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Editorials

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Milk In Interstate Commerce

The latest development in the increasing federal attention directed to the interstate shipment of milk and milk products is the bill, S. 3711, introduced by Senator Guffey, of Pennsylvania, on April 3. The purpose of this bill is "to make unlawful the shipment in interstate commerce of certain milk or milk products for the evasion of State laws regulating the milk industry." It was referred to the Committee in Interstate Commerce.

The bill states that inasmuch as "The security of the American Nation depends upon the stamina of its population, the health and well-being of which demands a continuous production of wholesome milk and a larger per capita consumption thereof"; that "the high standard and purity of milk cannot be maintained by producers operating at less than cost returns; that the attempt to discourage an increase in milk production through artificially forcing the price paid to producers below cost tends to undermine the health of the Nation, to discourage farmers from progressive and sanitary practices, and *to undermine their sense of social usefulness*" (italics ours); "that milk dealers may play the producer of one State against those of another" by demoralizing the market through importation of cheaper milk from other States, and that milk dealers thereby find a means of evading the police power of the several States, especially those which have established milk-control boards and health regulations pertaining to milk, it is declared that hereby the policy of Congress will be the exercise of its constitutional power of regulating interstate commerce to protect the rights and welfare of the States, less failure to do so tend to foster the erection of trade barriers and the growth of sectionalism.

It would prohibit the shipment in interstate commerce of milk products in one state at prices lower than those prevailing in the state of destination, or produced under lower sanitary standards than those obtaining in the latter state. Milk includes fluid milk and cream, all skimmed milk, flavored milks or milk drink, buttermilk, ice cream mix, and evaporated and condensed whole milk.

Violation is punishable with a fine of not over $2,000 and or by imprisonment not to exceed six months. The milk in violation would be subject to seizure and forfeiture to the United States by a process of libel for condemnation, and the dealer would jeopardize his State license to do business.

We wonder why the backers of this bill did not ring in the unwritten law, the sun-spot cycle, and the influence of the Pleiades. The intent is evidently to control the price of milk at the state of destination. To drag in sanitary provisions raises as many new problems as it solves present ones.

No provision is made for enforcing the provisions of this bill. Who would determine whether milk at the State of production measures up to the sanitary level of the milk produced in the state of destination? There would have to be an enormously extended federal bureau of milk supervision with inspectors by the hundreds engaged in supervising interstate shipments of milk, cream, and evaporated milk—but not local products.

What standards would they use? Since the standards in the states of destination become the determining factor, thus the interstate standard would vary. Each inspector would certainly have to carry around a library of state and municipal regulations. A well-organized clerical staff would be necessary to keep this field force informed of the numerous revisions. What is more difficult yet is to interpret those parts of the state regulations which are enforced—because it is well-known that often only parts of state and municipal milk regulations are enforced.

This seems to be another attempt to harass industry with an intricate system of federal law enforced by another bureau in Washington, seeking to handle a problem too large for any one man or group of men.

Moreover, this is another instance of economic legislation masquerading under the guise of public health. Economics are not on a par in all sections of the nation and not only is this true in various sections but it has been demonstrated to exist even in adjoining states. Therefore, consumers in some states would be gouged by unwarranted high prices for milk which would be equivalent to paying an internal tariff for a commodity which the proposed legislation states to be so vital to public health. Resulting curtailed milk consumption would directly affect the public health and the industry as well, and the stated purpose of the bill would be defeated. Some groups of organized dairymen and some legislators appear to be quite concerned about the public health and welfare when in fact they are attempting to legislate economics. Under such a bill, the price of locally produced milk would determine the price which would have to be paid for all imported milk. We can imagine how the local, politically appointed milk boards would boost prices, juggle the market and turn industry into chaos.

Much more could be said concerning the inadvisability of adopting this bill, but limitation of space precludes. Because of the resultant evils of legislation of this type it is our hope that the bill dies in Committee.

J. H. S.

A Method for the Accurate Sampling of Ice Cream

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There is no standard method for sampling ice cream containing such added products as fruits or nuts. A common practice has been to strain out the added material and then run a test on the ice cream mix remaining. Another method consists of melting the ice cream, mixing the fruit or nuts with a stirring rod, and then sampling. This is quite similar to the former method, but involves a little less trouble and equipment. However, neither of these methods gives a true indication of what the test would be if this added material could be broken up finely enough to be included in the test sample. On the other hand, neither do they give an accurate representation of the unflavored portion of the mix. In order to get a truly representative test, it is desired to break up the added material finely enough so as to be able to include it in the test. With the advent of stricter legislation regarding the minimum fat content of fruit and nut ice cream, it becomes important to have a method that will give the true test of the entire ice cream, and not just an approximation.

During the summer of 1939, a method was devised at the University of Illinois which gave such accurate results as to recommend it for this purpose. To make the study as inclusive as possible, tests were run on samples containing strawberries, crushed pineapple, pineapple cubes, canned peaches, fresh peaches, raspberries, cherries, raisins, tutti frutti mixture, pistachio nuts, butternuts, black walnuts, English walnuts, cashew nuts, and pecans.

PROCEDURE

In carrying out the experimental work, the procedure used consisted of testing a sample of vanilla mix for fat by the Mojonnier ether extraction method. Some of this mix was then weighed out into 400 c.c. beakers, and 5, 10, 15, and 20 percent fruit added so that each of the four different samples prepared contained a sufficient amount of fruit and ice cream to make a total of 300 grams. This material was then dumped into a Stevens malted milk mixer, and the inside of the beaker scraped with a wooden spatula so as to transfer as much as possible of the material to the mixer, thus leaving only a trace in the beaker. The mixer was then started and allowed to run until the fruit was in a very finely divided state. This required varying the time of beating in order to get the particles in the desired state of fineness. These variations are shown in Table I. Raisins were most difficult to break up, but when beaten sufficiently long, came out in a fine condition. After the beating of the sample, it was tested by the Mojonnier ether extraction method. Results were also calculated from the amounts of fruit and ice cream mix used, and the two results compared.

RESULTS

Tables I and II show the actual and calculated tests obtained. In the case of the fruits, satisfactory checks were obtained, but the nuts, due to their fat content, all raised the ice cream fat test markedly, usually in the vicinity of 2 percent over what the original mix had tested. With the fruit ice creams, the readings tended to run slightly lower than the calculated results for the strawberry, pineapple cube, and cherry samples. The raspberry, canned peach, fresh peach, raisin, and tutti frutti samples either

TABLE 1.

Tests on Fruit Ice Creams

Flavor	Calculated test % fat	Actual test % fat	Whipping time minutes
Strawberry			
5% berries	12.01	11.92	1
10% "	11.38	11.32	
17.2% "	10.47	10.39	
20% "	10.12	10.02	
Pineapple			
5% fruit	10.86	10.81	1
10% "	10.29	10.19	
15% "	9.72	9.65	
20% "	9.15	9.07	
Pineapple cube			
5% fruit	10.74	10.73	2
10% "	10.17	10.07	
15% "	9.61	9.56	
20% "	9.04	8.99	
Cherry			
5% fruit	11.84	11.76	3
10% "	11.21	11.13	
15% "	10.59	10.52	
20% "	9.97	9.95	
Raspberry			
5% berries	11.70	11.74	1
10% "	11.08	11.13	
15% "	10.47	10.49	
20% "	9.85	9.99	
Canned peach			
5% fruit	11.70	11.73	1
10% "	11.08	11.10	
15% "	10.47	10.48	
20% "	9.85	9.87	
Fresh peach			
5% fruit	10.74	10.74	1
10% "	10.17	10.17	
15% "	9.61	9.59	
20% "	9.04	9.02	
Raisin			
5% fruit	11.84	11.90	7
*Tutti Frutti**			
20% of mixture	9.97	10.01	8

* Tutti frutti mixture consisted of pineapple cubes, raisins, cherries, crushed pineapple, allspice, cinnamon, and citron.

TABLE 2

*Tests on Nut Ice Creams**

Flavor	Chocolate test % fat	Actual test % fat	Whipping time minutes
Pistachio nuts	11.96	13.90	6
Butternuts	11.96	14.30	2
Black walnuts	11.96	13.45	2
English walnuts	11.96	14.31	2
Caschew nuts	11.96	13.75	2
Pecans	11.96	13.88	4

* The amount of nuts used in each case was 4 percent.

checked exactly with the calculated results or were slightly higher.

The duplicate tests performed on each sample gave remarkably close checks. Of the 30 samples of fruit ice cream tested using varying amounts of fruit, 83 1/3 percent of the duplicates checked in the range 0 to 0.05, and the remaining 16 2/3 percent of the samples checked within the range 0.06 to 0.10 percent. The mix made up with nuts showed equally good checks among the duplicates.

A number of samples of commercial fruit, nut, and candy ice creams were sampled by the method outlined, using a 4- or 5-ounce sample, and also by merely melting down the sample, stirring with a stirring rod, and then pipetting. Where the fruit ice creams contained chunks of material, as fresh strawberries, the test with the mixer was as much as 0.35 to 0.85 percent lower than the other method. This lower test would be the more truly representative, since in this case the fruit would have been thoroughly broken up and intimately mixed with the ice cream. Tests on the commercial samples are given in Table III.

TABLE 3

Tests of Commercial Ice Cream

Flavor	Old method % fat	Revised method % fat	Whipping time minutes
Cherry	10.56	9.72	3
Orange pineapple	11.46	11.34	2
Tutti frutti	10.53	10.18	3
Fresh strawberry	10.14	9.62	2
Whitehouse	12.00	12.30	6
Maple nut	11.88	13.96	4
Black walnut	12.05	13.83	6
Toffee	12.59	13.57	6
Chocolate chip	12.72	12.77	1
Mint stick	12.32	12.36	1

It was found that chocolate chip and mint stick ice creams could be tested just about as well without the mixer as with it. The candy dissolved and was incorporated quite readily with the mix. With the chocolate chip, the samples had to be heated to dissolve the chocolate, and then cooled before testing. There are some advantages in using the mixer even here, however, for a solution of the candy takes place much more rapidly. The actual tests, however, were within 0.04 percent of one another on the mint stick, and 0.05 percent on the chocolate chip when the two methods were compared, so either method is sufficiently accurate. Toffee ice cream acted much as a nut ice cream when beaten, giving a higher result in the mixer.

With some of the commercial samples, a little difficulty was encountered with churning when they were beaten in the mixer. This made it impossible to get duplicates to check, so it became necessary to warm them after mixing and then beat them again, after which they were cooled and sampled. It is likely that this churning was caused by inefficient homogenization, since no difficulty was encountered with those mixes that were known to be properly homogenized.

When testing frozen ice cream, a large enough sample should be taken to be representative of the mass, yet the sample should be of such size that when melted and placed in the mixer, the mixer will not be more than one-third full. *All of the melted sample* should be placed in the mixing cup. Samples weighing from 4 to 5 ounces should be used in order to obtain representative tests.

The Stevens malted milk mixer is manufactured by the Stevens Electric Company, Racine, Wisconsin. The ordinary mixer manufactured by this company does not come equipped with a motor powerful enough to stand prolonged operation without heating. However, the manufacturer will equip the machine with a heavier motor that will not heat, if it is so specified.

SUMMARY

A method of sampling and testing fruit ice creams has been described. A 4- or 5-ounce sample of ice cream is thoroughly broken up by means of a malted milk mixer to give an accurate test on the product.

Nut meats and English toffee cause a considerable increase in the fat content in ice cream when the nuts or candy are broken up in the malted milk mixer due to the ether soluble substances contained in these flavoring materials.

The chief advantage in using the malted milk mixer in testing chocolate chip and mint stick ice creams is to hasten the time required to dissolve the candy. No appreciable gain is made in accuracy.

Toffee ice cream resembles nut ice cream in its action in that the malted milk mixer gives higher results.

Churning of the sample can be overcome by warming it and then beating it again.

Scarlet Fever Outbreak Traced to Raw Milk. *New York State Health News.* Vol. 16, No. 50, December 11, 1939, pp. 204-205. *Pub. Health Engin. Abs.* xx, Mi. 15.

"A small outbreak of scarlet fever which occurred recently in the city of Hornell has again strikingly demonstrated the real purpose back of ordinances requiring the pasteurization of milk." By regulation, only pasteurized milk may be sold in Hornell. The outbreak was traced to a dairy which produced 325 quarts of milk daily from 35 cows which was sold on the premises exclusively to customers who brought their own containers and purchased the milk directly. There were eighteen cases including eleven adults with four secondary cases, no deaths. A new milker complained of a sore throat the day after he went to work and a month later, on examination, showed the presence of hemolytic streptococci which were likewise isolated from the udder of one cow. E. W. C.

Training in the Public Service in New York State

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DEVELOPMENT IN ACTIVITIES OF GOVERNMENT

The development and growth of the United States during the past half century has been paralleled by the development and growth of the functions of government. As industry, commerce, and agriculture have expanded with the impetus provided by new inventions, the discovery of new sources of raw materials and improvements in educational processes, the functions of government have also expanded and increased and their administration has become more complex. Scientific developments and improvements must be applied to functions of government if it is to keep pace with the economic and social progress of the nation. A skilled personnel is likewise an essential in public work as in private enterprise.

The old idea that the duties of public office are so simple that men of intelligence can qualify readily for any governmental post has been dissipated. Citizens are concerned today about the efficiency of government. They demand adequate performance of duties by public employees. They look upon public employment as a career service. To stimulate development and vitalization of a career public service, it is necessary to provide adequate training facilities for public employees.

PUBLIC SERVICE TRAINING ACTIVITIES IN NEW YORK STATE

Until recent years, experience alone had been teaching the public employee the daily routine of his public service. Experience was a slow, expensive, and inadequate teacher. To implement and to give direction to experience, the in-service training school was developed. Extensive in-service training programs have been established for the personnel of local subdivisions of the state. Limited in-service training programs have also been provided for state employees.

The organization and operation of in-service training programs for most local employees has been in the hands of the State Conference of Mayors, an association of cities and villages, and the State Association of Towns. Many branches of the state government have cooperated officially in training activities of these organizations. In-service training programs for state employees and employees of large urban centers have been provided by departments of the state and local governments, associations of public employees, and educational institutions.

TRAINING PROGRAMS

The Mayors' Conference established training schools for policemen and firemen on a state-wide regional basis in 1928. By 1931, the Conference had expanded its training programs to include twenty groups of municipal employees.

On January 1, 1935, the Regents of the University of the State of New York recognized the soundness of this work by granting an educational corporation charter for the operation of the schools to a group of officers and members of the Mayors' Conference. This corporation, the Municipal Training Institute of New York State, has been empowered by the Governor and Legislature to share in federal funds for vocational education.

Eighty thousand city and village employees have attended training schools operated by the Mayors' Conference and the Institute in the period January 1 1928 - July 1, 1939.

In 1935, the Regents chartered the Town and County Officers' Training School of the State of New York, a corporation administered principally by officers and members of the Association of Towns. This corporation is also authorized to receive reimbursement from federal vocational education funds.

Eleven thousand town and county employees have attended training schools in the period December 13, 1935 - July 1, 1939.

Large urban centers, including New York City, have developed and operated through municipal departments, associations of municipal employees, and educational institutions, special courses of in-service training for groups of municipal employees.

Some in-service training has been developed for state employees. The state departments of Correction, Conservation, and Taxation and Finance, for example, have operated programs for employee groups. Several educational institutions have provided extension training for employees. The school of the Division of State Police has performed outstanding work in training state and local police.

The experiment which was thus inaugurated on a large scale by municipal officials of the State of New York has spread rapidly throughout the country. Since 1928 there have been hundreds of training schools for municipal officials in this country conducted by state leagues of municipalities with a total attendance of several hundred thousand municipal officials. Leagues of municipalities in Virginia, West Virginia, Texas, Kansas, Colorado, Michigan, Minnesota, Nebraska, Oklahoma, Kentucky, Ohio, South Dakota, Oregon, California, Illinois, North Carolina, and Wisconsin have been active in operating such schools. The American Municipal Association, the national federation of state leagues of municipalities, with headquarters at 1313 East 60th Street, Chicago, has given a strong impetus to this movement by advising and assisting leagues in establishing such training programs.

In each state, municipal officials have developed their training programs in accordance with their peculiar local conditions and needs. There is thus a wide variety of organization and procedure in carrying out this work. However, certain fundamental principles are followed by all of the Leagues in the operation of their schools. The zone or regional system is employed in those cases where mass instruction covering a large area is desired. The schools present fundamental curricula covering the essential duties of officials. They are thoroughly practical in character. Efforts are made to procure competent and practical instructors and emphasis is placed on the development and use of proper teaching methods and facilities. Instructional staffs are drawn in large part from the ranks of public officials in all levels of government and particularly from the staffs of supervisory state agencies. Active cooperation with state and local vocational education authorities is the general rule, particularly in the development of proper teaching methods. The schools are conducted as college classrooms with strict attendance requirements. The lecture method is used, with lecturers speaking informally and utilizing the blackboard and other graphic means of presentation as much as possible. Officials participate actively in the class work and are asked questions on material which has been discussed. In practically all of the schools, officials are required to keep notebooks which in some cases are rated. Many of the schools provide class participation in a practical way in some phase of demonstration or inspection work which municipal officials normally encounter in their everyday duties. For example, milk inspectors examine and rate dairy barns, and food inspectors examine and rate meat markets as a phase of their school work. All of the schools provide opportunity for question periods and round-table discussions. Many of them provide final examinations. In all of them, formal graduation exercises are held and certificates of qualification for attendance are presented. In many cases,

supplementary information is sent to students on a regular schedule after they have returned to their duties.

State leagues of municipalities are not the only agencies which are alive to the possibilities of training in service. There is abundant evidence that the value of in-service training in all levels of government employment is gaining wide recognition. Institutes and special courses of the type operated for public employees by American University, New York University, George Washington University, the University of Southern California, and the University of Virginia, departmental training schools carried on in federal, state, and local governments, and the development of extension courses for municipal administrators by the International City Managers Association attest to the spread of this movement.

TRAINING RESULTS

In-service training of public personnel has increased the efficiency of state and local administration. Agencies operating schools report improvements in administration traceable directly to such training. Comments of employees and increasing attendance at training classes indicate that the programs are meeting a need. Employees are demanding lengthier and more frequent school sessions, regional classes, and the development of extension training. The training programs have developed a closer degree of cooperation between federal, state, and local employees than existed formerly. The schools are increasing public understanding of the complexity of government work and enhancing the prestige of public employment. Training is improving the morale of government employees. In training classes, public employees are made aware of the social importance of their jobs and are stimulated by professional pride to better their work. Studies have shown that tenure is lengthened by such training. A number of city civil service commissions are giving credit in promotional examinations for attendance at the schools. In-service training nourishes the merit system and contributes to the development and stability of a career public service.

