milk and other dairy products—develop concurrently with its resistance to quaternary ammonium compounds. The significance of this phenomenon with respect to the coliform test of pasteurized milk is apparent.

The decrease of the methylene-blue reducing power of *E. coli* developed concurrently with resistance to quaternaries, lessens the value of the reduction test as an index of the quality of raw milks in which resistant strains of *E. coli* might occur.

SUMMARY OF STUDY FINDINGS

Our data on the development of resistance and changes in the characteristics of *S. marcescens* and *E. coli* when subjected to quaternary ammonium compound solutions may be summarized as follows:

Serratia marcescens	*Escherichia coli*
1. Developed resistance to quaternary ammonium compounds.	1. Developed resistance to quaternary ammonium compounds.
2. Loss of the power of typical pigmentation.	2. Loss of typical presumptive test characteristics: a) inability to produce gas in selective broths. b) failure of colonies to attain distinctive size on selective media.
	3. Selective loss of confirmatory test characteristics: a) loss of power to produce distinctive green-colored colonies. b) development of atypical-colored colonies. c) loss of power to produce typical metallic sheen on colonies.
	4. Inability to produce gas from saccharose, mannitol, maltose, and lactose.
	5. Inability to produce indole.
	6. Development of "giants" in morphology.
	7. Retardation of growth in broth.
	8. Decrease of reducing action.

CONCLUSIONS

The development of resistance to quaternary ammonium compounds by *Serratia marcescens* and *Escherichia coli* has been confirmed.

Concurrently with this induced resistance, it has been observed that variations in the characteristics of *E. coli* are such as to reduce the value of the various tests used to identify its presence.

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C. S. Bryan—1908–1951

As we go to press, we have just received word of the sudden death of Dean Bryan, Michigan State College, at the University Hospital, Ann Arbor, on July 30. He had been in the hospital since July 13.

Dr. C. S. Bryan received his B.S. degree from the Pennsylvania State College in 1930, and his M.S., Ph.D., and D.V.M. degrees from Michigan State College. In 1947, he succeeded Dr. Ward Giltner as Dean of the School of Veterinary Medicine. He was a widely known educator and scientist, and was an authority on bovine mastitis and dairy hygiene. He has written more than one hundred journal articles and bulletins in these fields. In 1950 he was elected to honorary membership in the Mexican Society of Veterinary Doctors for his outstanding work in the profession. He was Secretary of the Association of Deans of American Colleges of Veterinary Medicine.

MILK and FOOD SANITATION

FACTS IN CATTLE DISEASE WHICH ARE ESSENTIAL FOR INSPECTORS TO KNOW*

C. S. Bryan

Dean, School of Veterinary Medicine, Michigan State College

Dr. C. S. Bryan grew up in Pennsylvania and received a B.S. in dairy husbandry at Pennsylvania State College in 1930. He held a graduate assistantship at Michigan State College 1930–31, subsequently served as instructor, and was appointed professor and head of the Department of Surgery and Medicine in 1944. Since 1947 he has served as Dean of Veterinary Medicine.

HOW PATHOGENS OR TOXIC MATERIALS AND DRUGS GET INTO MILK AND DAIRY PRODUCTS

1. *From animals producing the milk:*
   (a) Through the body directly into the milk.
   (b) External contamination by feces or infected discharges.
2. *From milk handlers—on the farm, in milk plant, on delivery route or in the home:*
   (a) Direct contamination of milk or dairy product.
   (b) Indirect contamination through milk equipment.
3. *From contaminated water supply:*
   (a) Used for cooling or washing the product or the containers for the milk or milk product.
   (b) Accidental splashing into product.
4. *Carried by dust, air, flies, vermin or rodents:*
   (a) Direct contamination of milk or dairy product.
   (b) Indirect contamination through milk equipment.

THINGS FOR THE INSPECTOR TO REMEMBER

1. *Wear clean clothes and overshoes on coming to the farm if the barn and surroundings are to be inspected; clean and disinfect overshoes, hands and equipment before replacing equipment into car when leaving the farm:*
   (a) The basis of all infectious disease control and eradication is sanitation.
   (b) The entrance of foot and mouth disease into Colombia, S. A., eight months previously resulted in a 30% rise in meat price during the period five to eight months after its appearance.
   (c) Survival of pathogens-tubercle bacilli, one year in manure.
   —mastitis streptococci, one month in dust and bedding of barn.
   —Brucella, five days in burlap sack, 46 days in soil.
   Resolution No. 12 (Barn Inspection) of Michigan Milk Producers Assn. 1950. "Be it resolved, that all Department of Health and all Department of Agriculture barn inspectors be required to use a disinfectant on their boots or shoes before entering the barn."
2. *Disinfect hands between cows, if udders are handled:*
   (a) To prevent the transfer of human infection to cows and vice versa.
   (b) To prevent the spread of cattle diseases, such as: infectious mastitis, cowpox, ringworm.
   (c) To teach sanitary procedure by example.
3. *Stay out of feed alleys and do not excite the cows:*
   (a) The most common entrance for disease germs is by way of the mouth.
   (b) Many disease germs are eliminated in the feces; therefore advise separate brooms and shovels for feeding.
   (c) Cows may injure themselves during excitement.
4. *Close the stable doors, especially during wintertime:*
   (a) Chilling and drafts encourage calfhood diseases.
   (b) Chilling may cause non-infectious mastitis.
   (c) The comfort of cattle influences production.
5. *Stick to dairy inspection:*
   (a) To prevent the spread of diseases from other livestock to cattle. Tuberculosis of poultry can be spread to swine and will sensitize cattle.
   (b) To prevent the spread of any disease agent, such as—hog cholera virus, Newcastle virus, etc., and the causes of cattle diseases from farm to farm.
6. *Other information of value:*
   (a) Brucellosis results in an approximate 20% reduction in milk production.
   (b) Mastitis results in an approximate 20% reduction in milk production.
   Mastitis results in an approximate 50% drop in milk quality.
   (c) Some cows produce abnormal milk when they are "in heat."
   (d) Advise the quarantine of animals to be added to the herd.
   (e) Owner should not allow promiscuous nursing of a number of cows by one calf.
   (f) Withhold the milk from mastitis treated quarters for 3 days.
   (g) Some drugs that are eliminated in the milk, in varying quantities, are:

Iodoform	Morphine	Copper
Iodine	Sulfa drugs	Atropine
Formalin	Sulfur	Antimony
Benzaldehyde	Ether	Strychnine
Camphor	Chloroform	Arsenic
Turpentine	Mercury	Salicylic
Tetrachlor-	Lead	acid
ethylene		Antipyrin
		Boric acid

* Presented at the Eighth Annual Dairy and Food Inspectors and Sanitarians School, April 10, 1951, at Michigan State College.

WHAT THE MILK INSPECTOR SHOULD KNOW ABOUT NEW MASTITIS TREATMENTS*

A. R. DRURY, D.V.M.

Michigan State College, East Lansing, Mich.

THE use of any antibiotic for the treatment of mastitis is creating new and serious problems with possible public health aspects on the farm and at the milk plant. As shown by various surveys on milk sheds, milk from treated animals is being shipped to processors. This is possible because the antibiotics are doing a remarkable job in returning abnormal milk to grossly normal milk appearance. Present methods of treatment for chronic cases seldom affect the appearance of milk in such a way as the milk is not marketed.

The antibiotics used for treatment of mastitis are numerous and changing. All create the problems in proportion to their general use in udder therapy. Chloromycetin and Neomycin are least significant in their inhibitory abilities on various tested starter cultures. Various published reports are: †

1. The presence of 0.5 unit of penicillin per cc of milk resulted in complete inhibition of acid production by six starter cultures.
2. The presence of 0.1 unit of penicillin per cc of milk resulted in marked inhibition of acid production by six starter cultures.
3. The presence of 0.05 unit of penicillin per cc of milk resulted in moderate inhibition of acid production by six starter cultures.
4. The presence of 0.0005 mg of aureomycin per cc of milk resulted in marked inhibition of acid production.
5. The presence of 0.00005 mg of aureomycin per cc of milk had almost no effect on the fermentation.
6. The presence of as little as 1 percent of milk or cream from a treated quarter resulted in a restriction of acid production for from 4 to 6 milkings after treatment. Sulfanilamide, sulfamerazine, and aureomycin were slightly less restrictive in action.
7. Lactic acid bacteria were restricted in growth and acid production in reconstituted milk where the milk powder was manufactured from milk containing at least 1 percent of milk from recently treated quarters. Under these circumstances sulfanilamide, sulfamerazine, and aureomycin exerted a slightly stimulating effect on the lactic acid bacteria.

It is apparent that milk from treated cows should be withheld from a milk supply 3 days when ordinary agents are infused into the udder and 6 days when so-called 96-hr preparations are used.

Milk from treated cows can safely be fed to cats, pigs, chickens, and calves.

The next important consideration is the possibility that people are sensitizing themselves to these various antibiotics by consuming milk which contains antibiotics from such sources. This sensitization may mean that such persons cannot be treated for diseases which they may contract because of the allergic response to the antibiotics. Another possibility is the development of a resistant strain of the pathogen to the antibiotic.

At the farm the problem of more resistant strains of pathogen has already been noted. Careless farm use of mastitis therapy agents has also introduced new species of bacteria to significance in the infectious mastitis complex.

A sound mastitis program reverts to following good dairy husbandry practices which encompass:

1. Adequate physical facilities, a stable that tends to keep cows clean, comfortable, and prevents injuries to teats and udder by providing proper stalls, curbs, provides dry yards and approaches to the barn, removal of all such items as high sills, drafts from doors and windows, and anything else that can conceivably injure the udder.
2. Clean, fast milking procedures making proper use of a strip cup, a routine for stimulating milk "let down," a rinsing of machine between cows, with complete attention to actual milking operation.
3. Care of equipment such as: proper vacuum, pulsation, complete brush washing after each milking. Replacement of worn inflations.
4. Sound stabling arrangement and replacement practices.
5. Diagnose mastitis early and have treated by a competent veterinarian.

Go to the real cause of the problem by early, accurate diagnosis. Remember mastitis is a herd problem, not a cow problem, and treatment is only one of the tools of the program.

* Presented at the Eighth Annual Dairy and Food Inspectors and Sanitarians School, April 10, 1951, at Michigan State College.

† Mich. Ag. Exp. Station Bull., Vol. 33, No. 3, pp. 223–228, Feb. 1951.

Pennsylvania Dairy Bacteriology Short Course

The Dairy Bacteriology Short Course will be conducted at The Pennsylvania State College from August 13 to 29, 1951. Instruction will consist of the study of standard methods used in the bacteriological analysis of dairy products. Previous instruction in bacteriology or experience in a laboratory is desirable.

For an application blank, write to A. Leland Beam, Director of Short Courses, School of Agriculture, State College, Pennsylvania.

Wisconsin Short Course

The Department of Dairy and Food Industries of the University of Wisconsin plans to offer a twelve weeks Short Course in Dairy Manufacturing beginning September 26 and closing December 22. The subjects covered in this course are: Dairy Arithmetic, Dairy Bacteriology, Dairy Cattle Diseases, Dairy Mechanics, Dairy Sanitation, Marketing Dairy Products, Milk Composition and Tests, Ice Cream Making, Buttermaking, Market Milk, and Cheesemaking.

THE DEVELOPMENT OF THE MILK AND FOOD SANITATION PROGRAM OF THE PUBLIC HEALTH SERVICE

(Continued from the May-June issue, page 118)

Other Investigations

Public health literature contains numerous references to individual milk-borne outbreaks of disease and to compilations of such outbreaks. The first extensive publication on milk issued by the Public Health Service included a compilation of 500 milk-borne outbreaks of disease which had appeared in the literature up to that time (1908). In Supplement No. 62 to the Public Health Reports this compilation of milk-borne outbreaks of disease is continued by Drs. Charles Armstrong and Thomas Parran, so as to complete the data for the United States as published up to January 1, 1927. In order to have a continuing up-to-date record of milk-borne outbreaks of disease, the Public Health Service has, since 1923, compiled annual summaries of milk-borne outbreaks of disease as reported to it by health authorities in the United States in response to annual questionnaire surveys. These compilations indicate that reported milk-borne outbreaks of disease in the United States have declined from about 40–60 per year in the 1920's to about 20 per year in recent years. Practically all of these outbreaks are due to raw milk supplies; and for the most part they occur in small cities and towns, for in such communities a large part of the population is still served by raw milk supplies. It has been shown by Fuchs (1941) that the danger of contracting disease from raw milk is about 50 times greater than for pasteurized.