The benefits of this pioneer work have not been confined to New York. These training programs have provided a stimulus and a pattern for the development of similar training activities in a score of states.

RECENT DEVELOPMENTS IN TRAINING IN THE PUBLIC SERVICE

The most significant development in the in-service training field in recent years has been the passage of the George-Deen Act. This Act, passed by Congress in 1936, provides for the further development of vocational education, and authorizes the use of federal funds for in-service training courses for public employees in states and cities. Such federal funds must be matched by state or local funds and can be expended only through a state vocational education agency.

The Act is a milestone in the development of cooperative relationships between federal, state, and local governments. It establishes for the first time by statute the principle of governmental responsibility for the training of public employees. It is a recognition of the fact that the training of public employees is at least equal in social importance to the vocational instruction of employees in industry and agriculture.

THE STATE EDUCATION DEPARTMENT AND PUBLIC SERVICE TRAINING

As has been pointed out, there was for many years prior to the passage of the George-Deen Act widespread activity in public service training in New York. The Regents and the State Education Department have cooperated in this training. The Vocational Education Division has assisted organizations of municipalities, state and municipal departments, associations of public employees, and educational institutions by advising on curriculum and teaching methods and in the training of conference leaders.

New York, as a pioneer in public service training, was equipped, therefore, to take immediate and effective action under the George-Deen Act.

On December 1, 1937, the Regents established in the State Education Department a Bureau of Public Service Training, responsible for cooperative aid to all interested and competent agencies in the operation, development, and coordination of training programs for state and local employees.

The functions of the State Education Department in the public service training field, as outlined in a policy statement adopted by the Regents are as follows:

(a) To be a service agency for interested public, quasi-public, and private agencies in the operation, development, and coordination of sound training programs for state and local employees by providing general advisory assistance, aiding in the development of curricula, teacher training programs, and teaching materials, providing teacher training service, and acting as a clearing house of information making available to interested groups throughout the country the in-service training experience of New York State, and apprising agencies within the state of in-service training developments in the state and nation.

(b) To cooperate with public, quasi-public, and private agencies in extending the scope and usefulness of existing training programs, and establishing programs for officials for whom no training has heretofore been provided.

(c) Within the restrictions of federal statutes and the State Vocational Education Plan and the limits of the small amount of federal monies available for this purpose, to reimburse from federal funds, on a matching basis, those public agencies, including departments of the state government, departments of local governmental subdivisions, associations of municipalities financed by public tax monies, and educational institutions chartered by the Regents for the in-service training of public employees which demonstrate their capacity to operate and develop sound in-service training programs for state and local employees.

(d) To encourage the growth of in-service training programs initiated, sponsored, directed, and supported by public employees in order to stimulate and maintain effective interest in employee self-improvement.

(e) To assist in the development of public employees as instructors in training programs.

(f) To assist in the coordination of all public in-service training activities within the state and to work with all interested agencies for the elimination of overlapping and duplication of training effort.

(g) To assist in promoting economy in the administration of public in-service training programs by urging and aiding all agencies to achieve full cooperative utilization of rich existing public and private training facilities and resources.

TRAINING THE MILK SANITATION EMPLOYEE

The first training school for municipal milk and dairy inspectors of New York State was held in Albany in 1932 under the direction of the State Conference of Mayors and with the cooperation of the Bureau of Milk Sanitation of the State Department of Health. The school was of the three-day short course type. More than ninety percent of the municipal milk inspection units in the state were represented in this school. Attendance at subsequent short course schools in 1934 and 1936 likewise evidenced the great interest of municipal milk sanitation employees in self-improvement.

To be successful a training program needs not only interested clients but also adequate course material and instruction. It has been fortunate that the Bureau of Milk Sanitation of the State Health Department has held such an enlightened point of view on the need for and practical problems involved in the organization and operation of these schools. Without the enthusiastic support of the training idea by the Milk Sanitation Bureau and the participation of its Chief and his associates in curriculum drafting

and teaching, the progress made thus far would not have been possible.

The success of the milk sanitation training program was undoubtedly an important factor in the action of the 1937 State Legislature in providing statutory qualifications for dairy and milk inspectors. Under the terms of the statute, the State Public Health Council has classified dairy and milk inspectors in three grades and prescribed qualifications for each grade. These qualification requirements are of far-reaching importance. They will insure definite standards of competence with resulting improvement in service to the public. They will make difficult arbitrary and unwarranted dismissals and lengthen the tenure of competent public servants. Employee morale will be stimulated. The professionalization of milk sanitation work will be hastened and its dignity enhanced. Remuneration of employees probably will tend gradually to approach professional levels. Furthermore, the principles embodied in these requirements may well provide a pattern for the development of similar qualifications for other classes of municipal employees.

The State Sanitary Code provides that the Public Health Council may require completion of a course of instruction in milk sanitation approved by the Council as one of the conditions of qualification for a particular grade. In May 1938, the Public Health Council approved a two-week course as meeting the instructional requirements for qualification in Grade I or II. The course was given from May 31 to June 13 by the New York State College of Agriculture at Cornell University for, and as a part of, the general training program of the Municipal Training Institute of New York State and in cooperation with the State Health Department, the State Conference of Mayors, the State Association of Towns, the Town and County Officers' Training School, and the Public Service Training Bureau of the State Education Department.

Comments of students enrolled indicated that it was highly successful. It consisted of approximately one-half actual laboratory work performed by each student and one-half study, recitations, and lectures. Written examinations were held daily, and a comprehensive written examination was given at the end of the course. Of the 20 students enrolled, 17 completed the course satisfactorily and received a certificate attesting to that fact, issued by the Municipal Training Institute under authority of the Regents. A similar course for Grade I inspectors was held from June 19 to July 1, 1939 with an enrollment of 15 students.

Such advanced training will supplement the regular basic training received in the three-day short-course schools operated under the same sponsorship for all inspectors every two years. The Public Health Council has approved the short courses as meeting the instructional requirements for Grade III milk and dairy inspectors. When facilities are available, Grade III inspectors having the required experience will have an opportunity to become qualified in a higher grade by taking an advanced course. Grade III schools will be open for review purposes to all municipal milk inspectors, irrespective of grade.

Training in the public service is still in the experimental stage. Although certain fundamental principles can be enunciated, there are few fixed methods of organization and administration of such training. Those who have been identified with the in-service training of milk sanitation employees in this state do not view their progress with complacency. They are aware that they have only scratched the surface of a new and exciting device for improving, fundamentally, local milk sanitation work. They know that the training program cannot be administered successfully with an inflexible and routine point of view. Milk sanitation work and training in that field present constantly changing problems demanding adaptability and resourcefulness for their proper solution. Undoubtedly, courses of instruction will be lengthened and made more complete. Extension courses may also be developed.

Although conditions vary widely throughout the country, the experience of New York suggests that in any successful comprehensive in-service training program for milk sanitarians, certain groups and agencies have a preponderant interest and should be identified officially with the work. These include state and local health departments, the State Department of Education, the state league or leagues of municipalities, the state association of milk sanitarians, and colleges and universities.

CONCLUSION

Some competent observers believe that in-service training is one of the greatest contributions of the last twenty-four years to the permanent improvement of public administration. All agree that it is a highly useful device in making democracy function more satisfactorily. It has been demonstrated that training increases competence and builds morale. Competence and morale are a potent combination in any human enterprise. When they pervade all levels and areas of government, the wheels of democracy will hum with new energy and effectiveness.

Phosphatase Test In Court. *Illinois Health Messenger*, Vol. 10, No. 18, September 15, 1938, p. 108. *Pub. Health Engin. Absts.* xx, Mi., 19

The operator of a roadside milk station, selling bulk or dipped pasteurized milk, in violation of the State statute, was found guilty in Cook County Magistrate's Court. The phosphatase test perhaps for the first time was used in Court, and it apparently was a determining factor in the successful termination of the case. The results of the tests were introduced as evidence by the prosecution to show that the milk, previous to handling by the defendant, had been pasteurized. "The safety of pasteurized milk is entirely dependent upon an unbroken chain of protection from the time it leaves the pasteurization plant until it reaches the consumer."

D. S. A.

Sanitary Milk Control Situation in Havana *

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The milk supply of Havana is not as good as one might presume from just a visit to a few of its show-place dairies, but it is not as bad as a newspaper from Miami would put it, when it advised prospective tourists to indulge in all the rum they wished, while in Havana, but not to touch a drop of milk.

Other factors being equal, the nearer to its market that the milk supply is produced, the better the milk quality will be. Most conditions do not favor Havana in this respect. First, geography plays an important part in shaping the milk-shed of a city. Havana is a seaport with half its surrounding area covered with water. The average distance of all the dairies to its market is greater than would be the case if the city had land all around it.

Another disadvantage in the way of obtaining a sufficient supply of milk near Havana is the extensive system of management of many of our dairy farms. Dairying is rather new with us, and many producers still rely almost exclusively on pasture and on soiling crops such as sorghum or corn sown broadcast. This system naturally requires a great deal of land. It is also unfortunate that we do not have in Cuba leguminous pasture plants like your clovers and alfalfa. A ration based almost entirely on roughages and lacking in protein results in poor milk production. In addition, the native and grade cows are poor producers. This combination of factors make for a very light production of milk per unit of land. I would estimate the production to be around 25 to 30 quarts of milk daily per "caballería" (33 acres) which is less than one quart per acre. In the newer zones it is even less. This results in a more extended milk-shed than would be the case if the cows were heavily fed as, for instance, around Miami where two and three hundred cows are found in just a few acres of land.

PRODUCTION

There is, of course, a number of dairymen whose well-fed, pure-bred and grade Holstein and Jersey cows average 10 and even 15 quarts of milk daily. With soy bean cake at $60 a ton and other protein concentrates around that price, on the one hand, and land at a yearly rental value of $3 to $5 an acre, on the other hand, it is a moot question which of the two systems —intensive or extensive—is better from a farm management standpoint. From a public health viewpoint, it is also a toss-up, for while we should like to have a large supply of milk close at hand, we find there is more freedom from diseases in the extensive system. In fact, the very rare cases of tuberculosis in cattle have been found in confined cattle, while none was present among the cows which are allowed to roam all day long in the open spaces.

In tropical and semi-tropical countries we have no well defined seasons as in the temperate zone. Our year is divided into a warm, rainy season which lasts from April to November and a cooler dry season during the remaining months. In a pasture country with a four-month dry spell every year, the water-holding capacity of the soil is of prime importance. Most Cuban soils have a high clay content, but the red soils are so well flocculated that they behave entirely different from what their texture would indicate. A temperate-zone farmer not familiar with them would be astounded on seeing these soils being plowed and turned into a mellow seed-bed a few hours after an inch-deep rain-fall. But, these red soils—known as the Matanzas clay family—which are so pervious to moisture, dry out badly in the "sequia", or dry season. Towards the end of the "sequia", especially on very dry years, a dust mulch a few inches deep forms on the surface of most of these Matanzas red soils, killing all shallow-rooted plant growth. It is, therefore, not surprising that dairy farmers have avoided these red soils in favor of the black Havana clay family. This soil family, due in most cases to unfavorable drainage, has not reached such an advanced stage of weathering as the red type and holds much better the precious moisture during the dry season. In the province of Havana the black soils are located to the east of the City of Havana, while the red soils, to the west. Until a new system of management is brought into use, the land west of Havana will not be used for milk-producing purposes. We see that in the circle around Havana, the northeast and northwest quadrants are under water and the southwest is mostly red land, leaving only the southeast segment for its milk-shed. This limitation on three sides results in a lengthened milk-shed on the remaining part.

TRANSPORTATION

Transportation facilities is another factor in the location of dairy farms. Milk is bulky and perishable and must depend on good means of communication to reach its market cheaply and swiftly. Railroads and roads are most commonly used, but in Havana milk is no longer shipped in by train; all is trucked in. While our main roads run from fairly good all the way to the excellent Central Highway, side roads and especially farm roads are what becomes impassable during the rainy season. Improved roads are expensive to build over clay soils, while on unimproved roads, milk can only be transported on horseback. Dairy farmers, especially producers-distributors of raw milk, select location for their farms on or very near good roads. This condition makes for a more extended milk-shed than we milk sanitarians would like to have.

CLIMATE

Finally, another natural disadvantage, working against a good milk supply, lies in the climate. Although in Havana the thermometer rarely goes above 90° F., even at high noon in July and August, it never goes down low enough to protect the milk. Our mean annual temperature of 75° F., is very favorable for the development of bacteria in milk. Milk must be cooled immediately over a surface cooler when intended to be sold as raw milk and within two hours when it is to be pasteurized. In our warm climate, failure to observe this rule rapidly spoils the milk. To make matters worse, we cannot depend on cool spring or deep-well water. We have none cool enough to be of assistance. The Cuban dairy farmer must use artificial ice or mechanical refrigeration, both of which are expensive. Of course we are absolutely free from the worry of milk freezing in the cans, as you experience during sub-zero weather in New England and the North Central States, but we wish somehow that we did not have to ice our milk 365 days every year, including Christmas and New Year's Day.

ADVANTAGES

Now, against all these disadvantages, I can think of two favorable factors which help in obtaining a better milk supply. One of these is the fact that the Cuban diet does not include as many fresh, perishable vegetables as you would find on the average American table. On a trip through the country-side near Havana, you will not see so very many truck farms. Except from the flower grower and the rather few market gardeners, the dairy farmer finds little competition for the desirable land near the city, and this naturally tends to narrow the milk-shed.

The second factor is quite important.

* Presented at the 28th Annual Meeting of the International Association of Milk Sanitarians, Jacksonville, Fla., October 25-27, 1939.

About half the milk supply of Havana comes from cows which are milked only once a day. From the animal breeding and farm management point of view, this might be utter folly, but from our milk sanitation standpoint it is simply ideal. A large part of the milk reaches the consumer twelve hours sooner than in the case when twice-a-day milking and once-a-day collection is practiced. This, in part, compensates for the distance this milk has to travel.

The people of Havana drink some 160,000 quarts of milk daily, of which about 30,000 quarts is pasteurized milk. This is not quite 20 percent. With the population of Havana about 600,000 inhabitants, the consumption of market milk is a little over half a pint daily per capita. This does not include some 40,000 cases of condensed and evaporated milk used monthly, representing the equivalent of 60,000 to 65,000 quarts of fluid milk per day. If the canned milk is counted, the figure would be nearer three-fourths of a pint per capita.

PLANT HANDLING

There are six pasteurizing plants in the milk-shed of Havana, two of which are located within the city limits. One of these handles about 75 percent of the business. This plant has over 30 cooling stations where milk is brought as soon as milked by its 1300 patrons. There it is cooled below 50° F., and put in 60-liter cans, which are packed with ice and shipped in closed trucks to Havana. This concern owns one of the three large ice-manufacturing plants in town, and as their cost of production is low, they use an abundance of ice in their cooling operations. The milk in the plant's tanks before pasteurization runs between 200,000 and 300,000 colonies per ml. The cooling stations are all more or less built on the same model: a three-room brick building, the central room of which is used for receiving the milk. On one side it is cooled and put in cans and on the other side a three-compartment tank provides facilities for the washing, rinsing, and bactericidal treatment of the patrons' cans. These cooling stations are used exclusively for this purpose; all the milk is shipped as whole milk to Havana.

Four of the plants are country plants. One of these is a show place, which puts out certified milk pasteurized. All the plants use the conventional 143° F.-30 minutes pasteurizing process.

Most of the milk sold in Havana is raw milk from producers-distributors, of which there are about 360. Their production ranges from small dealers with less than 50 quarts daily to large dairies with over 2500 quarts. As to distance, some are on the outskirts of the city, while there is one located 120 miles away.

REQUIREMENTS

The main requirements are about the same as found in most milk ordinances. Each farm must have a milking barn with well-drained, concrete floor. It must be provided with running water and convenient facilities for the washing of the milkers' hands. Due to the warm climate all the barns are of the open type. The cows are brought in only to be fed or milked. The milk-house is attached, in most cases, to the barn and it must have two separate rooms; one for cooling and bottling, and storage of sterilized bottles and equipment; the other provided with a three-compartment tank for the washing, rinsing, and sterilizing of the bottles and equipment. The almost universal practice is the use of chlorine and not steam for the bactericidal treatment.

After each cow is milked, the milk is poured from a platform into a strainer and piped through the milkhouse wall to the surface cooler. It might be argued that it is not a proper procedure to pour milk from the pail into the strainer, right in the barn. However, we take the stand that since the barn is used only at milking time, is flushed with water quite frequently, and the only manure present is that freshly dropped from the cows which are being milked, there should not be so many bacteria in the air as to contaminate to any great extent the milk while it is poured. In addition, the platform is generally located at one end of the barn, not very close to the nearest cow. To avoid the danger of contamination from flies while the milk is being strained, we prescribe a lid over the strainer, or an electric fan, or even a screened vestibule in which the strainer is placed.

Most other operations are similar to those generally familiar.

SUPERVISION

No milk is shipped by rail into Havana; all is trucked in. The milk trucks can enter into the city only between noon and six o'clock in the evening and between mid-night and six o'clock in the morning and only through six official entrances. Before a producer-distributor is permitted to operate, along with other formalities, he must offer proof of ownership of the cows. In addition, the owner must state the hour when milking is begun, the quantity of milk produced, the official entrance he wishes to use, and the hour of entrance (within the permitted time limits, of course). On a surprise inspection, the production of his herd is controlled and the quantity of milk obtained, plus a 10 percent margin in the amount he is allowed to bring into the city. The milk trucks are checked frequently at the official entrances, so as to prevent an excess milk from being brought in. All milk trucks are painted yellow with a wide black stripe all around the body to make them conspicuous. Any truck being caught entering the city outside his time limit or through an entrance other than its own is severely fined. The Milk Division goes through all this trouble in order to prevent a producer-distributor from bottling milk other than that produced by his cows and in his own barn. These measures also act as a check against other forms of boot-leg milk from entering the city. Every dairyman must keep a herd book with data on every cow bought or sold, on his heifers, and on the date of freshening and drying out of all his cows. This also affords a gross check on the quantity of milk produced by the individual dairyman.

Every dairy must be under the supervision of a veterinarian who tests the herd for tuberculosis twice a year. On his monthly visit he must report to the Milk Division any abnormality observed and also the number of cows milked and the quantity of milk produced.