From the beginning of the commercial pasteurization of milk supplies, there have been differences of opinion as to the effect the heating of milk has upon its food value. Although practically all health authorities feel that pasteurizing milk has no significant effect upon its food value, the question nevertheless continues to arise from time to time in those communities in which considerable raw milk is still being sold. As this problem was a pressing one with a number of health officers, in 1931 Frank, Clark, Haskell, Miller, Moss, and Thomas made a field study of this problem in surveys of 39 cities and covering a total of about 3,700 white children of 10 months to six years of age. The final conclusion of this study was that, taking into account the average supplementary American child diet, children who are fed pasteurized or other heated milk thrive as well as children who are fed raw milk, and contract certain communicable diseases less frequently. To combat unsupported claims by raw milk advocates in recent years, a review article on this subject was prepared by Sanitary Engineers John Andrews and Fuchs in 1948 at the request of the Council on Foods and Nutrition of the American Medical Association.

Municipalities considering the adoption of the Public Health Service Milk Ordinance frequently inquire as to probable costs of enforcement. A questionnaire survey was undertaken by Frank and Fuchs in 1934, to determine local cost of milk control in those cities which were satisfactorily enforcing the Public Health Service Milk Ordinance, as evidenced by milk sanitation ratings of 90 percent or more. On this basis, of the information received from 74 cities ranging in population from less than 1,000 to over 300,000, which were adequately enforcing the Public Health Service Milk Ordinance, the mean cost of milk control for those cities in 1934 was 8.3 cents per capita per year, 0.46 cent per gallon of milk, or $47.00 per producer or plant per year. All unit costs were generally lower in the larger than in the smaller cities. Other questionnaire surveys were made on the extent of tuberculin testing and pasteurization in 1923, 1927, and 1931, and an extensive survey on municipal milk control was made in 1936 by Fuchs and Frank. A national inventory of needs for milk pasteurization facilities was undertaken in 1943 by Andrews and Fuchs.

In the development of a satisfactory milk sanitation program, adoption of a satisfactory milk ordinance is only one step in the program, and must of necessity be accompanied by effective enforcement of the ordinance. In order to measure the degree of milk ordinance enforcement, the Public Health Service developed a milk-shed rating method which it and many of the State health departments have used. The method was described and standardized in 1938 by Sanitary Engineers Frank, Fuchs, and Walter N. Dashiell. This rating method uses as a yardstick the Grade A pasteurized and Grade A raw milk requirements of the Milk Ordinance and Code recommended by the Public Health Service. These ratings are not safety ratings, but represent the degree to which the community concerned has enforced sanitation requirements which are designed to make pasteurized milk and raw milk, respectively, as safe as these grades may practicably be made. The method, moreover, takes into account all items of sanitation, the quantity of milk sold by the violators of any of the items, and the relative sanitation importance of the violated items.

In order to encourage the municipalities of the United States to attain and maintain a high level of excellence in the public health control of milk supplies, there have been published semi-annually since January 1934, the names of American municipalities for which milk-sanitation ratings of 90 percent or more have been reported by their respective State milk sanitation authorities. Owing to the wartime deterioration in milk quality resulting from labor and equipment shortages, as well as from reduction in local milk control staffs, publication of these lists was suspended after the issue of February 19, 1943. It was resumed with the issue of February 25, 1949. The latest report is that of August 18, 1950. These reports also include the rules under which a municipality is included in the list.

(To be continued in next issue)

Dunbar Succeeded by Crawford as U. S. Commissioner of Foods and Drugs

Effective May 31, Dr. Paul B. Dunbar, Commissioner of Food and Drugs, will retire after having spent nearly forty-four years in Government service.

Federal Security Administrator Oscar R. Ewing states, "I want to express my most sincere appreciation of Dr. Dunbar's services. In his association with his colleagues and with members of the regulated industries, he has enjoyed wholehearted cooperation and the highest respect. . . . Dr. Dunbar's career is an example of the finest type of devoted, conscientious, statesmanlike government service. His devotion to the principles of good government administration and innate modesty with reference to his own accomplishments are well known throughout the food, drug and cosmetic industries. He enjoys a wide respect among the members of those industries, where his cooperation and helpful counsel are well known. It was with extreme regret that I learned of Dr. Dunbar's intention to retire."

Mr. Charles W. Crawford, now Deputy Commissioner, will succeed Dr. Dunbar.

Mr. Crawford has been in Government service thirty-four years. He began as an analyst at FDA's Chicago and New Orleans stations before coming to Washington in 1918. In 1928 he became head of a new division handling enforcement activities. He was appointed Assistant Commissioner in 1942, and in 1944 was appointed Deputy Commissioner, becoming FDA's second ranking officer.

Before entering Federal service, Mr. Crawford did research and analytical work, and taught chemistry at Oklahoma A. & M. College and at Washington State College.

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As Their Official Organ

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California Association of Milk and Dairy Sanitarians

An all-day sectional meeting of city, county, and state milk control officials operating in the San Joaquin Valley was held in Merced, May 17.

Considerable sentiment was expressed for holding brief sectional association meetings in various parts of the state between annual meetings.

The meeting was attended by representatives of the following milk inspection departments: Kern County; Fresno City and County; Tulare County; Stanislaus County; San Joaquin County; Oakland, San francisco, and Los Angeles inspectors operating in the San Joaquin Valley; and the 24 members of the State Bureau of Dairy Service located in the area.

Florida Association of Milk Sanitarians

At the recent annual meeting of the Florida Association of Milk Sanitarians held in Gainesville, April 11–13, 1951, a motion was passed empowering the president to appoint a "Constitution and By-Laws" committee to study, revise the constitution, and bring up to date and in agreement with the newly adopted constitution of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, of which the Florida Association is an Affiliated Section.

For this committee President L. T. Smith, Jacksonville, appointed the following:

W. Howard Brown, Jacksonville
Alex G. Shaw, Tallahassee
Prue D. Shirley, Tampa
Ben J. Northrup, St. Petersburg
Same O. Noles, Jacksonville

This committee met at the Dairy Products Laboratory, University of Florida, Gainesville, on May 29 and discussed at length all suggested changes. The secretary-treasurer of the Association, Dr. H. H. Wilkowske, was asked to prepare a revised version for redistribution to the committee, for approval. The committee hopes to have a completely satisfactory revised constitution for presentation at the next annual meeting.

H. H. WILKOWSKE
Secretary-Treasurer

Michigan Association of Sanitarians

Members of the Michigan Association of Sanitarians who attended the meeting of the INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS at Glenwood Springs were authorized by the Executive Committee to present some item that represented Michigan to be given away as a door prize. The official delegate is President Milo Wilson and alternates are Messrs. Grey Turney and Russell Palmer.

JAMES AXELSEN
Secretary-Treasurer

Wisconsin Milk Sanitarians' Association

The next meeting of the Wisconsin Milk Sanitarians' Association will be held at the Loraine Hotel, Madison, Wisconsin, September 5, 1951. Mr. Myron Clark, 1810 Ohio Street, Oshkosh, Wisconsin, is the program chairman.

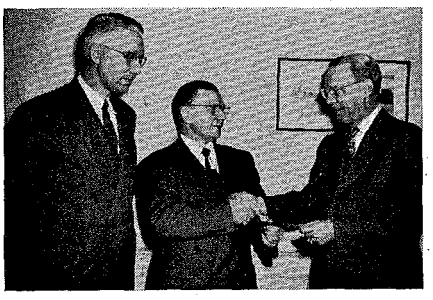
The State Board of Health in cooperation with the College of Agriculture, University of Wisconsin; the State Department of Agriculture; and local health departments, is conducting a course for pasteurization plant operators and their employees. C. K. LUCHTERHAND

Central Ohio Dairy Technology Society

The Central Ohio Dairy Technology Society recently presented a check for $100 to the Ohio State University Development Fund.

This donation is to be added to the Cenrtal Ohio Dairy Technology Society Fund established in 1950 to be used by the Department of Dairy Technology as need may arise. A committee of Dairy Technology Society members and Department of Dairy Technology staff members constitutes the governing board for the fund.

This marks the second year that such a donation has been made by the society.



Dr. O. F. Garrett (center), President of the Central Ohio Dairy Technology Society, presents a check to Kenyon S. Campbell (right), Field Director of The Ohio State University Development Fund, as Dr. I. A. Gould (left), Chairman of the Department of Dairy Technology, looks on. Check is to be used to further the work of the Dairy Technology Department.

Central Illinois Dairy Technology Society

The May meeting of the Central Illinois Dairy Technology Society was held on May 9, 1951, at the Allerton Estate, Monticello, Illinois. The first Ladies' Night of the year was well attended and many walked through the formal gardens on the estate before dinner.

President Harder announced that the Society Executive Committee had voted to sponsor a $100 scholarship at the University of Illinois. This award is to be used by a Junior entering his Senior year in the Dairy School.

The Society will resume its meeting in September.

JOHN W. HAYES
Corresponding Secretary

Tri-City Dairy Technology Society

The officers of the Tri-Cities Dairy Technology Society are as follows:

President, Burton Peck.....Louisville, Ky.
Vice-President, T. R. Freeman..Lexington, Ky.
Secretary, F. H. Osborn, Falls Cities Coop. Milk Producers Assn., 1051 E. Main St., Louisville, Ky.
Recording Secretary, R. Von Allmen Louisville, Ky.
Treasurer, C. Quillman.....Louisville, Ky.
Sergeant-at-Arms, F. Vigar..New Albany, Ind.

The Tri-Cities Dairy Technology Society, in cooperation with the local health department and the dairy industry, is sponsoring a training school for milk plant operators. The most pertinent subject at this time is the unfortunate grade received by the Louisville dairies in the last U. S. Public Health survey. The Society will offer the following program. It has set up the Tri-Cities Dairy Technology Society Training School covering the following subjects:

1. Sanitation — equipment, care and handling.
2. Good Housekeeping—cost of pipe, equipment, etc.
3. Flavors—grading.
4. Fat losses—control.
5. Safety.
6. Operation — costs, spillage, efficiency, etc.

The meetings are open to all plant personnel and interested persons, and will be free of cost to those attending. It is further proposed by several milk plants to pay a modest bonus to those employees attending, if on the next U.S.P.H.S. survey the employee's plant makes a grade of 95 or better.

The first meeting was held in the amphitheater at General Hospital, June 27. "The only equipment needed will be a pencil and paper and an open mind." Meetings will start promptly and should not last over two hours.

FRANK H. OSBORN
Secretary

North Carolina Dairy Technology Society

The North Carolina Dairy Technology Society announces its list of officers for 1951 as follows: W. E. Younts of Burlington, president; R. B. Davenport of Durham, vice-president; Paul R. Jordan of Raleigh, treasurer; W. M. Roberts of Raleigh, secretary.

PROGRAM OF THIRTY-EIGHTH ANNUAL MEETING INTERNATIONAL ASSOCIATION OF MILK AND FOOD SANITARIANS, Inc. GLENWOOD SPRINGS, COLORADO, SEPTEMBER 26-29, 1951

Monday, September 24th

1:00 P.M. **Meeting of Executive Board**—Report on Journal.

Tuesday, September 25th

8:30 A.M. **Breakfast**—Continued meeting of Officers of the Association.

Wednesday, September 26th

8:00 A.M. **Registration**—Secretary-Treasurer of the Association, George A. West.