LABORATORY EXAMINATION

Samples for chemical and bacteriological analysis are taken from the trucks at the official entrances or in the city during the distribution of the milk, and also from stores. For bacteriological examination, the sampling is very simple. The inspector takes a bottle of milk, puts it in ice, and takes it to the laboratory where it is plated within four hours. The working hours in the bacteriological laboratory —with different men, of course—are from 3 A. M. to 10 A. M., and from 3 P. M. to 10 P. M., so as to have the plating done within the prescribed time. For milk to be pasteurized, the samples are taken at the plant. The Milk Division seldom takes samples for bacterial count at the cooling stations, placing the responsibility for this work on the dealers.

Sample taking for chemical analysis is more elaborate. From a bottle of milk or a milk can, three 250 ml. samples are taken. After proper agitation (pouring 20 times from one container to another) 11 drops of 40 percent formalin are added, and a numbered strip of paper is stretched across the mouth of the sample bottle, sealed with sealing wax. One of the samples is taken to the laboratory, another is given to the dairyman, and the third is sent to the Chief Milk Inspector's office. In case of discrepancy in the results between the Milk Division laboratory and the dairyman's, the third sample is tested in the presence of the dairyman; these findings are considered final. This method which is somewhat time-consuming for both the inspector and the chemist, provides, nevertheless, a protection to the dairyman against the possible accidental mixing of samples in the laboratory, or an error in the office when correlating the number sent in by the labora-

tory with the name handed in by the inspector.

The routine work in our laboratory consists of Babcock fat-testing, lactometer and refractometer readings, and determination of chlorides. The chlorides test is a reminiscence of the old days when a little common salt was sometimes added to watered milk to increase the molecular concentration of the solution and disguise the refractometer reading. We keep on doing it because it gives us a clue on bad cases of mastitis. When the refractometer reading of the copper sulphate serum is below 37°, we run a total solids test.

Market milk in Cuba must contain no less than 3 percent butter-fat, 8 percent solids-not-fat, 36° refractometric reading on $CuSO_4$ serum and no more than 2.1 parts per thousand of Cl read as NaCl. The bacterial count for raw milk must be below 100,000 per ml.; 1,000,000 for milk to be pasteurized; and 50,000 after pasteurization.

QUALITY PROMOTION

Since we have so far been unable to pass the new milk ordinance which provides for the grading of milk, we have established a "seal of guarantee" which is awarded to those producers and dealers who offer for sale a superior product. The seal is awarded on low count, low temperature, and satisfactory farm inspection. The seal may be displayed on the milk bottle cover, on the exterior of the milk truck, and on advertising material. The recipients of the seal are now financing a newspaper and radio campaign in support of high-quality milk. We have great hopes that the public will respond to the campaign and that the number of dairymen who will voluntarily improve their supply in order to obtain the "seal of guarantee" will increase rapidly. If the scheme proves successful, it is being planned to extend it to the ice cream industry.

CREAM

Fraudulent creaming of the milk is a practice unheard of, for Cubans use very little cream and there is thus no market for this product. Our morning "coffee" is the "café con leche", that is, hot milk with a little of our very dark coffee. This heated milk introduces another problem, for the refractometer reading is lowered up to two degrees when milk is heated above 75° or 80° C. (probably due to the precipitation of soluble salts, especially soluble phosphates) and recovers or even surpasses its original reading on losing moisture from continued heating.

PASTEURIZATION PROSPECTS

Now, in conclusion, I want to state that the milk supply of Havana has had a good improvement lately. Looking back to what has already been done, we feel hopeful in looking ahead toward what has yet to be done. We are trying to increase the percentage of pasteurized milk being used. Pasteurization is a different problem in the United States from what it is in Cuba. Before the advent of mass pasteurization, Americans were raw-milk consumers and pasteurization came about to protect the people. Cubans, on the other hand, boil their milk, and it is difficult to invoke the safety argument in favor of pasteurization since nothing can afford a greater safety than our time-established custom of heating the milk until it rises three times, just before drinking it. This practice has thus far prevented milk-borne epidemics. From the nutritionist's angle, when the destruction-of-vitamin-in-boiled-milk argument is presented, the answer is given that our Cuban sunshine gives us, as it does, too great ultra-violet intensity to have any worries about vitamin D; and as to vitamin C, there are plenty of tomatoes and citrus fruits at a low price all year round.

In addition we realize it is hard to change the people's habits and tastes. Most Cuban milk sanitarians are in favor of milk pasteurization but we realize that after a few million dollars would be spent in erecting plants throughout the island in order to provide pasteurized milk for everyone, some more millions would be necessary to induce the people to change from boiled milk to pasteurized milk.

Preliminary Report on the Deaeration of Market Milk *

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INTRODUCTION

The importance of copper contamination as a factor in accelerating the rate of oxidation of ascorbic acid and the development of the oxidized flavor in milk has been demonstrated. (1, 3). It was shown that heating milk to 170° F. tended to counteract the accelerative effect of copper and that additions of 0.1 to 0.2 gram of ascorbic acid per liter of milk tended to prevent the development of the oxidized flavor even though the milk was contaminated with copper. It was clearly demonstrated that the development of the oxidized flavor could be largely prevented and the ascorbic acid present in the milk could be preserved by removing the dissolved oxygen from the milk (2). We now present some preliminary results obtained in the study of milk deaerating equipment capable of continuously deaerating milk at a rate in excess of 3,000 pounds per hour.

DETERMINATION OF OXYGEN CONTENT OF MILK

In order to study properly the operation of the equipment and other milk plant operations from the standpoint of their effect on the dissolved oxygen content of the milk, we required a simple rapid method by which we could obtain at least approximate information as to the oxygen content of a considerable number of samples. The absolute accuracy of the method developed is being investigated further and will be described in detail later. It consists in adding an excess of ascorbic acid to the milk and determining by titration with 2-6 dichlorophenolindophenol the decrease in ascorbic acid when the rate of oxidation of ascorbic acid is accelerated in the dark and cold by the action of 1 mg. of copper per liter or by agitating the sample in a closed full tube exposed to a mercury vapor light. We have assumed that the oxygen dissolved in the milk is all utilized in oxidizing reduced ascorbic acid to dehydroascorbic acid and that the statements in the literature are correct, that one atom of oxygen oxidizes one molecule of ascorbic acid. The decrease in ascorbic acid divided by 11 gives the oxygen content both expressed in mg. per liter. The method is very simple and the results obtained have been of great value. As an example of the application of the method, two samples of milk were prepared, one approximately saturated with air at 5° C., the other containing no air. These two milks were then mixed in various proportions and the oxygen content was determined. The oxygen content of the mixture bore a direct relation to the proportions of the two milks in the mixture. Mixtures by weight of deaerated milk and milk aerated at 5° C. were prepared, analyzed for oxygen, and the percentages of deaerated milk in the mixtures calculated from the oxygen content of the mixtures and the original aerated milk. Table 1 gives typical results obtained.

A number of factors have been studied which might influence the oxygen content of milk. Table 2 shows the results of an experiment on the alteration in oxygen content as a result of heating. A decrease in oxygen content resulted on heating at 143° F. and a more definite decrease took place on heating to 165° F.

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TABLE 1

Accuracy of Oxygen Determination in Milk

Experiment No. 1		Experiment No. 2		Experiment No. 3	
Actual as prepared by weighing Percent	Calculated from oxygen-content of mixture Percent	Actual as prepared by weighing Percent	Calculated from oxygen content of mixture Percent	Actual as prepared by weighing Percent	Calculated from oxygen content of mixture Percent
0	0	0	0	0	0
8	9	5	5	13	11
14	15	10	9	22	21
24	25	21	20	33	32
30	29	29	27	37	36
34	36	34	33	47	47
42	41	41	37	63	60
55	56	48	47	74	71
68	69	58	56	81	80
75	74	72	71	100	100
87	87	83	82		
100	100	100	100		

TABLE 2

Effect on Oxygen Content of Heating Milk in an Open Can with Continuous Stirring

	Experiment No. 1			Experiment No. 2		
Sample number	Temp. °F.	Time min.	Oxygen content mg./liter	Temp. °F.	Time min.	Oxygen content mg./liter
1	80	start	3.60	80	start	3.73
2	130	10	3.43	150	10	3.05
3	143	20	3.18	165	20	2.58
4	143	30	2.87	165	30	2.20
5	143	40	2.79	165	40	1.95
6	143	50	2.76	165	50	1.74

in a can with continuous stirring. However, even after heating under these conditions the milk still contained enough oxygen to produce considerable oxidation. The actual decrease would depend on the oxygen content of the original milk, the type of container in which the milk was heated, and agitation and exposure during heating.

Table 3 gives the oxygen content of milk in cans as received at the plant. These data represent occasional determinations which extended over the period of a year.

TABLE 3

Oxygen Content of Milk in Mg. Per Liter Samples Taken from Cans Received at the Cornell Milk Plant

3.27	4.09	2.14	4.19	3.71
3.91	3.53	3.03	3.91	3.28
3.82	3.68	3.23	3.54	2.77
3.91	4.01	3.33	4.00	2.49
		3.55		

The oxygen content of samples taken at various stages of the holder pasteurization of milk is given in Table 4. The most important thing to be noted is the large increase in oxygen content on passage over a surface cooler. Coincident with this increase in oxygen content an increase in the intensity of the oxidized flavor was noted with some but not all lots of milk. Since the milk did not come in contact with copper, we are inclined to attribute the increase in oxidized flavor to the effect of the increase in oxygen content of the milk.

This observation coupled with others tempts us to consider the hypothesis that some of the variations previously observed in the development of oxidized flavor might be caused by variations in oxygen content. For instance, it has been observed that the oxidized flavor developed in the milk from the same cow may show great daily variations. This difference might be due to variations in the amount of air driven into the milk during the milking, since the milk as it exists in the udder of the cow is essentially oxygen-free. Such variations might be produced by different milkers or by milking more rapidly one time than another. In some instances the differences between the milk of cows in developing oxidized flavor might be traced to a difference in air content as a result of variations in ease of milking. The difference between the oxidized flavor of the milk from different quarters of the same udder might also be due to a difference in aeration. Incidental variations in methods of handling after milking may result in a change in the oxygen content of milk which may under some critical conditions be just enough to influence the development of oxidized flavor.

TABLE 4

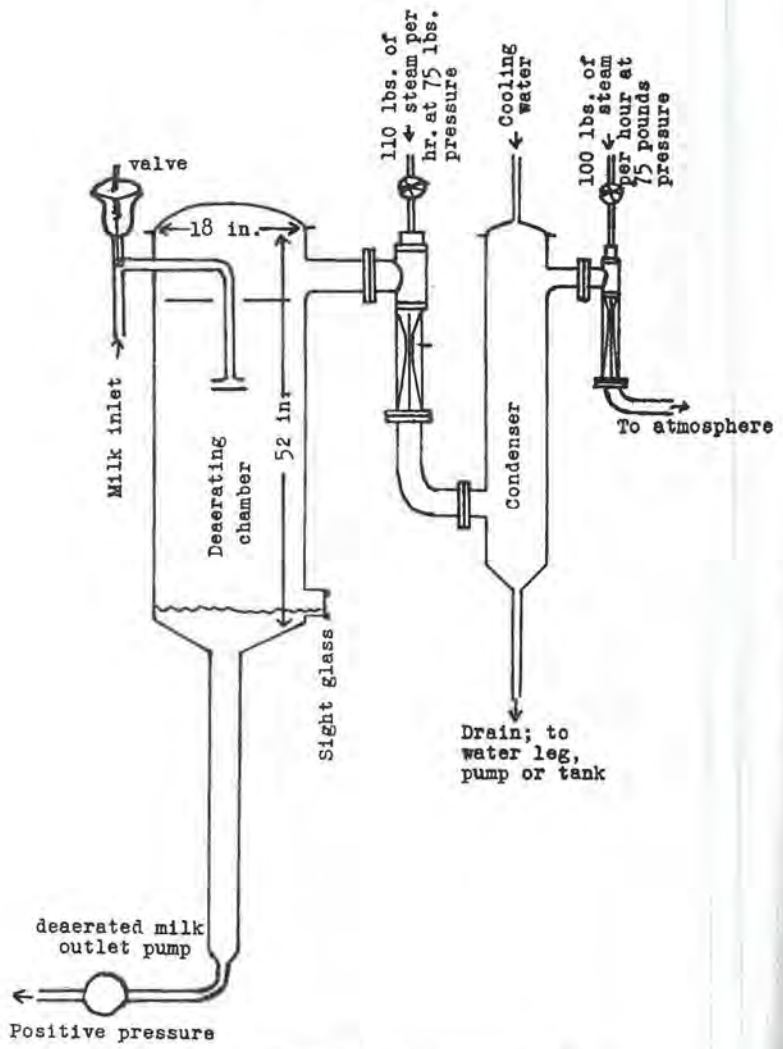
Oxygen Content of Milk as Influenced by Holder Pasteurization and Passage over a Surface Cooler

	Experiment No. 1		Experiment No. 2	
Samples taken for examination	Oxygen content mg./liter	Third day oxidized flavor score	Oxygen content mg./liter	Third day oxidized flavor score
Raw milk in past. vat	3.55	1	.....	.....
Heated to 143° F. Start past.	3.55	1	2.91	2
Held at 143° F. End past.	3.19	1	2.91	2
Cooled in vat to 120° F.	3.09	1	3.19	2
Distributor over surface cooler	3.27	2	3.19	2
Collector under surface cooler	5.26	3	5.55	3
After bottling	5.45	3	5.55	3
Held in vat at 120° F. for 30 min.	3.47	2	3.27	2

Studies are in progress on the rate of decrease in the oxygen content of raw and pasteurized milk on holding which may lead to an explanation for the more rapid development of the oxidized flavor in pasteurized milk.

DEAERATION OF MILK

The equipment used in these experiments is capable of deaerating milk continuously at a rate in excess of 3,000 pounds per hour. Figure 1 illustrates the essential features of the deaerator. The milk is deaerated by the sweeping out effect of water vapor created by a reduction of pressure sufficient to cause the water of the milk to boil. Boiling sufficient to lower the temperature of the milk about 7 to 10° F. seems to be sufficient. The temperature range of 115° to 105° F. is suitable, but under some conditions other temperature ranges can be used. The reduced pressure was produced by two steam jets in series with an inner condenser. The milk was introduced into the deaerating chamber through a control valve which was actuated by the change in level of the milk in the bottom of the deaerator. The milk was removed from the deaerator by a postive pump and the milk lines from the pump to the other equipment were maintained under positive pressure. The reduced pressure in the deaerator caused the milk to flow from the storage tank through the heater or cooler, as the case might be, into the deaerator, without the necessity of a pump. Plate heaters and coolers were used. Great care must be taken in connecting pipes to make sure the joints are air-tight, particularly in the case of a few critical connections. Overhead pipe lines are prone to suck air into the milk. Unions which are satisfactory from the standpoint of preventing the outward leak of milk may be very unsatisfactory from the standpoint of preventing the leak of air into the milk line.



Diagrammatic illustration of continuous milk deaerating unit rated over 3,000 pounds per hour as designed by Thermal Research Corporation, Richmond, Virginia

FIGURE 1—*Deaerating unit*

The following flow systems for the deaeration of market milk were found to be satisfactory:

LONG HOLD PASTEURIZATION

Heat to 143° F.
Hold for 30 minutes.
Cool to within range of 115°-90° F.
Deaerate with a drop in temperature of from 7 to 15° F.
Complete cooling to bottling temperature.
Bottle.

SHORT HOLD, HIGH TEMPERATURE PASTEURIZATION

Preheat raw milk to 115° F.
Deaerate with temperature drop of 7 to 15° F.
Final heat to 160°+.
Hold for 15 seconds.
Cool to bottling temperature.
Bottle.

TABLE 5

Absorption of Oxygen by Deaerated Milk During Holder Pasteurization and Bottling

	Oxygen content	Ascorbic acid content after 3 days	Ascorbic acid content after 7 days
	mg./liter	mg./liter	mg./liter
Raw milk at start	2.21	13.3	9.2
Deaerated	0.00+	19.3	19.6
Deaerated, milk plate heated to 133°F., and run into pasteurizing vat	0.10+	17.3	17.1
After 30 minutes at 143° F.	1.29	13.3	10.8
Bottled milk	1.86	10.5	7.0

Ascorbic acid at start 19.9 mg. per liter.

TABLE 6

Oxygen Content, Cream Volume, Ascorbic Acid Content and Flavor of Milk Deaerated Raw, Then Pasteurized 15 Seconds at 160° F. Average results obtained on six different days

Samples taken for examination	Oxygen content	Cream volume 4 hrs.	Cream volume 24 hrs.	After holding in cooler at 36° F. Three days Ascorbic acid	Three days Oxidized flavor	Seven days Ascorbic acid	Seven days Oxidized flavor
	mg./liter	percent	percent	mg./liter	score	mg./liter	score
Raw milk from storage vat	3.64	17.6	16.5	12.2	0	7.5	0
Raw milk after deaerator and pump	0.10	18.0	17.1	18.7	0	19.0	0
After pasteurizing and cooling	0.26	16.3	16.6	19.1	0.3	19.3	0.7
Milk from tank on bottler	0.36	15.9	16.3	18.4	0.9	19.0	2.8
Milk from bottle	0.80	15.3	16.0	18.4	1.8	16.3	3.6
Pasteurized milk from holding vat	0.39	15.1	16.3	19.1	0.6	18.3	2.2
Pasteurized milk reaerated	3.87	.....	.....	11.2	2.4	6.1	4.1

Temperature drop in deaerator 95° F. to 88° F.

Ascorbic acid at start 19.4 mg. per liter.

The oxidized flavor intensity increases with the numerical value of the flavor score.

The deaeration of milk after holder pasteurization offered no serious difficulty and a number of successful runs was made.

Experiments were performed in which the raw milk was deaerated, heated to 133° F. by running through a plate heater, and finally heated to 143° F. in a pasteurizing vat, held for 30 minutes, and then cooled by means of a plate cooler and finally bottled. The results of a typical experiment are presented in Table 5. These experiments indicate that enough reaeration occurs to make this process unsatisfactory unless some pro-

vision is made to prevent exposure to air in the holding pasteurizing vat; an increase in oxygen content during bottling is also shown.

A number of experiments were made in which the raw milk was deaerated and then pasteurized by the short hold, high temperature method in a closed system. Typical results are presented in Table 6. This process can be carried out successfully. Minor changes of a mechanical nature are being made which we believe will give better results than those indicated in Table 6. There now remains the problem of preventing reaeration during bottling.

Even with the present type of bottler the deaerated, pasteurized milk after holding was usually superior in flavor and always higher in ascorbic acid content than pasteurized milk containing the normal amount of oxygen.

CONCLUSION

The results obtained indicate that market milk can be deaerated cheaply and easily by a continuous process. The prevention of reaeration depends on airtight connections in a few critical places and on changes in bottler construction. Deaerated milk has greatly increased resistance to the development of oxidized flavor and the ascorbic acid remains stable.