Wednesday, September 26th

GENERAL SESSION

Morning Session

8:40 A.M. **Movie—"Safe Service."**

9:30 to
9:45 A.M. **Address of Welcome**—Dr. R. L. Cleere, Executive Director, Colorado State Department of Public Health, Denver, Colorado.

9:45 to
10:15 A.M. **Address of President—"Tumbleweeds"**—Dr. K. G. Weckel, President, International Association of Milk and Food Sanitarians, Inc.

FOOD SECTION MEETING

Chairman: O. J. Weimann, Director, Milk, Food and Drug Section, Colorado State Department of Health, Denver, Colorado.

10:15 A.M. **The Sanitary Control of Groceries, Meat Markets, Delicatessens and Other Retail Food Establishments**—Timothy Sullivan, Director, Division of Food and Drugs, Indiana State Board of Health, Indianapolis, Indiana.

10:40 A.M. **Discussion.**

11:00 A.M. **Food-borne Diseases in the Navy—A Training Program for Food Service Personnel as a Preventive Measure**—Lt. Fred E. Stewart, MSC, U.S.N., Head, General Sanitation Section, Bureau of Medicine and Surgery, Dept. of the Navy, Washington, D. C.

11:30 A.M. **Discussion.**

11:40 A.M. **Report on a Study of Methods of Evaluating Food Handler Training Techniques**—R. L. Tarbett, Associate Sanitary Engineer, Bureau of Sanitary Engineering, California State Dept. of Public Health, Berkeley, California.

12:10 P.M. **Discussion.**

Wednesday, September 26th

MILK SECTION MEETING

Chairman: James M. Doughty, Jr., Supervisor, Milk Sanitation, Division of Sanitary Engineering and Sanitation, State Department of Public Health, Santa Fe, New Mexico.

10:15 A.M. **Three A Standards from Viewpoint of the Dairy Industry**—Dr. E. H. Parfitt, Chairman, Sanitary Standards Sub-Committee of the Dairy Industry Committee (DIC), Chicago, Illinois.

10:40 A.M. **Discussion.**

11:00 A.M. **Role of Plant Fieldman in Sanitation**—Vincent V. Kiser, Hoosier Condensed Milk Company, Bluffton, Indiana.

11:30 A.M. **Discussion.**

11:40 A.M. **Quaternaries and Chlorine in Udder Washing**—P. R. Elliker, Oregon State College, Corvallis, Oregon.

12:10 P.M. **Discussion.**

Wednesday, September 26th

Afternoon Session

President K. G. Weckel presiding.

1:15 P.M. **Business Meeting** including **Reports of Committees:** Applied Laboratory Methods, Chairman L. A. Black; Communicable Diseases Affecting Man, Chairman I. A. Merchant; Dairy Farm Methods, Chairman R. G. Ross; Food Handling Equipment, Chairman C. W. Weber; Frozen Foods Sanitation, Chairman Marvin Speck; Membership, Chairman E. A. Graber; Ordinances and Regulations, Chairman C. J. Babcock; Professional Status, Chairman H. B. Robinson; Resolutions, Chairman M. R. Fisher; Sanitary Procedure, Chairman C. A. Abele.

4:00 to
5:00 P.M. **Organization Meeting of the Council of the I.A.M.F.S.Inc.**

Evening Session—8:00 P.M.

"Get Acquainted in the Corral"

Thursday, September 27th

Morning Session

7:30 A.M. **Breakfast**—All members of committees and all officers of the Association.

GENERAL SESSION

First Vice-President Harold J. Barnum presiding.

8:30 A.M. **Movie—"Make Mine Ice Cream."**

9:15 A.M. **Coordination of Health Department and Agriculture Department Programs**—Paul W. Swisher, Commissioner, Colorado State Department of Agriculture, Denver, Colorado.

FOOD SECTION MEETING

Chairman: William V. Hickey, Chief Sanitarian, Division of Foods and Sanitary Engineering, City Board of Health, Salt Lake City, Utah.

10:00 A.M. **The Need for Establishment of Standards in Bakery Sanitation**—Edward L. Holmes, Director, Bakery Sanitation Department, American Institute of Baking, Chicago, Illinois.

10:30 A.M. **Discussion.**

10:45 A.M. **Canning Plant Sanitation**—Edwin S. Doyle, Sanitarian, Western Research Laboratories, National Canners Association, San Francisco, California.

11:15 A.M. **Discussion.**

11:30 A.M. **The Use of a Performance Test for Evaluating the Effectiveness of Jet Types of Dishwashing Machines**—W. L. Mallmann, Professor of Bacteriology and Public Health, Michigan State College, East Lansing, Michigan.

12:00 Noon **Discussion.**

Thursday, September 27th

MILK SECTION MEETING

10:00 A.M. **Cleaning and Sanitizing Permanent Pipeline Installations**—Dr. W. H. Haskell, Director of Programs, Klenzade Products, Inc., Beloit, Wisconsin.

10:30 A.M. **Discussion.**

10:45 A.M. **National Program on Interstate Milk Shipments from Viewpoint of Receiving States**—M. L. Raines, Chief Field Milk Supervisor, Bureau of Food and Drugs, Texas State Department of Health, Austin, Texas.

11:30 A.M. **Discussion.**

11:40 A.M. **The Effect of Refrigerated Storage on the Reduction of Resazurin and Methylene Blue in Milk**—Dr. C. K. Johns, Senior Bacteriologist, Division of Bacteriology and Dairy Research, Canada Dept. of Agriculture, Ottawa.

12:10 P.M. **Discussion.**

12:15 P.M. **Luncheon Meeting**—Board of Associate Editors of the JOURNAL OF MILK AND FOOD TECHNOLOGY. (Meeting room to be announced.)

Thursday, September 27th

Afternoon Program

1:15 to 6:00 P.M. **Field Trips.**

Evening

"Chuck Wagon Dinner and Entertainment."

Friday, September 28th

GENERAL SESSION

Morning Session

Second Vice-President John D. Faulkner, presiding.