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DISCUSSION

Mr. Tiedeman: We are indebted to Dr. Sharp and his associates for presenting this subject. This work is directed toward preserving the flavor of pasteurized milk which to me is very important. Anyone who has seen the room full of machinery with which Dr. Sharp is working might question the practicability of deaerating milk. I understand, however, that some of it is required only for experimental purposes to make it possible to deaerate at any stage of the operation. More equipment is needed to condense and return the small amount of water evaporated in the process. This seems to me to be an unnecessary refinement. No doubt when the experiments are completed a considerable simplification in equipment can be made. Perhaps Dr. Sharp may decide to suggest adding ascorbic acid to milk as a simpler procedure. However, there is considerable opposition to adding anything to milk.

In addition this work has a feature of secondary importance in pointing out the places in which air is being incorporated in milk in ordinary installations of pasteurizing equipment. Dr. Sharp's reference to the sucking of air at the joints in an overhead pipe line resulting from a drop in pressure is interesting. We had a similar experience. A plant operator did everything possible to eliminate foam on holders into which milk preheated to pasteurizing temperature was being pumped. It was finally found necessary to use gaskets in the overhead pipe line before foam could be controlled.

This work should help materially in teaching us how to pasteurize milk with the least possible effect on quality.

Mr. Levowitz: How much water is lost in the deaeration process?

Dr. Sharp: About 0.5 of 1 percent of water is lost in dropping the temperature about 7 to 8° F. This water can be put back into the milk. One of the devices that Mr. Tiedeman mentioned in connection with this equipment is a device to put the water removed back into the milk. The water removed does not smell or taste like anything you want to see put into the milk. This process removes some of the flavors which are not desirable and some of the off-flavored substances are condensed in the water removed. If the water removed is not returned there is a slight disadvantage of a loss of 0.5 of 1 percent of water. We could deaerate the milk directly from the pasteurizer and increase the fat content of 3.5 percent milk.

Mr. Perry: How much of a vacuum is created and what is the cost of deaeration?

Dr. Sharp: The machine is capable of cooling water by its own evaporation until it freezes. The pressure can be lowered to about 0.15 of an inch. The cost depends on the cost of steam. We figure from the price we have to pay for coal that it costs for steam about 8 to 11 cents to deaerate 3,000 pounds of milk. You can figure it out on the basis of your steam costs. It takes less than 210 pounds of steam at 75 pounds pressure to deaerate 3,000 pounds. We have another pair of jets which operate at 90 pounds. The jets used should be selected to agree with the steam pressure available but the pressure should not be less than about 75 pounds. There is another thing that could be done. If your steam cost is high and refrigeration is cheap, a condenser could be put in series with the vacuum line. That would reduce the steam requirement. With the price of steam relatively cheap it probably would not be worth the extra cost of equipment to put a condenser in series with the line.

Dr. Brooks: Is the loss of vitamin C that takes place during pasteurization a result of the increase in oxygen?

Dr. Sharp: The loss is usually relatively small. It may be 1 to ½ mg. per liter. The loss during pasteurization depends on two things: the amount of oxygen in the milk and the contamination with copper. If milk is highly contaminated, the loss during pasteurization will be considerably greater. When we ran pasteurization tests in glass bottles and then held milk for about three days, there was little difference between the raw and pasteurized milk at the end of the three days in so far as vitamin C content was concerned. The main decrease in the vitamin C of ordinary pasteurized milk occurs after pasteurization before the milk is consumed. After deaeration it makes no difference whether the milk is contaminated with copper or not; the vitamin C remains stable.

Copper and Copper Alloys. *Richard S. Burr. Water Works & Sewerage*, Vol. 86, No. 8, September 1939, pp. 362-364. *Public Health Engin. Abs.* xx, 5, 11.

The author, who is development engineer of the American Brass Company, first defines the three most common varieties of refined copper, which are: Electrolytic, Lake, and Deoxidized. Electrolytic and deoxidized copper are then discussed and compared in more detail.

Copper alloys readily with a great many of the other elements forming several hundred commercially important copper base alloys. The brasses are the commonest and most widely used of these metals and consist principally of copper and zinc. Generally speaking, the corrosion resistance of brass increases in proportion to the copper content and the strength, hardness and wearing qualities increase in proportion to the zinc. Some of the alloys are the brasses, the bronzes and the copper-zinc-nickel alloys, known as nickel silver.

The true bronzes are essentially alloys of copper and tin. These alloys are commonly known by the name of Phosphor Bronze as a small amount of phosphorous is generally used as a deoxidizer. The Phosphor Bronzes are suitable for their high ultimate strength, yield strength, and fatigue properties, good corrosion resistance, and bearing qualities. Other special alloys which have come to be known as bronzes include the Aluminum Bronzes, Cadmium Bronzes, and Copper Silicon alloys The Aluminum Bronzes are available in wrought forms containing less than 10 percent aluminum. They are notable for high strength, hardness, and excellent corrosion resistance. The Cadmium Bronzes are used principally in electrical work due to their high conductivity, strength, and good wearing properties.

The most important of these special alloys is the Copper-Silicon group. Because of their relatively high strength, excellent fabricating qualities and satisfactory fusion welding properties, these alloys have come into considerable prominence as engineering materials during the past ten years.

The copper-silicon alloys have been used extensively in the sewage treatment field over the past twelve years with uniform success.

Corrosion problems in handling sewage are numerous and varied in character. It has been necessary for the manufacturers of corrosion resisting metals to work very closely with the engineers and operators of sewage treatment plants, as the answer to a particular problem is often one which cannot be definitely determined in the laboratory, but must be based on actual service experience.

A. H. F.

Detecting Cow-Goat Milk Mixtures

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The detection of cow-goat milk mixtures by use of the Beyrich test, referred to in recent papers,* has resulted in the receipt of numerous inquiries concerning the technique for making the test. It is for this reason that the procedure is described briefly herein.

Twenty cc. of the skimmed suspected mixture is mixed with 2 cc. of ammonium hydroxide (sp. gr. 0.91). This mixture is held at 52° C. (125.6° F.) for 1 hour with frequent shaking during the first 30 minutes. It is centrifuged at 1200 r.p.m. for 10 minutes, and then it is again held at 52° C. for 20 minutes, followed by a centrifuging at 1200 r.p.m. for an additional 10 minutes. The appearance of a sediment in this simple test will detect the addition of as little as 1 percent of goat's milk to cow's milk. This is a test to detect the addition of goat's milk to cow's milk.

This simple test has been studied and used in Germany. It was improved by Beyrich and others. Besides having a practical application in milk inspection, the test holds an academic interest because of the oddity of the formation of a precipitate when 1 percent or more of goats' milk is added to cows' milk.

The history of the test is interesting. It was proposed about 1920 because the Director of Agriculture in Germany became infuriated over the practice of cow's milk adulteration with goat's milk and vica versa. Unfortunately, the first party to study the procedure, Walter Austen, was able only to detect the addition of goat's milk to cow's milk to the extent of 20 percent or more.

In 1923 the test was improved by Beyrich and Heiduschka to detect additions of goat's milk to as litle as 1 percent of cow's milk. The test is based upon the fact that goat's milk will give a casein precipitate with 9 to 10 percent of ammonium hydroxide (sp. gr. 0.91) at certain temperatures, and cow's milk protein is not precipitated with like treatments.

The test can be applied to raw or pasteurized milk. It is necessary to heat the milk before or after mixing far above pasteurization temperature to interfere with the test. Then the heated flavor is apparent. Heating does not interfere with the test unless the milk is heated to temperatures ranging from 170-190° F.

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* See 13th Ann. Report N. Y. State Assoc. Dairy Milk Inspectors, 153 (1939); *J. Milk Technol.* 2, 280 (1939).

Milk Investigations of the U. S. Public Health Service

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The purpose of this paper is to give a review of the research work on the public health aspects of milk carried out by the U. S. Public Health Service, chiefly since the formation of the Office of Milk Investigations in 1923, but with a brief account of some of the more important milk researches by the Service prior to that time.

EARLY STUDIES OF THE PUBLIC HEALTH ASPECTS OF MILK

The annual report of the U. S. Marine Hospital Service for 1896 included a report on cooperative work by the Hygienic Laboratory in connection with an investigation of the prevalence of typhoid fever in the District of Columbia. This report contained the following statement: "It is not improbable that if a comprehensive study be made of the water supply of the dairies supplying milk to Washington our knowledge of the relation which the milk supply bears to the prevalence of intestinal and other diseases would be proportionately increased."

Although the Public Health Service continued its interest in various phases of the public health aspects of the use of milk, it was not until 1907 that an extensive study was made of the problem. An investigation by the Service during the summer of 1906 of the origin and prevalence of typhoid fever in the District of Columbia revealed that milk was the agent of transmission in 10 percent of the 866 cases studied. Following this disclosure a thorough study, both practical and scientific in character, was made of the relation of milk to the public health. Results of this study were published in 1908, and an enlarged and revised edition was published in 1909 (1). Coincident with this work, a study was made of thermal death points of pathogens in milk (2). Results of this study gave impetus to use of low temperatures for pasteurization of milk supplies, and were an important factor in development of the holding method of pasteurization as contrasted with the flash method in use at that time.

The Public Health Service took an active interest in various efforts directed toward improvement of milk supplies, among which was the certified milk movement. However, experience indicated that even the elaborate sanitary precautions recommended in this connection were not sufficient to insure against possibility of milk-borne outbreaks of disease. It became evident that in the extension of pasteurization of milk supplies lay opportunity for accomplishing the best results, and the Service devoted its energies in that direction. Pasteurization, however, was not perfect, and as commercial pasteurization of milk supplies increased, doubt developed not only as to efficiency of some commercial pasteurizing machines but also regarding time and temperature standards used for commercial pasteurization.

In 1911, the New York Milk Committee appointed a group of experts designated as the Commission on Milk Standards to study and report upon rules and regulations for control of milk. The Public Health Service was represented on this commission at the time of its first and second reports, and published three reports of the commission in Public Health Reports during years 1911, 1913, and 1917. In 1921, a large dairy corpora-

tion engaged a commercial public health laboratory to make an exhaustive study of time and temperature standards for commercial pasteurization of milk and of commercial pasteurization equipment in general use at the time. This research included engineering tests, and bacteriological tests with pathogenic organisms generally recognized as transmissible by milk supplies. The Public Health Service cooperated in this research and published the results of the investigation (3).

OFFICE OF MILK INVESTIGATIONS

Milk sanitation became a definite activity of the U. S. Public Health Service, Division of Scientific Research, in 1923. At this time the Alabama State Board of Health, feeling the need for a state-wide milk control program, requested the assistance of the Public Health Service in development of such a program. Leslie C. Frank, an Associate Sanitary Engineer in the Public Health Service, was assigned to cooperate with the Alabama State Board of Health in this work. This action inaugurated the activities of the Office of Milk Investigations.

STANDARD MILK ORDINANCE

The work in Alabama centered around a cooperative effort to unify milk control methods throughout the state by the development and enforcement of an effective type of milk legislation (4). This cooperative program was put into effect in Alabama by the State Board of Health, with the Public Health Service representative acting in an advisory capacity.

In the preparation of this milk legislation, a thorough study was made of a large number of milk ordinances in effect at that time. One striking fact brought out in this study was that practically no two milk ordinances contained the same requirements. This multiplicity of requirements indicated need for a milk ordinance which would be applicable to communities in general, and led to development of the milk ordinance which was first known as the Standard Milk Ordinance and later as the U. S. Public Health Service Milk Ordinance.

This ordinance was of the grading type, with provision for degrading as a temporary punitive measure. More recent editions of the ordinance, however, contain alternate provisions with reference to grades of milk and milk products which may be sold. This was done because some communities prefer to use the grading and degrading system of improving milk quality, whereas others prefer to use exclusively the system of forbidding sale of milk and milk products which do not comply with all items of sanitation, and instituting court procedure if the violator persists in selling.

The sucess of the milk sanitation work in Alabama attracted the attention of other states and cities, and within three years nearly 100 communities had enacted this milk ordinance into law. Surveys were made in Alabama, and later in Mississippi and Missouri, in which the milk-sanitation status of a number of communities was determined both before and after the adoption of the Standard Milk Ordinance so as to measure the results of the enforcement of the ordinance (5, 6, 7). In May, 1926, the Standard Milk Ordinance of the U. S. Public Health Service, slightly modified, was adopted as a standard for the United States by the Conference of State and Territorial Health Officers.

The number of communities in which this ordinance is in effect has steadily increased, until at the present time there are about 2,200, ranging in population from less than 1,000 to about 3,500,000, and located in 34 States. As the number of adoptions of the milk ordinance increased, it was apparent that consideration needed to be given to a national program for the unification of milk control. A program of this nature was developed and put into practical application (8). It consists of the voluntary adoption and strict enforcement of the milk ordinance by states and communities, the organization of state milk sanitation programs, the milk sanitation rating of communities by the state authorities, and the training of state milk sanitarians, with technical advice and occasional check milk sanitation ratings by the Public Health Service.

STANDARD MILK CODE

With the growth in the number of adoptions of the ordinance, it soon became evident that even though a number of communities adopted the same milk ordinance, the interpretation and enforcement of the ordinance was not necessarily uniform. This fact led to the formulation of the Standard Milk Code, later known as the U. S. Public Health Service Milk Code, which discusses the Standard Milk Ordinance item by item, outlines in each case the public health reason therefor, and gives what is recommended as satisfactory compliance with each item. The first edition of the Code, a tentative draft, was published in mimeographed form in 1927.

During the formulation of the Standard Milk Ordinance and Code, it was referred to a number of public health and dairy organizations for critical study in order to have the advantage of review by a large number of groups and individuals. Moreover, after a series of conferences with the Bureau of Dairy Industry of the U. S. Department of Agriculture, the 1931 and succeeding editions of the Milk Ordinance and Code have carried the approval of that organization. The Public Health Service does not consider the Milk Ordinance and Code as fixed but rather as progressive standards, and welcomes additional suggestions for modification from any organization or individual interested in milk sanitation.

In 1932 the Public Health Service appointed a Board of Consultants, termed the Public Health Service Milk Sanitation Advisory Board, so that it might have at its command the technical advice of a comprehensive group of experts in the various phases of the public health control of milk supplies, and in allied problems relating to the production, processing, and distribution of milk. The various suggested modifications of the Milk Ordinance and Code received from time to time are presented to the Advisory Board for discussion and recommendation. In 1934 the first Technical Committee was appointed by the Dairy and Ice Cream Machinery and Supplies Association to advise with the Public Health Service Milk Sanitation Advisory Board. New editions of the Public Health Service Milk Ordinance and Code are published at such times as revisions in the ordinance or code make advisable the publication of a new edition, the latest edition having been published in 1939 (9).

RESEARCHES IN CONNECTION WITH THE DEVELOPMENT OF THE PUBLIC HEALTH SERVICE MILK ORDINANCE AND CODE

In the development of the Milk Ordinance and Code, considerable research has been necessary. Some of these studies have been published as separate papers, while in a number of cases no separate papers were issued, but the results of the studies were used in formulating the requirements and specifications contained in the Milk Ordinance and Code. Throughout this work, the advice and assistance of numerous individuals and organizations were most helpful. The more important of the various researches are briefly reviewed herein and are arranged in approximately chronological order within the main divisions.

Researches on the efficiency of commercial milk pasteurization equipment were started in 1926. This work included studies of the design and operation of milk pasteurization equipment, and of temperature control and recording devices. Wherever possible the tests were carried out in commercial milk pasteurizing plants during actual routine operation. In the temperature studies of pasteurizers, the temperatures of the milk at various points in the apparatus were determined by means of thermocouple-potentiometer equipment. The researches indicated that some of the equipment then in use could not be depended upon to pasteurize effectively. Some of the defects found consisted of "dead ends" or "cold pockets" which were beyond the influence of heating and agitation devices, foam which was lower in temperature than the milk, leakage of milk past inlet and outlet valves, lack of dependability of some temperature control equipment, etc. (10). As a result of these findings, many of the pasteurization equipment manufacturers modified designs of their equipment, and later studies

indicated the practicability of eliminating the defects mentioned. The testing work also disclosed that the deviations between the hottest and coldest milk could be kept within 1° F. in properly designed pasteurizers (11).

For a considerable period of time following the replacement of flash pasteurization by the holding method in this country, use of flash pasteurization was not considered acceptable by American health officials due to its lack of dependability. The old flash heaters were used only for preliminary heating prior to holding. However, due to improvements in design of heaters, and in temperature control and safety devices, there developed a demand for recognition of flash pasteurization as an acceptable method. Starting in 1927, the U. S. Public Health Service, in cooperation with the New York State and New York City Health Departments, made studies of electric flash pasteurization, including engineering observations and tests with pathogenic bacteria (12). Later the Public Health Service made similar studies of an internal tubular type of steam flash pasteurizer (12), and in cooperation with the Pennsylvania State Health Department made engineering tests of a plate-type steam flash pasteurizer (13). On the basis of this work, it was recommended that local and state health authorities approve provisionally the use of equipment which would heat every particle of milk to not less than 160° F., followed by a holding period of not less than 15 seconds at not less than this temperature. Moreover, it was specified that the equipment must comply with certain listed specifications, including a safety device designated as an automatic milk-pump cut-out which would stop the milk pump when the milk temperature at the heater outlet dropped below the legal requirement. Because of the use of a short but definite holding period in this method, it was designated as high-temperature short-time pasteurization rather than flash pasteurization. Since 1933 the definition of pasteurization in the Public Health Service Milk Ordinance and Code has included the temperature and time combination of 160° F. for 15 seconds in addition to that of 143° F. for 30 minutes.

Because of the increase in use of hot-air cabinets for the bactericidal treatment of milk utensils and containers, tests were made to determine an effective and practicable temperature and holding time that would insure the desired reduction of milk-borne pathogens (14). This study was made, using as a test organism a strain of *Esch. coli* which was more heat resistant than the most resistant pathogen transmissible through milk supplies. Results of this work indicated that if hot-air cabinets are operated so that the coldest portion is at not less than 180° F. for at least 20 minutes, milk cans contained therein will be subjected to adequate bactericidal treatment.

The use of regenerators (also known as heat exchangers or regenerative heater-coolers) presents a possible source of contamination of the pasteurized milk by the raw milk. This might occur either directly, as in milk-to-milk regenerators, or indirectly, as in milk-to-water-to-milk regenerators, unless certain requirements are met as to relative pressures in the system. The technical difficulties involved in complying with adequate requirements were such as to warrant a detailed study of the problem (15). The article dealing with this study outlines the problem and describes methods for automatically insuring the required relative pressures in various types of milk-to-milk and milk-to-water-to-milk regenerators. A discussion of this problem is also given on pages 129 to 137 of the 1939 edition of the Public Health Service Milk Ordinance and Code (9).

Studies were made of a number of problems in connection with the development of the Public Health Service Milk Ordinance and Code, which studies have not been published as separate papers but the results of which have been used in formulating the requirements and specifications contained in the Milk Ordinance and Code. A brief description follows of some of the more important of these studies.

The defect of leakage of milk past inlet and outlet valves was previously mentioned (10). Practically all valves used in milk work will leak sooner or later, due to the inevitable scoring of the seat during service, and tests indicated that leakage in some cases amounted to as much as 2.7 percent of the pasteurizer contents. In the study made of valve leakage the principle followed was not the development of a leak-tight valve, but instead the design of valves, both inlet and outlet, which would protect against leakage. Specifications and suggested designs of leak-protector valves are given on pages 115 to 124 of the 1939 edition of the Public Health Service Milk Ordinance and Code (9).

Another problem previously mentioned was that of foam (10) which was lower in temperature than that of the milk. In practically all cases where foam is present, it is lower in temperature than the milk, and foam temperatures were encountered which were as much as 35° F. lower than the temperature of the milk during the holding period. Heating of the air space above the milk using enclosed steam or electric heaters was not satisfactory because of the tendency of the dry hot air to rise away from the foam and thus not heat it. However, it was found that live steam admitted to the air space above the milk not only heated the foam but also tended to dissipate it. On pages 124 to 127 of the 1939 edition of the Public Health Service Milk Ordinance and Code (9), suggested designs of air-space heaters are given for various types of pasteurizers.

Although automatic pasteurization installations, either of the 30-minute or the high-temperature short-time type, must of necessity be provided with thermostatic control of the temperature of the milk, the Public Health Service Milk Ordinance and Code also specifies that such installations be provided with automatic milk-flow stops. Automatic milk-flow stops are devices which stop the forward flow of milk whenever its temperature drops below the required limit due to any cause whatsoever. Automatic milk-flow stops include automatic milk-pump stops (which automatically start and stop the milk pump motors at the required temperature), and automatic flow-diversion devices (which automatically divert the milk away from all downstream points whenever it drops below the required temperature, and automatically restore forward flow when it again reaches the required temperature). The requirement for the use of milk-flow stops necessitated the development of specifications for the design of the flow stops and for their location. Specifications in these connections are given in the 1939 edition of the Public Health Service Milk Ordinance and Code (9) on pages 104 to 108.

There has been a decided trend toward the use of automatic pasteurization equipment, especially in the larger plants. With this greater use of automatic equipment, there has been an accompanying increase in the sanitary engineering problems involved. In addition to the milk-flow stops previously mentioned, there are other safeguards, both of design and operation, which are necessary for automatic systems, to insure that the required pasteurization temperature and time will be applied to every particle of milk and milk products. These safeguards naturally fall into two main classifications, namely, those dealing with temperature control and those dealing with time control. A number of items are included under each of these classifications, and detailed instructions and specifications for each of the various items are given on pages 104 to 115 of the 1939 edition of the Public Health Service Milk Ordinance and Code (9).

RESEARCHES NOT CONNECTED WITH THE DEVELOPMENT OF THE PUBLIC HEALTH SERVICE MILK ORDINANCE AND CODE

The 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 (1) includes a compilation of 500 milk-borne outbreaks of disease which had appeared in the literature up to that time. In Supplement No. 62

to the Public Health Reports (16), this compilation of milk-borne outbreaks of disease is continued 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 (17) in response to annual questionnaire surveys. These reports indicate that about 30 to 50 milk-borne outbreaks of disease occur each year in the United States. 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.

Practically 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 believe 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, the Public Health Service 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 6 years of age (18). 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.

The Public Health Service receives numerous inquiries from health authorities and others for information on the control of milk supplies in American cities, and has made several surveys to collect data in this connection. Milk control data of 100 of the larger American cities for the year 1923 were collected for the Committee on Municipal Health Department Practice of the American Public Health Association (19). Questionnaire surveys were made as to the extent of pasteurization and tuberculin testing for the years 1927 (20) and 1931 (21). In 1929-30 surveys were made of the public health control of milk supplies in 430 American municipalities (22). The latest survey (23) gave a wide range of information on milk supplies and milk control for the year 1936, and included communities of 1,000 population and over. Data for the communities between 1,000 and 10,000 population were also published in a separate report (24).

Municipalities considering the adoption of the Public Health Service Milk Ordinance frequently inquire as to probable cost of enforcement. A questionnaire survey was started in November, 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 (25). On the 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 per producer or plant per year. All unit costs were generally lower in the larger than in the smaller cities.

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 (26) which it and a number of state health departments have used. 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. For each community in which both raw and pasteurized milk are sold, two enforcement ratings are obtained, a pasteurized milk rating and a raw milk rating. 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 for 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 semiannually since January, 1934, (27), 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. The latest report gives the twelfth semiannual revision of the list (28). These reports also include the rules under which a municipality is included in the list.

LABORATORY

As the number of communities enforcing the Public Health Service Milk Ordinance increased, there was an increase in inquiries received from state and local health officers relative to problems in milk sanitation. Moreover, increasing use of automatic pasteurization systems brought new problems in design and operation of equipment. This necessitated development of additional specifications for inclusion in the Ordinance and Code. Some of the numerous problems required considerable study and research, so in order to deal most effectively with them an experimental laboratory was added in 1933. This laboratory was designed to study problems chiefly of a bacteriological and engineering nature. Some of the investigations previously mentioned herein were carried out in this laboratory. Figure 1 shows the general layout of the milk investigations laboratory in its present quarters in one of the new buildings of the National Institute of Health at Bethesda, Maryland. Figure 2 is an illustration of a corner of one of the bacteriological laboratories showing in the foreground an electrically controlled constant temperature water bath used for thermal resistance studies. Figure 3 shows the plate-type heater, regenerator and cooler, or complete high-temperature short-time pasteurizer indicated in Figure 1. The pasteurization equipment in use in the laboratory is all full-scale commercial equipment.

Considerable time has been given in this laboratory to the development of a satisfactory procedure for using a non-pathogenic test organism for various milk sanitation studies. An extensive study has been made of the thermal characteristics of this test organism, a strain of *Esch. coli*, and cultures have been developed which are somewhat more heat resistant than the most heat-resistant milk-borne pathogen.

At the present time, this test organism is being used in a study of the bactericidal effect of the paraffining of container board used for single-service paper containers. Methods for bactericidal treatment of glass milk bottles are not generally applicable to bactericidal treatment of single-service paper containers. However, in the paraffining process, which is used primarily to waterproof the paper containers, relatively high paraffin temperatures are used, and this study is being made to determine whether the process might also provide adequate bactericidal treatment for the paper containers.

ADMINISTRATION STATUS OF MILK INVESTIGATIONS

Most of the earlier studies of the public health aspects of milk were made by the Hygienic Laboratory. When the Office of Milk Investigations was started in the Public Health Service in 1923, this activity was made a part of the Division of Scientific Research. In February, 1937, the Division of Scientific Research was merged with the National Institute of Health and has operated since that time as part of the Institute. At this same time, the Division of Public Health Methods was formed as one of the eight divisions

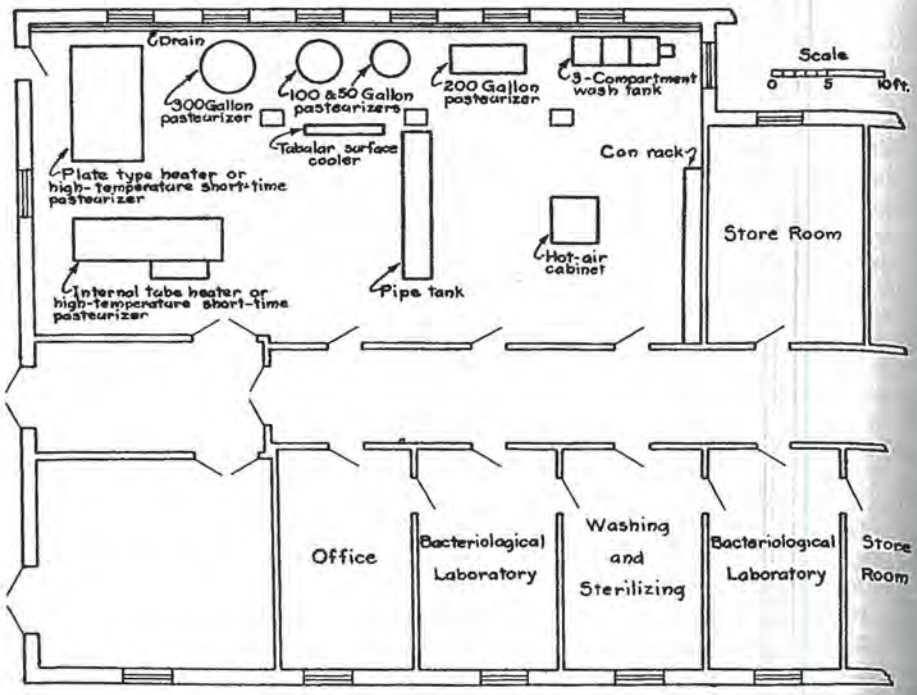

FIGURE 1—*General layout of milk investigations laboratory.*

in the National Institute of Health, and the Office of Milk Investigations was assigned to that division. All of the sanitation work in the Division of Public Health Methods was then grouped together in August 1, 1937, to form the Sanitation Section in that division, and the milk sanitation work was included therein.

In May, 1939, the activities of the Sanitation Section were divided between the National Institute of Health and the Division of Domestic Quarantine. The research work on milk and milk products was kept in the National Institute of Health, Division of Public Health Methods, Office of Milk Investigations. The other activities of the Sanitation Section relating to milk and milk products, foods, etc., such as advisory assistance to state and local health departments, development of codes, and similar activities, were transferred to the Division of Domestic Quarantine and merged with the Engineering Section of that division to form the Sanitation Section of the Domestic Quarantine Division.

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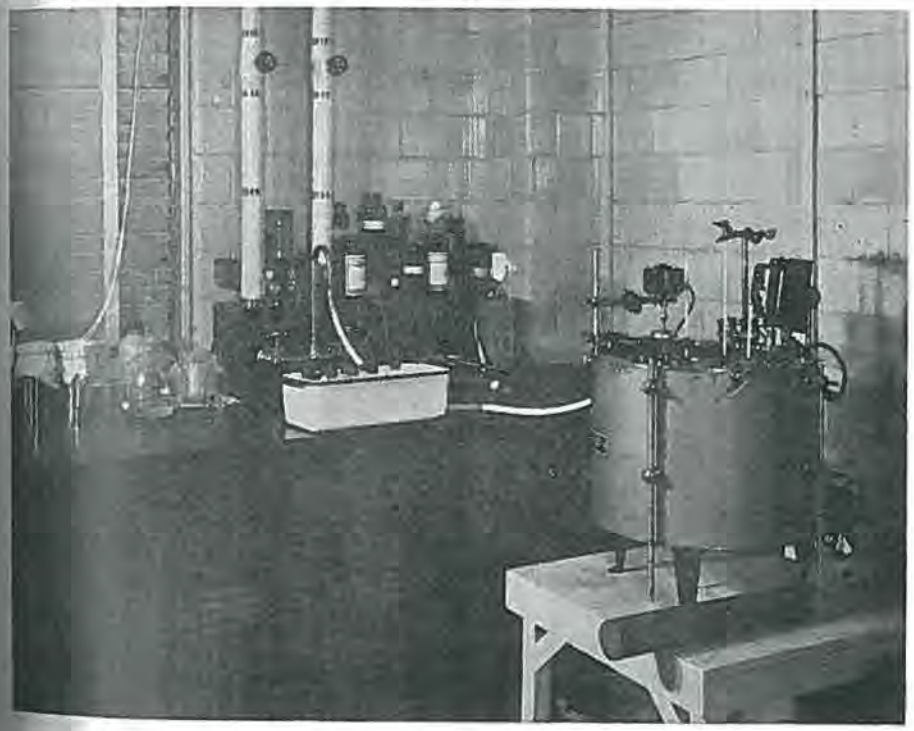
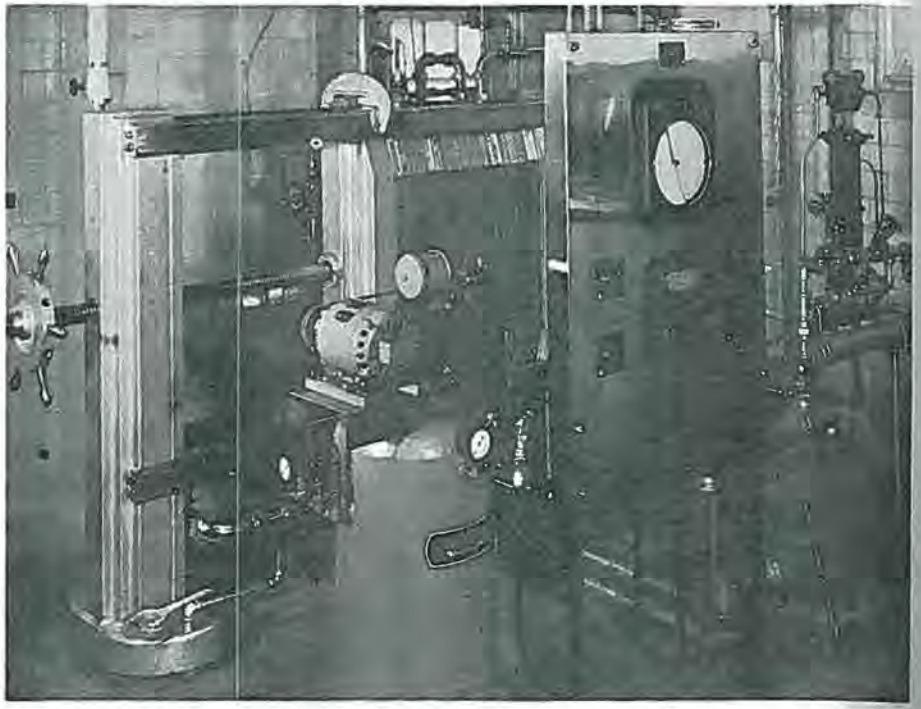


FIGURE 2.—*Corner of one of the bacteriological laboratories.*



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Modern Methods of Fly Control for Dairies *

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The title of this paper is possibly somewhat of a misnomer, because there is a great deal that must be done in the matter of controlling flies that is not, in any sense of the word, modern, but is strictly an application of common sense practices which unfortunately are not practiced. If they are practiced, they are carried out in a very desultory manner or hit-or-miss fashion. One reason for this, possibly, is that many people are too willing to accept the fly as a necessary evil, and are not fully aware as to how expensive an insect it is, not only in the matter of spoilage of the product but also as a health menace.

This subject should be divided into two sections as follows:

Section 1—PROPHYLACTIC METHODS
- (A) In the territory adjacent to and surrounding the plant property
- (B) In the plant proper.

Section 2—PLANT OPENINGS
- (A) Proper closure of all openings in the processing department
- (B) Erection of devices as barriers at points through which normal traffic flows
- (C) Elimination of superfluous or unnecessary openings

PROPHYLACTIC TREATMENT

This is possibly the most important factor involved in the matter of fly control, and is undoubtedly the one given the least attention. This is due, in a great measure, to lack of knowledge rather than neglect. We can accept ignorance as the major cause because in all my contacts—which have included some of the best minds in the dairy industry, and institutions that are spending as high as $5,000 per year in the control of this particular insect—I have found an earnest and sincere desire by these people to eliminate this problem. In a great many of these plants the matter of cost is no objection so long as a reasonable measure of control can be secured.

There is a woeful lack of knowledge of the habits of the fly on the part of the men responsible for this control. It would be money well spent by the health departments to issue informative pamphlets and distribute them to each licensed dairy producer or processor operating in the state.

The normal range of the fly can be circumscribed by a circle with a radius of approximately 1,000 yards. Therefore, accepting this as a working fact the fly situation in the majority of plants is of their own creation. There will be some of the fly population that can be charged to the wind blows, and some that can be charged to transportation by farmers on delivery. These two sources of infestation, however, are so small that they can not be considered much of a factor. The actual facts are that 90 percent of the flies that any given plant has to contend with are raised on their own property or on the property immediately adjacent.

It necessarily follows that common sense would dictate that we try to eliminate the propagation areas of these insects. For successful propagation, flies must have (1) moisture; (2) food—and in the matter of food, please keep in mind that soil rich in humus will provide sufficient food for the larvae to develop on; and (3) areas not exposed to direct sunlight nor to constant disturbance. Places meeting the above description will be found around the outside of practically any dairy plant, and all areas of this na-

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ture should be accepted as suspected plots and thoroughly impregnated with ordinary 20-mule team borax.

Now for the inside of the plant. In a great many instances, hundreds of flies are hatched out every day *inside* a plant. There will be many plant managers who take exception to this statement, and there are undoubtedly many plants in which this condition does not occur. However, there are a large number of older plants that have crevices either in the woodwork or in the masonry in which, over a period of time, there has accumulated matter that offers food for fly larvae. All parts of the plant not actually used in the processing of the product should be liberally coated with whitewash on all areas, not even excepting the coal bin. In applying this, care must be exercised that complete coverage of the entire area is made. In the processing room, all cracks and crevices should be sealed with concrete, and in the case of wooden walls, all old wood should be removed and new, tight-fitting wood installed.

Our investigations of cheese plants disclosed at least one place that invariably turned up as a most prolific propagating ground—namely, the drain and salt tables. A scum will form under these tables, and in the majority of cases we investigated this scum was alive with larvae and pupae cases. These tables should be scrubbed at least twice a month with a borax solution. In making this solution, it is necessary that borax be added to the water up to the point where the water will not absorb any more. The underside of the tables should be scrubbed with this solution.

We recommend the use of borax because it is but mildly caustic, or toxic, and only so in excessively large quantities. It is definitely safe as far as the possibility of injury to human beings is concerned, so that if any employee should, through error, include borax instead of salt or some other element of similar appearance in the product, no serious injury would result to the consumer of the product. We have found that it is especially effective in killing flies in the larvae stage. Areas that have been thoroughly impregnated or scrubbed with borax have definitely been closed as breeding grounds for flies. After the soil around the plant has once been saturated with borax, it takes very little further attention to maintain a degree of saturation sufficient to keep the area closed to propagation.

It is not practical, nor would it be even possible, to ferret out every fly-breeding spot, and of necessity our prophylactic treatment would be accorded only to those areas that indicate themselves on the surface as fertile areas. Therefore, our next step in the control of these insects must be taken in the plant itself.