7:30 A.M. **Breakfast.**

8:30 A.M. **Movie—"Best Food In Town."**

9:15 A.M. **Professional Education of the Sanitarian**—Dr. Sam Hopper, Department of Public Health, Indiana University Medical Center, Indianapolis, Indiana.

9:45 A.M. Discussion.

10:00 A.M. **Business Meeting—Election of Officers.**

FOOD SECTION MEETING

Chairman: Howard Weindel, Training Officer, Rocky Mountain Training Center, U. S. Public Health Service, Denver, Colorado.

11:00 A.M. **The Food Equipment Standards Program of the National Sanitation Foundation**—Charles L. Senn, Engineer Director, Bureau of Sanitation, Department of Health, City of Los Angeles, California.

11:30 A.M. **Panel Discussion on Poultry Inspection, Grading and Plant Sanitation.**

Friday, September 28th

MILK SECTION MEETING

Chairman: P. E. Riley, Division of Sanitary Engineering, Illinois State Department of Health, Chicago, Illinois.

11:00 A.M. **New Developments in the Fluid Milk Industry**—George Shadwick, Beatrice Foods Corporation, Chicago, Illinois.

11:30 A.M. **Discussion.**

11:45 A.M. **State Approval Program for Laboratories**—J. C. McCaffrey, Chief, Bureau of Sanitary Bacteriology, Illinois Department of Public Health, Chicago, Illinois.

12:30 P.M. **Discussion.**

Friday, September 28th

Afternoon Program

"Local Arrangements Committee."

Evening Program

"Miners' Dinner."

Saturday, September 29th

7:30 A.M. **Breakfast**—Officers of the Association.

GENERAL SESSION

President-Elect H. L. Thomasson presiding, Indiana State Board of Health, Indianapolis, Indiana.

8:30 A.M. **Movie—"Battling Brucellosis."**

9:15 A.M. **The Advantages of Using Glass Pipe in the Modern Dairy Plant**—Dr. R. F. Holland, Corning Glass Works, Corning, New York.

9:45 A.M. **The Sanitarian in Public Health**—Milton M. Miller, Associate Professor in Sanitary Science, University of Denver, Denver, Colorado.

10:00 A.M. Discussion of Doctor Holland's and Professor Miller's papers.

10:15 A.M. **A Sanitation Study of Fountain Mixed Milk Drinks**—F. H. Fiske, Assistant Director, Sanitation Division, Bureau of Health and Hospitals, City and County of Denver, Colorado.

11:00 A.M. **Discussion.**

11:15 A.M. **Business Meeting — Installation of Officers.**

12:00 Noon **Adjournment.**

NATIONAL CONFERENCE ON INTERSTATE MILK SHIPMENTS

SUMMARY OF PROGRAM

The National Conference of representatives of the states meeting in behalf of the Interstate Milk Shipment Program convened at 8:30 a.m. in St. Louis, Mo., on June 4, 1951.

Mr. J. L. Rowland, Chairman of the Conference, set forth the objective of the Interstate Milk Shipment Program, the plans for continuing the program, and the conference agreements which were consummated in 1950.

Dr. Buford G. Hamilton, Director of the Division of Health of Missouri, welcomed the Conference. He stressed that the success of our program could be assured by the individual conferee's willingness to accept and obey the so-called eleventh commandment, an admonition not to take our own importance too seriously.

Mr. A. W. Fuchs, Chief of the Milk and Food Branch of the U. S. Public Health Service, reported on the progress made by the Public Health Service in Connection with tasks assigned to that agency by the 1950 National Conference.

Comments on the objectives of the Conference and of the extent, possibility and need of further progress were addressed to the Conference by the following representatives of other agencies:

Lt. Fred E. Stewart of the U. S. Navy
Col. Russell McNellis of the U. S. Army
Col. B. F. Leach of the U. S. Air Force
Dr. C. J. Babcock of the U. S. Department of Agriculture
Mr. E. Kellogg, Executive Secretary, Milk Industry Foundation
Mr. H. L. Wiltsee, Council of State Governments

The conferees reconvened the next day in General Assembly. Chairman Rowland assigned the delegates to the following task forces to make recommendations on the subjects also submitted to them at the same time for consideration:

1. Certification
2. Supervision
3. Laboratory
4. Education
5. Promotion of Interstate Program
6. Manufactured milk products
7. Channels and forms for reporting

Chairman Rowland announced the following rules to govern the operations of

1. Task Force Rules
   (a) Task forces will be appointed by the Chairman.
   (b) Each task force will select its own chairman.
   (c) Each task force will select a subcommittee of three to prepare the report of the task force.
   (d) The chairman of the task force will present the report to the General Assembly at 4:00 P.M., Tuesday, June 5.
2. General Assembly Rules
   (a) In general assembly, each state will be entitled to one vote. If there is more than one state agency represented they should caucus to decide whether to vote "yea," "nay," or to "pass."
   (b) Representatives of municipalities, industry, Public Health Service and other federal agencies will not be entitled to vote in the general assembly.

Mr. E. B. Kellogg, Secretary of the Milk Industry Foundation, Washington, D. C., presented the following statement of policy, agreed upon by the representatives of producers and processors of milk in attendance, to the conferees in General Assembly:

1. We support the objective of this conference to do all possible to furnish the public with an adequate supply of dairy products of high quality as best serving the interests of producers, processors and consumers.
2. We believe that inspection requirements should be simplified as much as possible to include only those directly related to quality and safety.
3. We believe that the principle of certification of the quality of milk and cream supplies by a responsible authority will promote its acceptability to areas needing additional milk and cream.
4. The representatives of producers and processors here present are happy to make our contributions to the problems under consideration, and commend the originators of the Conference for their foresight and excellent leadership.

The reports and recommendations of each group were again read, discussed, and either accepted, amended, or rejected by the General Assembly. The final approved recommendations are contained in the main report of the Conference (to be published later).