PLANT OPENINGS

All new plant construction is, of course, taking the fly problem into consideration by eliminating unnecessary openings and further protecting the processing rooms by having buffer rooms between them and outside areas. This, of course, is just good common sense, and goes a long way toward alleviating the situation. It is not, however, the answer to complete control, as once an insect gets into the plant —irrespective of the buffer rooms between its original point of entrance and the processing rooms,—it will eventually find its way into the latter. Our fight, therefore, must start at those points where the fly has an opportunity to enter the plant. These points are first, the intake and can return chutes; second, the doors through which normal traffic flows; and third, the receiving dock for the returns.

The can return chute, as a rule, does not offer a very great problem in the majority of plants because of the proximity of the washer to this opening. The heat generated by the washer is a very definite detriment to the possibility of the flies using that opening as an entrance. However, the chute through which the milk is received is one of the greatest sources of plant infestation.

As a result of six years of experience in the field, testing practically every device we could think of or discover to close this point to flies, we have centered our recommendations on a spray nozzle

mounted immediately above the opening. The spray head we are using throws a fine mist comparable to that seen over a green vegetable display stand. There is not enough moisture discharged through this spray head to create a drainage problem outside the plant, nor to affect materially the outside of the containers except in instances where the line may be blocked for a period of time and a can remains directly under the spray. Even then, it would take considerable time for enough moisture to gather on the can to create the possibility of drippings from the can getting into the weigh tank.

This method provides a definite curtain through which no fly will pass. The same method is also applied to the intake chute on the return dock. This point is almost as important as the intake chute in the receiving room, with this added hazard: a great many of the bottles that are returned will, on investigation, be found to contain large numbers of live flies which normally work out of the bottles after they come to rest in storage while awaiting washing. In cases of this nature it is advisable to install auxiliary trapping equipment, which will be discussed further on.

In a great many plants the return department can be isolated from the rest of the plant, and the bottles, after being washed, can be transported back into the plant on a moving belt through a tunnel made of sheet metal. This is quite a deterrent to flies following the hot bottles into the plant.

BARRIERS AT DOORS

All openings used for entrance to or exit from the plant, whether for normal foot traffic or for trucks carrying the product, are so constructed under present arrangements that they provide nothing more than a roosting place on which the fly rests until someone accommodates it by opening the door and brushing it into the plant. Our problem here, therefore, would be to provide means to eliminate this area as a concentration point for the insects.

A great many devices, such as fans, paper ribbons, and ropes, have been tried out with very little success, but within the last four or five years there has been developed a device—an electrified screen —that can be inserted into the upper half of the door in that area now covered by ordinary screen mesh. This device operates off the regular light circuit through an auxiliary unit—a transformer—and will kill every insect approaching that area. These screens have been recommended in surveys on this problem taken at various plants, and we can report that every installation has been eminently successful.

In applying these units, the plant operator should make the lower half of the door solid so that all air currents are diverted through the top half of the door which, of course, carries the electric screen. The spacing between the electrocuting bars on the electric screen is 9/32 of an inch. This naturally offers very little resistance to air, with the result that there is a definite draft carried through the doors that are so equipped. As flies are influenced by air currents, any fly that may get into the plant through other sources is eventually drawn to the electric screen. Also, since the flies are drawn into the plant because of the odors originating there, they would naturally be attracted to the area where there was the greatest concentration of these odors, and this area, of course, would be at the doors. Because of the wide spacing of the bars, the unit offers no apparent barrier to the fly, and it attempts to enter this apparent opening to follow the odor to its source. The result is his demise.

At times it is practical to use electric screens in odd windows, and when they are used in this manner they act more as traps than as barriers to flies entering the plant. Situations where traps are needed usually develop around the cheese or casein plant where they have a whey storage tank outside the building but immediately adjacent to it. This area is, of course, particularly attractive to flies, and a unit installed in a window near the tank will destroy a great many of these insects. Naturally, those that are killed at this

point do not have to be contended with at the entrances.

We also find it advisable to recommend, in some instances, the use of another auxiliary unit such as a portable box trap, constructed of steel with an electric screen over the top of it, on loading docks or areas outside the plant where flies show a tendency to gather. Here the auxiliary equipment is used for the same purpose as the screens in the window installations.

Milk has a tendency to absorb foreign odors more easily, perhaps, than any other food product we have to deal with, and as a dehydrating fly has a distinctly unpleasant odor, a unit used for the destruction of this insect must be constructed so that it reduces to the barest minimum the possibility of an insect lodging and dehydrating on it.

This problem has been overcome by one screen manufacturer, whose device is so constructed in the matter of insulation as well as wire spacing that the problem of the dehydrating fly is practically nil. The ability of this equipment to operate under adverse moisture conditions also is such that the plants using the equipment hose it down at the end of the day just as they do their other machinery.

Electric screens and electrocuting traps have their limitations just the same as any other equipment, and unless they are properly applied they are liable to give very unsatisfactory results. I have met operators who used units of this type and are not satisfied with the results. Invariably the cause of this dissatisfaction was not in the equipment itself but rather in its application. Anyone contemplating the use of this method of controlling flies should be certain that he is dealing with an individual who is trained in the application of the proper equipment to the problem at hand, and guard against being taken in by an ordinary screen salesman who has no interest in the matter of controlling the problem beyond the immediate mercenary angle.

Are we not spending more policing effort on the processing end than on the producing end? I have in mind particularly the small producers who are inadequately financed and unable to provide themselves with the equipment necessary properly to handle their product. In many cases, either through negligence or ignorance, they do not observe even the fundamentals of sanitation.

I have been retained by some of the largest operators in the dairy field to help solve problems arising in fly control, and have found that in many cases the off-flavor and gas occurring in the curing product originated quite often at the initial source of the product.

Improperly handled milk might reach the processor in a state of deterioration that makes it difficult for the ordinary personnel of the plant to detect it, and can only be discovered through prolonged laboratory tests. This particular lot, when mixed with sterile milk, will have a tendency, because of further deterioration, to cause an off-flavor in the finished product coming out of the combined lots.

In checking back to locate the sources of milk of this nature, we have turned up situations that caused us to wonder if any inspection existed in that particular locality, as the conditions under which this milk was produced and handled made it impossible to keep the milk sterile.

Now, I appreciate that to police the entire source of this product would undoubtedly increase the personnel of this department materially, and as an engineer interested only in the answer to a certain problem, I have no comments to make on how this could be done. I also appreciate that were the same rules applied to the small producers that are set for the large operators, particularly in the matter of sanitation, the former would be forced out of the producing field. This view, on the surface, may appear very callous, but if a man is not financially able to handle a food product in such a way that it is kept fit for human consumption up to the point of delivery to the consumer, he has no business handling that product at all. However, I believe that a great deal can be accomplished in the matter of sanitation by a consistent and thorough educational program.

The Elimination of Mastitis *

(Preliminary Report)

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For the past number of years investigations on mastitis have had as their objective the reduction of the incidence of the disease in dairy herds. The opinions of the workers have varied as to the most acceptable means whereby such a reduction of mastitis could be brought about. Those interested in laboratory procedures entertain the viewpoint that only through the examination of the milk from suspected cows could the disease be properly diagnosed while those more intimately concerned with clinical examinations were of the opinion that an accurate diagnosis could be reached only through physical examination of the cow. More mature judgment on the part of those concerned with the study of the various aspects of mastitis indicated that there might be a common meeting ground for these two divergent points of view. Consequently, in recent years the conception of the physical examination has been broadened to include not only an examination of the udder but also of the milk from suspected individuals. Physical examination has now taken on the aspects of a diagnosis rather than confined to mere manual manipulation of the udder to detect fibrotic tissue.

In order to determine if progress has been made in the elimination of mastitis through physical examinations, cooperation was secured from various dairy organizations in studying the number of cows which have been segregated or condemned in these various agencies together with the total number examined for mastitis during the past four or five years. This survey is based entirely on the reports either of the company or municipal veterinarian, or in some instances the municipal laboratory which confines its activities entirely to the examination of composite samples of milk.

COMPARATIVE RESULTS OBTAINED BY DIFFERENT GROUPS OF EXAMINERS

The point has been raised many times that physical examinations were not sufficiently standardized for comparable results to be secured by different examiners working under different conditions and in the various dairy agencies concerned with this problem. A study of the results as obtained in six different companies totaling an examination of nearly a million and half cows over a period of four to five years, indicates that there is a remarkable similarity in the results by these examiners (Table 1).

TABLE 1

Relative Percentage of Cows Condemned or Segregated Through Physical Examination by Six Distinct Groups of Examiners

Company	Percent of cows segregated or condemned				
	1934	1935	1936	1937	1938
A	.....	1.45	1.92	1.49	1.38
B	.....	4.9	4.0	4.5	3.6
C	3.1	1.8	1.6	2.4	2.2
D	.....	1.2	0.92	0.83	0.63
E	2.2	2.1	.....	1.9	1.7
F	2.7	2.3	2.3	2.1	1.9

Total number examined, 1,491,325.

These results vary from a low of 0.6 percent of mastitis as demonstrated by the physical examination to a high of nearly 5 percent. However, in the main,

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TABLE 2

The Relative Number of Rejected Cows as Found by Examiners for Milk Companies and Municipal Inspectors

Agency Examining	Total number of cows	Percent of cows segregated or condemned					
		1934	1935	1936	1937	1938	Total
Municipal	172,628		1.49	1.18	1.33	1.19	1.5
Company	1,196,034		2.70	2.30	2.05	1.90	

the results as studied over a period of years indicates that the physical examination and its use in the field has become remarkably standardized.

COMPARATIVE RESULTS AS OBTAINED BY EXAMINERS FOR MILK COMPANIES AND MUNICIPAL INSPECTORS

Although the procedures may be entirely different, the objectives remain similar for those examiners connected with municipal departments of health and the examiners functioning for commercial milk companies. A study of the results of about a million and a quarter cows (Table 2) examined by these two types of field men indicates again that there is a remarkable similarity in the ultimate results obtained, although the number of cows examined by the company officials were much larger than those coming under the observation of municipal inspectors. It was found, however, in that survey that the company inspectors were much more severe in their examinations than examiners working under the jurisdiction of municipal departments of health. No special significance, however, should be placed on these relative figures other than that they reflect the obvious intent of the well-organized quality-control departments of the various milk companies to eliminate so far as possible cows which should be segregated or condemned from the producing herds.

RELATIVE NUMBER OF CONDEMNED AND SEGREGATED COWS FOUND IN GRADE A AND GRADE B HERDS

The requirements for the production of Grade A milk in New York State are obviously somewhat more stringent than the provisions covering the production of Grade B milk. A study of the results as obtained from the examination of some 50,000 cows (Table 3) in Grade A herds in New York State indicated that over the last four years a larger percentage of cows were condemned or segregated than was the case in examinations of over a million Grade B cows in approximately the same areas. These figures should not be interpreted to signify that there is a greater percentage of cows infected with mastitis in Grade A herds than herds producing Grade B milk. Examinations for mastitis in Grade A herds are much more frequent than in Grade B herds and in addition, examiners dealing with Grade A herds are much more severe in their examinations and in the interpretation of their findings. These results probably indicate that a greater effort is being made to eliminate infected cows from the Grade A than from the Grade B herds in the metropolitan area.

COMPARATIVE EFFECT OF SEGREGATION AND ELIMINATION ON HERDS WITH A HIGH AND LOW INCIDENCE OF MASTITIS

It has been the general opinion for a number of years among those interested in the study of mastitis that certain herds harbor an infection and only with difficulty can this infection be reduced to a

TABLE 3

Relative Number of Condemned and Segregated Cows Found in Grade A and Grade B Herds

Type of Dairy	Total number of cows	Percent condemned or segregated			
		1934	1935	1937	1938
Grade A	51,297	3.06	4.08	3.34	2.0
Grade B	1,144,034	5.08	2.18	1.96	1.8

minimum. In an analysis of the figures available, this viewpoint appears to be substantiated. A study of nearly 40,000 cows in herds which in the main harbor in excess of 6 percent mastitis as determined by physical examinations, were found to show year after year a larger percentage of cattle condemned or segregated. A study of 120,000 cows from herds harboring less than 1 percent of mastitis indicated a relatively low percentage of condemned or segregated cows over the last four years (Table 4). A cursory examination of these figures would indicate obviously that in the earlier years of the examination the high incident herds would have available a large number of individuals for condemning or segregating. It would naturally be expected, however, that following this large percentage of elimination each year, the incidence of infection would be reduced in proportion to the large number of cows condemned or segregated from these particular herds. However, it will be noted that no reduction in the annual percentage of cows condemned or segregated was noted when these herds were studied over a period of four years.

These results probably indicate that herds with a high incidence of infection are difficult of satisfactory results through any segregation or quarantine procedures. Herd management and barn sanitation problems no doubt enter into the problem in that procedures other than physical examinations must be available to reduce the incidence of infection or more possibly, to discover or eliminate the foci of infection in these herds.

In contrast to these high percentages of mastitis herds, our study of some 120,000 cows which in the beginning had less than 1 percent mastitis as determined by physical examination, indicated that this low incidence of infection remained at

TABLE 5

Annual Percent of Cows Condemned or Segregated Due to Mastitis for Past Five Years

Total number examined	Percent condemned or segregated				
	1934	1935	1936	1937	1938
1,491,325	2.3	2.1	2.1	1.9	1.7

a reduced percentage over the period of our observations. It can be readily noted that there is evidenced a slight increase in cows condemned or segregated over a period of years in these particular herds but the incidence of infection in all instances is so low as to make this slight increase of improbable significance.

ANNUAL PERCENT OF COWS CONDEMNED OR SEGREGATED DURING THE PAST FIVE YEARS FROM MASTITIS

The question remains as to the general results as secured in the field on the application of the principle of elimination of infected cows from dairy herds in its relation to the control of mastitis. A study of approximately one million and a half cows over the past five years (Table 5) indicates that on the eastern seaboard of the United States, progress is being made in the reduction of mastitis in carrying out the quarantine and elimination program in dairy herds. It will be noted that in a study of approximately one million and a half cows, the percentage of condemned or segregated individuals in 1934 was 2.2. This percentage of condemned or segregated individuals has gradually been reduced by the same methods and approximately the same examiners to 1.7 percent in 1938.

From these figures it is obvious that definite headway is being made in the reduction of mastitis through the segregation and elimination program as now practiced in well organized control areas.

TABLE 4

Comparative Effect of Segregation and Elimination on Herds with a High and Low Incidence of Mastitis

Percent of mastitis in original dairies	Total number of cows	Percent condemned or segregated			
		1934	1935	1937	1938
6 percent or over	38,394	7.45	6.73	7.36	7.10
Less than 1 percent	120,083	0.52	0.74	0.69	0.71

An Agar Slice Method for the Detection of Mold and Yeast on Utensils

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In connection with an investigation on the source of *Oospora lactis* in cream it became desirable to develop some means of determining the relative abundance of this organism on the various untensils used in cream production. The Hammer-Olson method (1, 2) which makes use of melted agar did not appear entirely feasible for the purpose because of the difficulty of retaining the melted agar on a convex surface such as, for example, the outside of a separator disc. To overcome this difficulty and to eliminate the necessity of having melted agar available for each test, a method was devised which makes use of agar slices readily obtained from a core of solidified agar with a sterile razor blade. The disc or slice thus formed may be placed on the desired location of the utensil under test, picked up and stored in a suitable receptacle for further observation.

Since this work was begun, a method for the detection of micro-organisms has been proposed by Demeter (3) which makes use of prepared slides by means of which solidified agar may be brought directly into contact with surfaces under test. While the agar slice method described below has not been compared critically with the above methods or with the various rinse methods, it is felt that it has some advantages in regard to ease and speed of operation.

METHOD

Preparation of materials: Straight-edged test tubes of a convenient size (¾" to 1", outside diameter) are selected and a small opening made in the bottom of each. The tubes are then corked, cotton-plugged tightly in the small opening, both ends wrapped with tin foil, and sterilized with dry heat. After sterilization, the tubes are filled with sterile acidulated potato dextrose agar (2.5 percent agar) (4), corked, and quickly inverted. The tinfoil wrappings are replaced and held with rubber bands.

A supply of small petri dishes or metal salve boxes and double-edged razor blades are sterilized. Salve boxes (¼ oz.) fitted with small squares of glass held in place by means of paraffin have proved satisfactory for holding the agar slices during observation. New razor blades may be sterilized in the original carton and each blade broken in two lengthwise before unwrapping. Used blades may be wrapped and used again.

Operation: A tube of solidified agar is prepared for use by removing the small cotton plug aseptically and replacing the tinfoil cap. The agar core is allowed to slide out of the tube approximately one-eighth inch and a disc is sliced off with a sterile blade. The disc may adhere to the blade after slicing. In order to facilitate its placement in the utensil under test, it may be pushed to the extreme end of the blade with the sterile edge of the test tube. The agar slice is placed where desired without touching the utensil with the blade. The slice should be pressed down with the blade in order to secure close contact of slice and utensil, after which the disc is removed by sliding the blade between disc and utensil and placed in a salve box contact side up. The dishes should be examined at 24-hour intervals since yeast or *O. lactis*, when present, develop rapidly but may be overgrown later with air-borne molds. A wide-field binocular microscope of the Greenough type, having a magnification of 20-30 has been found to be a useful aid in the examination.

Precautions should be taken at each step to insure freedom from contamination of agar core, ends of tube, and agar slice.

PRACTICAL APPLICATION OF THE METHOD

The agar slice method has been used in an extended field survey to determine the relative abundance of *O. lactis* on utensils used in the production of cream, but since this work was carried on as a part of a more general study of the conditions attending cream production, the results will not be discussed in detail in this article. In general, it was found that yeasts and molds were fairly common on dairy utensils. As was to be expected, air-borne molds occurred frequently. Yeasts also were noted in many instances with *O. lactis* occurring less frequently.

Work has also been done to determine whether or not contaminated utensils which are washed carefully will carry sufficient yeasts and molds to give positive tests with the agar slice method. Three series of tests were carried out. In two of these, utensils were contaminated with cream or milk containing yeasts and molds, after which they were left unwashed or washed with varying degrees of thoroughness, using the methods commonly available on the farm. In general, it was found that when the utensils were subjected to careful washing, both yeasts and oidia were practically eliminated as measured by the slice method. In the third, agar slice tests were made daily on pails used for milking and storing milk for gravity separation. The milk was kept at approximately 68° F. for 24 hours after which the cream was skimmed off, the pail emptied, and agar tests made at various stages in the washing procedure. In general, it was found that even before washing very few yeasts occurred per agar slice, and that after washing these were practically eliminated. No *O. lactis* colonies were encountered during this period, and in none of the tests has an *O. lactis* colony developed when agar slice tests have been made on clean utensils.