Several of the task force committees recommended to the General Assembly the study of specific problems relating to the implementation of the interstate milk shipment program adopted by the Conference. These recommendations, as amended and approved by the General Assembly, were as follows:

1. The task force on Certification recommended that the Conference Chairman appoint a committee to prepare uniform shipping tags and bills of lading for use on interstate shipments of bulk milk and submit the information to the U. S. Public Health Service for circulation to and approval by the states.
2. The task force on Supervision recommended that a committee composed of industry and state representatives be appointed to study the feasibility of recognizing industry inspection under a broad plan of official supervision of such industry inspection.
3. The task force on Education recommended that a committee be appointed by the chairman to make a study of the educational procedures to be followed in furthering the aims of the National Conference on Interstate Milk Shipments and that this committee submit its report to the 1952 Conference.
4. The task force on Manufactured Milk Products recommended that a committee composed of representatives of state regulatory agencies, the Public Health Service, and the manufacturers of dairy products, be appointed to study and expedite the formulation of standards for Grade A supplemental milk fats, concentrated and dry milk products, and standards for the manufacture and processing of these products. Industry members of this committee should include representatives of the national associations of the products affected, including but not limited to, the American Dry Milk Institute, International Association of Ice Cream Manufacturers, and the Milk Industry Foundation.

The date for the 1952 National Conference was set for June 10, 11, 12, 1952.

Industrial Notes

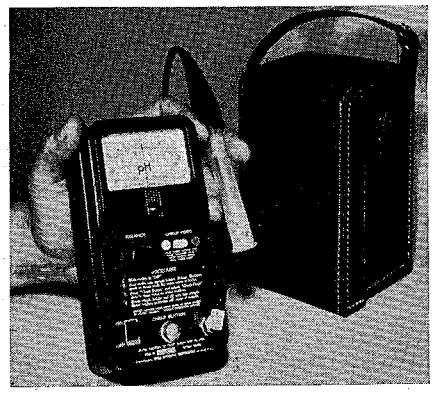
A revolutionary *pocket-size* **pH meter and companion probe unit,** now available for the first time, permit instant, on-the-spot pH determinations anywhere.

Completely self-contained with batteries, in a bakelite case 3" x 5⅞" x 2½", this instrument is furnished, camera fashion, in an ever-ready case with novel plastic tubes of buffer and KCl solutions. Total weight is 3 lbs.

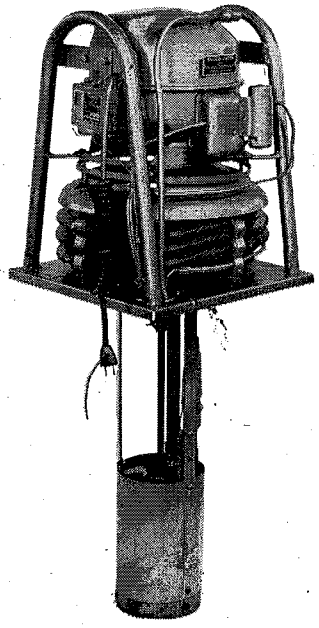
Supports and beakers are completely eliminated by combining the calomel and glass electrodes with the sample holder, in a single polyethylene probe unit. This revolutionary idea of combining the sample holder with the electrodes (Patents Pending) completely protects them and requires a sample volume of only 0.5 ml.

The meter is scaled from 2 to 12 pH for easy reading, and a simple adjustment gives readings from 0 to 14. Accuracy of 0.1 pH is obtainable.

Elimination of "grab samples" and trips to the laboratory by the ever-ready features of this new Pocket pH Meter and Probe Unit, open new fields for "on-the-spot" pH control. — Analytical Measurements, Incorporated, 585 Main Street, Chatham, New Jersey.



Drop-in Milk Cooler Unit for wet storage boxes or tanks. Designed to cool milk in a 2 to 8 can box or tank to 50° F in an hour. Units distributed through dairy plants, and readily replaceable, on short notice, should service become necessary. Hauler merely takes to the dairy farm a new unit, installs it in the tank, and removes the defective one to be returned to the factory for adjustment or repair.— Frigid Units, Inc., 315 Spitzer Bldg., Toledo 4, Ohio.

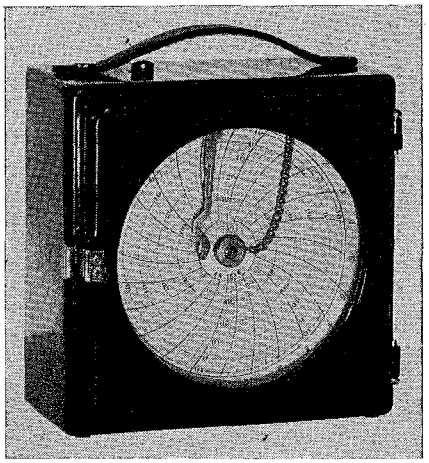


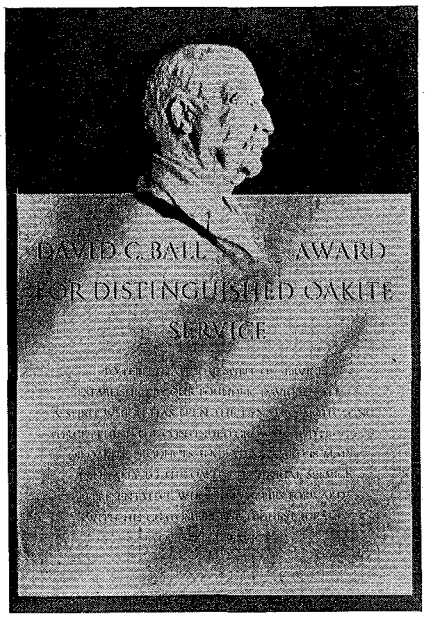
New TAG Miniature Recorder Charts for Temperatures in **Both Mobile and Stationary Refrigerated Units**—A continuous record of actual temperatures in refrigerated trucks, railway cars, warehouses, ships, and retail stores units, is provided by this new self-contained recording thermometer.

The Recorder requires no connection to any power supply, yet records temperatures over a period as long as *seven days* without attention. A specially-developed shock-proof mechanism makes it particularly satisfactory for use in trucks, trailers, railway refrigerated cars, and ships, where it can be installed with the cargo, without shock-proof mounting, and depended upon to record an accurate graph of ambient temperatures over a *seven-day* period.