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Federal Specialist to Help Ohio Improve Swiss Cheese

R. R. Farrar, associate dairy manufacturing specialist, U. S. Bureau of Dairy Industry, has been appointed to represent the Bureau in its cooperative program with the Ohio Agricultural Extension Service to improve the quality of Ohio Swiss cheese.

He will succeed R. E. Hardell, who resigned recently to accept a position with a large commercial cheese company.

The state and federal program is an effort to increase the returns for milk delivered by farmers to their cooperative cheese factories. The premium obtained for high-quality cheese is reflected in the farmer's milk check. In 1938 the Ohio factories using the methods recommended by the Bureau specialist paid their members an average of 30 cents a hundred more for their milk than the factories using the old methods.

Mr. Farrar, whose appointment became effective April 1, will have his head-

quarters at Sugarcreek. From there he will make periodic visits to the cooperative factories to assist the cheesemakers in diagnosing their problems and in using a scientific procedure to assure a higher percentage of high-grade cheese. For this work he will have the facilities of a portable modern research laboratory, the equipment for which is installed in an automobile truck.

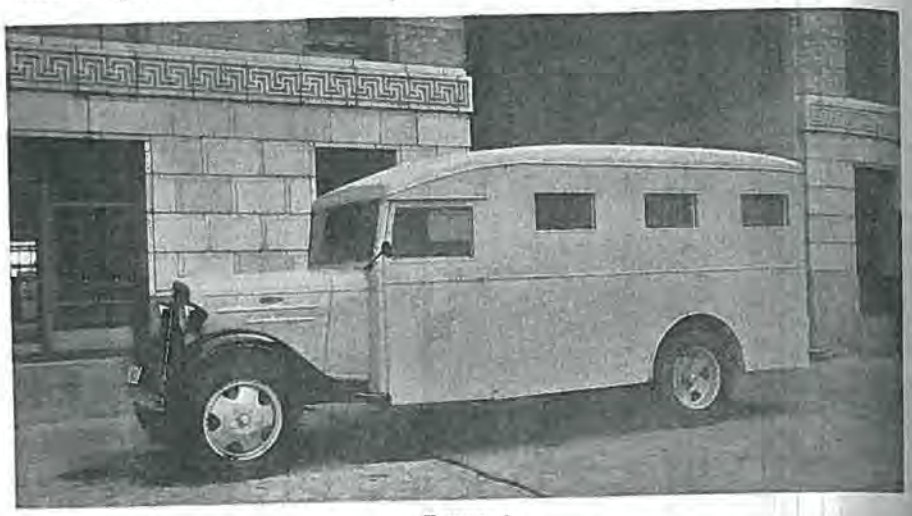

FIGURE 1

A traveling Swiss-cheese laboratory used by the U. S. Bureau of Dairy Industry, for demonstrating the advantages of scientific control in Swiss-cheese manufacture in Ohio.

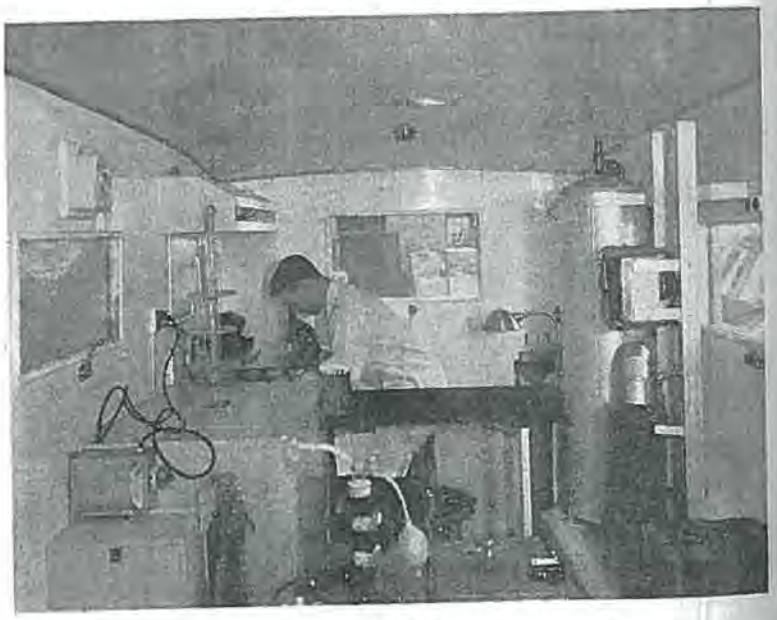

FIGURE 2

Interior of the traveling Swiss-cheese laboratory.

A General Consideration of Thermoduric and Thermophilic Organisms as a Source of Contamination of the Milk Supply*

D. M. Rudig

Chicago Board of Health Laboratories, Chicago, Ill.

Since many of the duties of the milk inspector confine his attention to the field work, he seldom has an opportunity to observe and become intimately acquainted with laboratory procedure in studying the characteristics of microbic life. I shall try to present to you a few general fundamental factors which I hope may prove applicable to your work in the field.

When bacteria are exposed to temperature below the minimum required for their growth, their activities are decreased, but they may not be otherwise injured unless actually frozen for a certain time. When exposed to higher temperatures than the maximum allowed for their growth, the organisms are more or less quickly killed. Sudden marked changes in temperature are detrimental to bacteria.

The equilbrium and number of the different types of bacterial flora of milk depend on the initial contamination, the age of the milk, and especially on the temperature at which it has been kept.

The locating of high counts in a mixed milk supply presents many problems. When one is especially interested in locating the thermophilic types of organisms, as it is applied to pasteurized milk, the agar plate and microscopic examination must supplement each other. One cannot intelligently proceed by the use of one method alone. The agar plate count may show the presence of just a few organisms and yet in the milk there may be millions of them living. Some of these organisms will grow in agar plates incubated at 140°-145° C. (184-293° F.) or more. Others will not grow in agar unless some selective nutrient substance is added to the medium.

These heat-loving and heat-resistant organisms are not considered to be able to produce disease, but they do affect the palatability of the milk.

They survive the pasteurization temperatures in milk plants. Their control requires supervision of the milk as received prior to pasteurization.

This takes the problem into the field where it requires the help of dairy inspectors. The controlling of these organisms will demand a persistant, daily, careful, and thorough cleaning of all equipment. This should then be treated with hot water at least above 180° F. or by steam after the equipment has been thoroughly cleaned.

A thermophilic organism was recently isolated in the Chicago laboratories, able to withstand a temperature of 170° F. for 20 minutes but which was killed when exposed to the same temperature for 30 minutes. This fact should help amplify the importance of heating the equipment above 180° F. for a prolonged period.

Inspectors use fluid disinfectants to advantage in the field. The point to emphasize is the daily enforcement of the technique selected. The trained technician or inspector, directly or indirectly, plays an important role in the bacterial control of any milk supply.

The efficiency in producing and maintaining a better controlled product will be in keeping with the measure of inspection efforts. The job is a big one.

* Presented before the Central States Milk Sanitarians, Chicago, April, 8.

Summary of the Report of the Chief of the Bureau of Dairy Industry, 1939 *

DAIRY HERD-IMPROVEMENT INVESTIGATIONS

This work in the United States is at an all-time peak. During 1938 the number of associations increased 122, or 11 percent. The association cows produced on an average, 7,832 pounds of milk and 317 pounds of butterfat per cow, whereas all cows milked in the United States averaged only 4,359 pounds of milk and 170 pounds of butterfat per cow. The former cows consumed only 91c worth of feed per each 100 pounds of milk they produced in comparison with $1.22 for the others. Since the cost of feed usually represents approximately one-half the total cost of producing milk, a cow should return more than $2.00 for each one dollar's worth of feed to be profitable.

UDDER INJURIES

The four quarters of a cow's udder develop from entirely independent, tubular formations which are present at birth and remain independent through life, so far as their secretory and ductal systems are concerned. One quarter, therefore, may be injured and its activity completely destroyed without the others becoming impaired.

In nearly every case in which udder infection was found in the calf or young heifer, the affected quarters were abnormal in development for a time, but "filled out" about the same as the unaffected quarters before calving time. After calving, however, it was impossible to obtain milk from the affected quarters, and a marked decrease in size of those quarters soon followed. It appears, as a result of autopsical findings, that an early infection or injury does not necessarily cause a cessation of the development of mammary gland tissue in the affected quarter, and that milk may be secreted in such quarters at calving time, but that the occlusion of the outlet makes the removal of the milk impossible with the result that involution of the mammary gland tissue in that quarter soon follows.

CANCEROUS GROWTHS RARE IN THE COW UDDER

It is particularly noteworthy that, among the hundreds of udders sectioned, no lesions have been found that appeared to be cancerous. In fact, the work of a number of investigators and the examination of many millions of cattle slaughtered subject to meat inspection by the Bureau of Animal Industry, indicate that cancer in the udder of the cow is virtually nonexistent—the few cases on record having invaded the udder from carcinoma that originated in the skin. In view of the high incidence of cancer in the mammary glands of humans and of certain other species, it is difficult to understand the rarity of the disease in the udder of the cow, especially since that organ is so highly developed functionally, often of enormous size, and subjected to friction, irritation and bruising.

CHEMISTRY AND BACTERIOLOGY OF MILK

In studying the nutritive value of milk fat, it was necessary to obtain more detailed information about the composition of butterfat, especially of some of the minor constituents. A satisfactory method was developed for the separation of hydroxy from nonhydroxy fatty acids by the use of maleic anhydride.

ICE CREAM INVESTIGATIONS

A few years ago a method was developed by which the milk-solids-not-fat in an ice cream mix may be increased without danger of the objectionable sandy texture in the ice cream, which is caused by crystallization of the lactose. In this process, sucrose is added to skim milk in the proper proportion, and the mixture is concentrated under a vacuum to a point at which crystallization of the lactose takes place on cooling. Since the sucrose prevents excessive thickening, the lactose crystals may be removed by centrifuging in the usual way to make a self-preserving skim-milk product that is low in lactose. This product permits the manufacture of an ice cream with a better texture and a higher nutritive value. The method was used by one ice-cream manufacturer this year with very satisfactory results.

INDUSTRIAL BYPRODUCTS

Casein fiber has not been found to be as strong as wool, but it has the same resiliency and takes the same dyes. In the near future this product is not likely to become a competitor of wool. It may be mixed with wool to sell at lower prices. The method developed in the government laboratories has been tested on a semiplant scale and is considered to be sufficiently advanced to warrant its use commercially. The latter requires the same equipment and technical experience as those needed for rayon. It is reported that a plant will be built at once for the manufacture of a casein fiber by a process developed privately.

Work is being continued on derivatives and compounds of casein with the object of improving the strength of the casein fiber, and an investigation has been started to develop a means of simplifying the process of making a good grade of casein so that it will become more nearly automatic.

In 1928, the Department published the results of the first of a series of investigations showing that the lactose of whey could be converted into lactic acid in a short time. On the basis of this information the commercial manufacture of lactic acid from whey was successfully established. While manufacturers have had difficulty in selling all the acid produced, the somewhat limited market for lactic acid has retarded the growth of this industry.

A considerable quantity of lactic acid is now used in making plastics, but since little acid of sufficient purity for this purpose is made in this country most of it is imported. In attempting to extend the outlet for lactic acid, the Department recognized the need for a better method of purifying, under commercial conditions, the crude acid produced in this country. Such a method was developed and tested on a pilot-plant scale in a commercial plant with such success that the plant is now taking steps to put it in operation. The capacity of the plant will be materially increased, and it will then be in a position to produce an acid of sufficient purity for any use to which lactic acid may be put.

A large number of esters and other combinations of lactic acid have been made. The most notable success has been in the preparation of a polymethylacrylate, from lactic acid, a water-clear resin with remarkable elasticity and other properties which make it valuable for impregnating cloth, dressing leather, insulation, and probably many other uses which cannot be foreseen. This resin is now made by a synthetic process but at a cost which limits its use. The lower cost of making it from lactic acid should encourage its wider use in various industries.

FOOD BYPRODUCTS

Last year, the Department reported a new method of separating the constituents of whey based on the removal of the lactose from concentrated whey by alcohol. [*See J. Milk Tech.* **2**, 294 (1939)]. Enough work was done on a pilot-plant scale this year to indicate that the method will work on a commercial basis and that substantially all of the alcohol may be recovered. The concentrated whey is then freed from alcohol in a vacuum drier, and a white water-soluble powder is obtained, containing about 40 percent of protein, largely in the form of lactalbumin. After the reaction of the filtrate is adjusted and a short time has been al-

* Editor—The original report covers 46 pages from which are selected the following subjects of particular interest to dairy technologists.

lowed for crystallization, the lactose is removed by centrifuging and is sufficiently pure to meet the requirements of the pharmaceutical grade. The alcohol in the filtrate from the centrifuge is recovered by distillation, leaving a residue which contains in a concentrated form most of the water-soluble vitamins that were in the original milk.

The possibility of using the soluble powder containing the albumen in some food product is now being investigated.

WHEY SOLIDS IN CONFECTIONERY

This work has shown that whey solids may be utilized advantageously in the commercial manufacture of fudge, taffy, and caramels, at the rate of 20 to 30 percent of the total solids. A new type of candy was devised, containing 40 percent of whey solids, with cereal to mask the whey flavor. The use of whey solids not only reduces the excessive sweetness of these candies and increases their nutritive value, but by displacing some of the more expensive ingredients tends to lower the cost. Whey solids may be used in the dry form, but a sirupy product may be made by adding sucrose to the whey and condensing it under vacuum to provide a satisfactory form for shipping and storing.

The value of whey solids in soups has been demonstrated, and soup preparations of vegetables and whey solids are now made commercially. A dried-pea soup was made in which the defects of the ordinary dried soup are largely eliminated. The ordinary dried soups lose their property of hydration and, when reconstituted, appear thin and watery; adding thickening agents tends to mask the characteristic flavor of the soup. In the dried-pea soup made with whey solids the hydrating property is retained, and a soup of any desired consistency may be obtained by adding water and heating. This dried soup is also unusual in that, although the normal amount of fat is included, it does not become rancid on storage.

Some progress was made in developing uses for whey solids in bakery goods, a field which offers a potential outlet for a large volume of dairy products. A very satisfactory canned pudding was made from inexpensive ingredients, including whey solids in place of eggs, but further work is necessary to overcome a slow change in texture, the results of which are somewhat similar to the change which takes place in the staling of bakery goods.

A start has been made in combining skimmed milk with potatoes to make a new product having some of the characteristics of potato chips. This product contains no fat and accordingly it has excellent keeping qualities. It can be made in regions remote from the markets where skimmed milk and culled potatoes are cheap.

CHEESE INVESTIGATIONS

The Department advises that cheese made from good milk with proper control of the acid development should be cured at a much higher tempearture than 34° F. (as now practiced) to develop the characteristic flavor of Cheddar cheese.

A successful commercial demonstration was made of the practicability of packing sliced Swiss cheese in cans for distribution to lunchrooms and restaurants. Selected cheese is cut into blocks that have a cross section approximating that of a loaf of bread. These blocks are cut by machine into uniform slices, which are then made into one or more packages, wrapped in cellophane, and packed in cans holding about 4½ pounds. If the cheese is of good quality and the storage temperature is not too high, this package may be held indefinitely. The lunch-counter proprietor buying cheese in this form has no waste, the cheese is ready to serve, and he knows exactly how many sandwiches may be made from each package. The convenience and economy of this package is so obvious that there has been no difficulty in interesting managers of all classes of lunchrooms in it, and a business is already established for distributing Ohio Swiss cheese sliced and in cans.

There is an even greater opportunity for marketing Cheddar cheese in this form. The volume of Cheddar cheese used in sandwiches is much greater than that of Swiss cheese, and it is very evident that the lunch-counter proprietor would be glad to pay the extra cost of slicing and canning for the convenience of the package. Cheddar cheese has the advantage of being susceptible to ripening in the can. The curd may be pressed into loaves of the proper cross-section size and shape, sliced, and sealed in cans as it comes from the press. The cheese ripens in the can and is ready for sale to the sandwich maker, without removal from the can.

The use of cans for a retail cheese package has been retarded by a general belief that the can would add too much to the cost of the package. The can used most extensively at present holds ten ½-pound prints and adds much less to the cost per pound of cheese than the can holding 1 pound or less. A type of can is now available, in sizes holding any number of prints desired, that can be hermetically sealed without the use of a sealing machine. If a can holding 20 pounds in the form of ½-pound prints is used, the can itself will add to the cost of the cheese only slightly more than the container for a single 20-pound daisy, and the additional cost will be overcome by the saving on shrinkage, labor of handling, and other items. This type of can is suitable for opening by the retailer, who then has a number of attractive prints available for dispensing, each of which is already cut, weighed, and wrapped for the purchaser. Half-pound prints wrapped in heat-sealing cellophane may be held under proper refrigeration for at least 2 or 3 weeks without molding or perceptible drying.

A few years ago assistance was given in the establishment of a small factory in a city milk area making a cheese of the Port Du Salut Paese type by methods worked out in the laboratory. This factory was handicapped by the fact that most cheese consumers were unfamiliar with this cheese and that it was obliged to compete with imported cheese for the small business that was available. Notwithstanding these obstacles, the business is now on a profitable basis.

DAIRY-SANITATION INVESTIGATIONS

A new method was developed for using the Hotis test for *Streptococcus agalactiae* in milk, improving its usefulness without involving much additional work. The test is set up with bromo-cresol purple in the usual manner. This shows immediately whether the sample is normal or alkaline in reaction. The tubes are then incubated at 37° C. for 20 to 24 hours and examined for the characteristic canary-yellow flakes, which may occur with or without the development of acid in the milk. A distinctly positive test is then discarded as completed. Under the new procedure all "suspicious" or negative samples are then examined microscopically for the presence of long-chain streptococci. Quantitative experiments show that the concentration of dye in the Hotis test is not so great that it will delay or retard the growth of mastitis streptococci. [For more detailed discussion, see this Journal 3, 75 (1940)].

MILK-PLANT-MANAGEMENT STUDIES

Bottle washers of the soaker type are used more extensively than formerly. The use of this type of washer with a conveyor system to the fillers greatly reduces the labor required for washing and filling the bottles. Vacuum fillers are now used in many large plants.

Practically all plants using clarifiers clarify the milk at a low temperature, while formerly about half of them preheated the milk before clarifying it. Filters are still more commonly used than clarifiers, but more milk is now filtered cold. Clarifiers have been developed in recent years which clarify the milk efficiently at low temperatures without causing foam. Clarifying milk cold has practically no effect on the creaming ability of milk, but clarifying at higher temperatures may injure the cream layer.