It has a temperature range, in various models, within the limits of minus 30° F to plus 165° F. Charts are available for 24-hour, 72-hour, 3-day and 7-day recording. Special two-pen models are made for on-off recording of related equipment. The instrument measures 5¾" x 5¾" x 4¼", and weighs 3½ pounds. Remote recording types are also available.

Complete details about the Model No. 8475 Recorder, and a copy of Bulletin 1040F, devoted to this unit, can be had from the TAGliabue Instruments Division, Box 414, Weston Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, N. J.





Oakite Establishes Annual Award for Distinguished Service to Industry

John A. Carter, President of Oakite Products, Inc., manufacturers of industrial cleaning and related materials, has announced the establishment by the Company of the David C. Ball Award for Distinguished Service, a bronze plaque to be presented annually to the member of the Oakite technical field who has rendered the most outstanding service to industry during the year.

INDEX TO ADVERTISERS

Preheating on Inactivation of Phosphatase

(Continued from page 133)

ing temperature increases. This is also shown in Graph 1, which compares the slopes of the experimental and theoretical curves with the slope of Sanders' and Sager's [6] curve. The high degree of agreement noted between the slopes of the theoretical and experimental curves supports Ball's thesis. When the data are available, it is possible and practical to calculate a pasteurization process that is equivalent in lethal value, with respect to phosphatase, to a given process which is known to be adequate to destroy the enzyme.

CONCLUSIONS

1. There is a direct correlation between the percentage of total lethal heat contributed by one minute of preheating time and the holding temperature of the process.

2. It has been demonstrated that the amount of lethal heat contributed by a preheating time of one minute can be expressed mathematically.

3. It appears possible to obtain the inactivation values for phosphatase in milk by different pasteurization processes referred to a standard process.

REFERENCES

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2. Hetrick, J. H., and Tracy, P. H. Effect of High-Temperature Short-Time Heat Treatments on Some Properties of Milk. 1. Inactivation of the Phosphatase Enzyme. *J. Dairy Sci.*, **31**, 867–879 (1948).

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6. Sanders, G. P., and Sager, O. S. Heat Inactivation of Milk Phosphatase in Dairy Products. *Ibid.*, **31**, 845–858 (1948).

"Better milk, fewer problems with the B-K Patron Relations Plan"

writes
Fieldman William L. Brown
of Brock-Hall Dairy Co., Hamden, Conn.

• *"I use PR Plan materials as plant letters and mail them out to my patrons every month with their milk checks. It costs me nothing—yet it pays off both to me and my dairy in terms of better milk and fewer problems for me to go out and correct on my patrons' farms."*

Milk sanitarians and fieldmen have *many* duties. They can't always take the time to instruct each producer personally in quality milk production . . . and that's why the PR Plan proves so valuable to them.

This plan is a ready-made milk-improvement program for producers. Designed to help fieldmen and sanitarians, it *automatically* stresses the importance of day by day, year 'round "quality thinking."

The PR Plan consists of 3 services, offered *free* in the interests of the dairy industry, by the makers of B-K cleansers and sanitizers.

Fieldmen and plant owners everywhere tell about the effectiveness of this B-K Patron Relations Plan.

1. "TIMELY TIPS"—a monthly bulletin for producers, on seasonal dairy problems.

2. MOVING PICTURES and sound-slide films on quality milk production, for showing at patron meetings.

3. PERSONAL ASSISTANCE of trained field representatives in planning and conducting patron meetings.

Health officers and milk sanitarians who would like to receive the PR Plan regularly are invited to write: Dept. 37, Pennsylvania Salt Manufacturing Company, *East:* 1000 Widener Building, Philadelphia 7, Pa. — *West:* Woolsey Building, 2168 Shattuck Ave., Berkeley 4, Calif.

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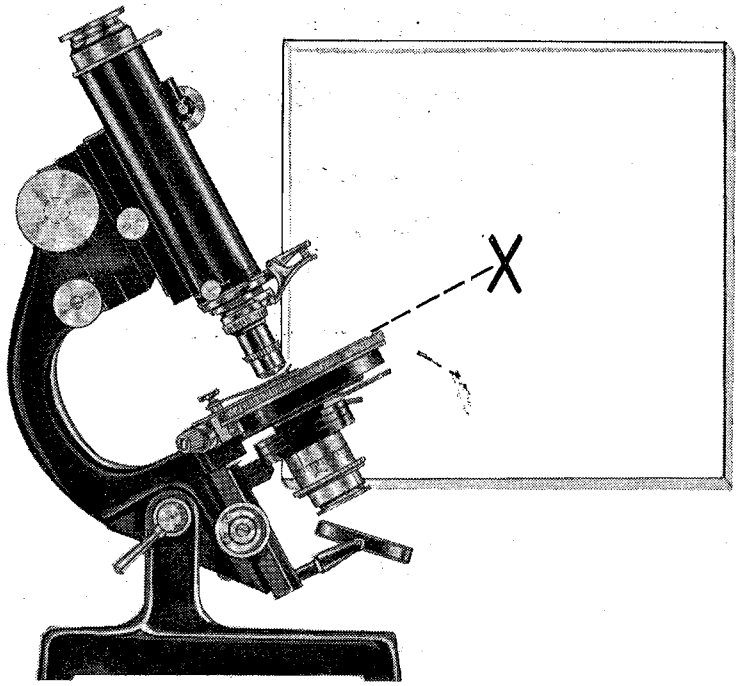
PROGRESSIVE CHEMISTRY FOR OVER A CENTURY



Absent every day—Coliform organisms

Ever since the development of the Canco single-service milk container, continuing bacteriological studies have been conducted.

Dangerous contamination as measured by the indicator of human contact, *Coliform organisms*, has been consistently absent.

This caliber of sanitary supervision is exercised through every phase of manufacture. As a result, the Canco single-service milk container is a virtually sterile package for carrying milk to the consumer.

And, having accomplished this all-important purpose, the Canco container is never used again!

You public health officials helped develop this method of milk distribution. American Can Company is proud to have taken a part in bringing the public the purest possible milk.

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