The average temperature of pasteurization at plants using the holding system is approximately 143.5° F., and the most common temperature is 143°. At the plants using the high-temperature, short-time system of pasteurization, the average temperature is 161.3°, varying from 156° to 162°. Much less floor space is required for the equipment for the latter system of pasteurization and there is much less equipment to be cleaned. However, its use is not permitted by the health officials in some states.

The types of heaters now commonly used are internal-tubular, surface-tubular, and plate-heat exchangers, and electric pasteurizers. The use of tanks, spray vats, and a rotating type of pocket holder, is more common than formerly, whereas coil vats, stationary pocket holders, and long-flow tubular holders are not so commonly used. Fewer internal-tubular coolers are used, and more heat exchangers and surface-tubular coolers, especially of the fan or cabinet type, are used.

The use of direct-expansion ammonia and also sweet water for cooling milk is increasing, and the use of brine and ice water is decreasing. The use of brine is somewhat less efficient and more expensive than direct expansion for most plants.

The use of stainless steel in milk-plant equipment is now quite common, especially for raw-milk storage tanks, pasteurizing equipment, and bottle fillers. Most plants, both large and small, now use mechanical refrigeration. The capacity of the machines is approximately 1 ton per 100 gallons of milk handled, though it is greater than this at small plants. Coal is still the fuel most generally used in steam boilers, but the use of oil and gas is increasing.

Large quantities of ice are required on the milk-delivery routes, the average being approximately 200 pounds for each 100 gallons of milk handled.

Fewer men are required to operate milk plants than formerly because of more efficient equipment and the higher speed of some of the machines used.

CURD TENSION OF MILK

A method for determining curd tension by the use of hydrochloric acid and pepsin as the coagulant was outlined in last year's report. [See this Journal, **2**, 48 (1939)]. In order to set a standard for dividing milk into hard-curd and soft-curd milk when determinations are to be made with the hydrochloric acid and pepsin solution as a coagulant, curd-tension measurements were made on 300 samples of milk by the Hill method and also by using the above coagulant. The average curd tension of the 300 samples was 43.6 grams by the Hill method and 30.45 grams by the hydrochloric acid-pepsin method.

Milk showing a curd-tension reading of 33 grams or less by the Hill method is considered as soft-curd milk. On this basis the 300 samples consisted of 180 samples of hard-curd milk and 120 samples of soft-curd milk. The hard-curd samples had an average curd-tension reading of 58 grams by the Hill method and of 41.4 grams by the hydrochloric acid-pepsin method. The reading was approximately 29 percent lower by the latter method. The soft-curd samples had an average curd-tension reading of 21.6 grams by the Hill method and of 14.2 grams by the hydrochloric acid-pepsin method.

The above data indicate that if a curd-tension reading of 33 grams is the proper dividing line between hard-curd and soft-curd milk by the Hill method, a lower reading should be used with the hydrochloric acid-pepsin method. Approximately 21 grams appears to be a reasonable dividing line for the latter method, but more data on the relation between curd tension and digestion are necessary before a definite standard can be set.

HOMOGENIZATION AND CURD TENSION

The effect of homogenization pressure on the curd tension of milk containing 3 percent butterfat is shown in the following table:

Homogenization pressure (lbs. per sq. in)	Average curd tension: Hill coagulant (grams)	Average curd tension: HCl-pepsin coagulant (grams)
0	49.2	35.9
500	43.9	29.6
1,000	33.2	19.5
1,500	28.0	16.0
2,000	23.9	13.6
2,500	22.0	13.6
3,000	21.3	13.1

These data indicate that, from a curd tension standpoint, the maximum pressure of homogenization need not be greater than 2,500 pounds per square inch.

When homogenized milk and unhomogenized milk were mixed, the lowering of the curd tension was roughly proportional to the relative amounts of these two milks.

The curd tension was not found to be appreciably affected by freezing.

When milk that had been homogenized at 2,500 pounds pressure and then pasteurized was compared in digestibility to that of boiled milk, it was found that the boiled milk showed a higher rate of digestion during the first 15 minutes than the homogenized milk. On the other hand, the rate of digestion did not decline as rapidly for the homogenized milk as it did for the boiled milk. The homogenized milk averaged the following rates in greater digestion than the raw milk:

Interval	Increased digestibility
15 min.	56.5 percent
30 "	40.5 "
45 "	30.1 "
1 hr.	22.2 "
2 "	15.4 "
3 "	9.3 "
4 "	4.9 "
5 "	0.77 "

Measurements showed that there is no material difference between the digestibility of raw and pasteurized milks, indicating that the increased rate of digestion of homogenized-pasteurized milks is due mainly to the homogenization treatment and not to the pasteurization.

Work has been started to determine the relation of curd size to curd tension and digestibility. Rubber bags served as artificial stomachs in which milk was digested for a period of 1 hour, after which the area of the curds formed was determined. While this work has not progressed sufficiently to warrant definite conclusions, it has shown that the curds formed with soft-curd milk are smaller and therefore have a greater exposed surface than the curds formed with hard-curd milk. When the average curd tension of raw milk (46 grams) was reduced to 10 grams by homogenizing and pasteurizing, the average curd surface increased approximately 230 percent.

J. H. S.

Information Concerning the Study and Practice of Veterinary Medicine

Veterinary medicine or veterinary science deals with the care and treatment of domestic animals and poultry, and the supply and control of food and other products derived from them for man's use. The veterinarian is particularly concerned with the preventive and curative treatment of animal diseases and injuries. He is also called upon for advice in regard to breeding, feeding, and hygienic management of livestock, including poultry. There is a wide field for his services with the food and fur-producing animals, horses, poultry, and pets.

Private practice attracts the majority of veterinarians. Government service with the Department of Agriculture as the largest employer, is next in importance to the veterinarian, and in the aggregate a considerable number are employed in state and municipal service, in teaching, and in commercial work, such as the preparation of veterinary biologics and milk inspection.

THE UNITED STATES BUREAU OF ANIMAL INDUSTRY

The Bureau of Animal Industry, Department of Agriculture, is the largest single employer of veterinarians. Its Federal veterinary inspectors must be graduates of veterinary colleges maintaining the requirements necessary to be listed by the U. S. Department of Agriculture and the U. S. Civil Service Commission as accredited veterinary colleges. The U. S. Civil Service Commission conducts examinations for openings and the salary of a Junior Veterinarian begins at $2,000 per annum. The chief functions of this Bureau are to build up and protect the livestock industry in the United States by Controlling or stamping out certain animal diseases and by research in the breeding and development of improved types of animals. The protective measures include the control or eradication of animal diseases such as tuberculosis, Bang's disease, cattle-tick or splenetic fever, hog cholera, sheep and cattle scabies, anthrax, glanders, and other diseases. The Bureau also conducts the Federal meat inspection at establishments engaged in shipping meat or food products in interstate or foreign commerce.

THE AMERICAN VETERINARY MEDICAL ASSOCIATION

The American Veterinary Medical Association, 221 North LaSalle Street, Chicago, Illinois, is a national professional organization established in 1863. The Journal of the American Veterinary Medical Association is its official organ.

LICENSE TO PRACTICE

All the states and the District of Columbia, also the provinces of Canada, have laws regulating the practice of veterinary medicine, and these must be complied with before veterinarians can legally engage in the practice of their profession. Licensing tests or examinations are offered periodically for candidates to qualify as practitioners. Registration is generally required and such registration is usually with the State board of veterinary medical examiners located at the State capital.

VETERINARY EDUCATION

The first veterinary school was established in Lyons, France, in 1761. In the United States little attention was given to veterinary education until 1855-1860 when short-lived schools appeared in Boston and in Philadelphia. Since then schools have sprung up, lasted varying lengths of time, and have closed. In 1918 there were 23 schools—12 private and 11 publicly supported. When requirements for Government positions increased, the private schools could not meet the additional demands and were gradually forced to close. Through this process of elimination, there remain 10 accredited colleges which offer degrees in veterinary medicine. All except the University of Pennsylvania, which receives state aid, are land-grant colleges or universities receiving Federal appropriations for support. Most of the state veterinary colleges developed out of veterinary courses offered to agricultural students. For information on entrance requirements to the veterinary colleges, tuition and fees, etc., prospective students should secure the latest catalog of the school in which interested. (There are no accredited night schools or correspondence courses in veterinary medicine.) The United States Government conducts no schools or courses in veterinary medicine.

ACCREDITED COLLEGES OF VETERINARY MEDICINE IN THE UNITED STATES AND CANADA

ALABAMA: Alabama Polytechnic Institute, College of Veterinary Medicine, Auburn.

COLORADO: Colorado Agricultural College, Division of Veterinary Medicine, Fort Collins.

IOWA: Iowa State College of Agriculture and Mechanic Arts, Division of Veterinary Medicine, Ames.

KANSAS: Kansas State College, Division of Veterinary Medicine, Manhattan.

MICHIGAN: Michigan State College of Agriculture and Applied Science, Division of Veterinary Medicine, East Lansing.

NEW YORK: Cornell University, New York State Veterinary College, Ithaca.

OHIO: Ohio State University, College of Veterinary Medicine, Columbus.

PENNSYLVANIA: University of Pennsylvania, School of Veterinary Medicine, Philadelphia.

TEXAS: Agricultural and Mechanical College of Texas, School of Veterinary Medicine, College Station.

WASHINGTON: State College of Washington, College of Veterinary Medicine, Pullman.

CANADA: University of Toronto, Ontario Veterinary College, Guelph, Ontario.

CANADA: l'Ecole de Medicine Veterinaire, Universite de Montreal, Oka, Quebec.

New Books and Other Publications

Management of Dairy Plants. by M. Mortensen. Revised edition. The Macmillan Company, New York. 1938. 396 pages. $3.00.

The material presented in this book is stated by the author to have been collected from practical experience and from the research of various investigators. Although it represents what is introduced in the course of dairy plant management offered to undergraduate students in dairy industry in the Iowa State College, it also presents information in a form that is valuable in the practical management of dairy plants. The material covers the whole range of subjects included in dairy plant operations ranging from the preliminary survey, through the mechanical engineering of plant operations, purchasing, financing, procurement, production, elementary cost accounting, marketing, advertising, and collection. It closes with a few pages on chemical and bacteriological tests. At the conclusion of each chapter there is a list of references for additional reading.

The book is well printed, well illustrated, and contains much valuable information which would be useful to milk sanitarians in their supervision of dairy operations by giving them much practical knowledge and also appreciation of the problems of the dealers. J. H. S.

Dairy Science. Its Principles and Practice in Production, Management, and Processing, by W. E. Petersen. Published by the J. B. Lippincott Company, Chicago, Ill. 1939. 679 pages.

The author states in his preface that the book was designed primarily for use as a text for college students of dairy production, although it furnishes material that is essential in each of two college courses—the introductory course in dairy-husbandry usually offered to all agricultural college students, and the course in dairy cattle management or milk production. Only such information is given as is considered essential for the student to gain a conception of the entire dairy industry, its relations and its problems, and a knowledge of the general characteristics of milk and its products.

For those seeking additional information, reference reading lists are given in an appendix. Questions for teacher and pupils are likewise available.

The first 9 chapters deal with the history and economics of dairying and the important commercial products of this industry. The next 9 chapters are on the leading breeds. Then follow 15 chapters on selection, breeding, and herd management. There are 10 chapters on milk production practices. The chemistry and bacteriology of milk are discussed in 4 chapters. One chapter is given to dairy operations, and 5 to dairy products.

The reference readings list several publications as late as 1938. However, no mention is made of the new official method of scoring butter, and no reference to the phosphatase test later than that of Kay and Graham's original paper in 1935.

The index could be improved. No mention is made of Johne's disease although a page is devoted to its discussion. There are 112 illustrations, but on the whole their quality is poor. Many seem to be reproductions from printed ones.

Dairy farm inspectors and those interested in securing a broad but not intensive perspective of the dairy industry will find the book useful.

J. H. S.

Historic Tinned Foods. Publication number 85, 2d edition, International Tin Research and Development Council, Columbus, Ohio. 1939. 70 pages.

This interesting booklet gives a detailed description of some early developments in the production of canned foods. It carries pictures of cans of roast veal, and of carrots and gravy taken on Parry's voyage in 1824, and others of roast beef packed in 1842 and of tripe in 1880. Details are given of the chemical and bacteriological investigations, with pictures of the equipment used to collect the gases aseptically. The booklet can be secured without charge by writing to the publishers.

J. H. S.

JOURNAL OF MILK TECHNOLOGY

Official Publication of the

International Association of Milk Sanitarians

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Association News

Central States Milk Sanitarians

A meeting of the Central States Milk Sanitarians was held in Chicago on April 8th. New officers were elected and new committees were appointed by the newly elected president, Mr. William Dotterer, of Barrington, Illinois. Mr. D. M. Rudig, of the Chicago Board of Health Laboratories, presented a paper on thermophilic and thermoduric bacteria. This paper is published elsewhere in this issue.

In the discussion that followed, Mr. Dotterer stated that if all the utensils and equipment in the dairy are clean we shall have very little bacteria troubles. Mr. Krueger found that water which has stood in cooling tanks for some time may become lodging places for bacteria, and often this water is used for washing dairy utensils. Dr. Torey stated that where lye solution has been used in milking machine rubbers he has found low bacteria counts. Mr. Abele pointed out that the insulated water heaters that are used in milk houses can become seed beds for the growth of bacterial organisms, and stated that water for washing utensils should be taken directly from the source and not from cooling tanks in a milk house. Dr. Wiley has found thermoduric bacteria in washing vats and points out that if the pipe which conducts the water into the cooling tank goes to the bottom of the tank the dairyman has no place to get wash water except from the cooling tank.

DONALD J. FITZGERALD,
Secretary-Treasurer.

Chicago Dairy Technology Society

At the April 11th meeting, over 100 members and guests heard Dr. B. J. Stine of the Kraft-Pheonix Cheese Company demonstrate varieties and types of foreign cheeses. Dr. T. W. Workman, Deputy Dairy Commissioner of Connecticut, described high-short pasteurization as practised throughout the New England states.

At the meeting on May 14th, Mr. H. E. Schuknecht discussed pioneering in the dairy industry. He was the first man in the United States to pasteurize cream for butter-making purposes.

Plans are under way for the annual June party to be held in the Alpine Room at the Bavarian Hof-Brau. There will be dinner dancing and entertainment and dancing.

O. H. AUSE,
President.

New York State Association of Dairy and Milk Inspectors

The joint Committee on Local Arrangements and the Executive Committee of this association met at the Hotel Pennsylvania in New York City on April 10, 1940 to make preparations for the joint annual meeting of the International Association of Milk Sanitarians scheduled for October 17, 18 and 19, 1940.

Extensive plans are on foot for the entertainment of the wives of members. The presidents of both associations appointed the following committee of ladies in charge of Local Arrangements for the entertainment of the ladies:

Miss Vera McCrea, *Chairman*	
Mrs. Ed Baldwin	Mrs. G. E. Creighton
Mrs. Paul Corash	Mrs. John Jansen
Mrs. Herbert Eastwood	Mrs. C. S. Leete
Miss Mabel Flanley	Mrs. Ivar Mikkelsen
Mrs. M. B. Horton	Mrs. Sol Pincus
Mrs. C. L. Kern	Mrs. J. J. Regan
Mrs. Gordon Molyneux	Mrs. W. H. Rothery
Mrs. S. Abraham	Mrs. J. M. Sharp
Mrs. Paul B. Brooks	Mrs. W. D. Tiedeman
Mrs. E. E. Brosnan	Mrs. Geo. West

W. D. TIEDEMAN,
Secretary-Treasurer.

Michigan Association of Dairy and Milk Inspectors

The Michigan Association of Dairy and Milk Inspectors will hold their summer conference or short course at the Michigan State College, East Lansing, on June 18, 19, and 20, 1940. The tentative program is as follows:

Thursday, July 18

10:00 A. M. Registration.
10:30 A. M. What the Public expects of a Milk Inspector. Professor Earl Weaver.
12:00 At College Picnic Grounds.
1:00-4:00 P. M. Laboratory Sections as follows:
Sec. 1 The Use of the Microscope in Detecting Quality in Milk.
Sec. 2 The Phosphatase Test, Acidity, Residual Chlorine, Alkali, and Adulteration tests.
4:00 P. M. Golf Tournament.
8:00 P. M. The Bull Session. Mason Hall Lounge.

Friday, July 19

9:00 A. M. Refrigeration. J. Edward Walker.
10:00 A. M Milk Plant Equipment Demonstration.
11:00 A. M. Report of Coordinating Committees.
1:00 P. M. Practical Inspection. Dr. W. L. Mallmann.
1:30 P. M. Laboratory Sections as follows:
Sec 1 Continuation of Microscopic Work.
Sec. 2 Identification of flavors and odors in various dairy products.
4:00 P. M. Baseball game. Detroit vs. Outstate.
6:30 P. M. Banquet. State College Union.

Saturday, July 20

9:00 A. M. Tracing Milk Borne Epidemics. H. E. Miller.
9:30 A. M. Educational program for food handlers.
10:30 A. M. Licensing Milk Inspectors. Dr. F. W. Fabian.

HAROLD J. BARNUM
Secretary-Treasurer.

Milkstone Formation

Probably an accumulation of thin, metallic-like films on hot milk equipment, difficult to recognize during the period of their accumulation, causes milkstone formation, J. J. Johnson and C. T. Roland, of the Sealtest Research Laboratory, stated in a recent analysis of this problem which is to appear in full in the May issue of the Journal of Dairy Science.

Johnson and Roland find two definite types of milk films on hot milk equipment: one of cheese-like consistency, resulting from superheating and partial denaturation of milk around gas bubbles formed at the heat transfer surface; the other a thin, dense, metallic-like film or discoloration produced concomitantly with the cheese-like deposits or independent of it if conditions are such that gas bubbles do not form at the heat transfer surface. Removal of the cheese-like deposits is simple, but in the opinion of these investigators, failure to recognize the metallic-like deposits in daily cleaning operations is the direct forerunner of milkstone.

They state that the factors of daily cleaning efficiency, type of washing solution used, type and hardness of water, and processing equipment and procedure employed determine both the composition of milkstone and the rapidity with which it will be deposited on hot milk equipment.

"Doctor Jones" Says —

By
Paul B. Brooks, M. D.

" 'The Voice with a Smile'—when the telephone company put that out as a slogan several years ago, you remember how it sort of caught on? It did with me, anyway. And I always figured one reason it went over so strong: the operators—they didn't overdo it. Their voices just sounded pleasant: as if they were glad you called, instead of mad about it. Of course I don't know how they felt but, anyway, it gave the impression of sincerity. A smile that's a smirk, you not only don't take it at its face value but it's apt to make you kind of suspicious. Like the wolf that ate up Little Red Riding Hood's grandma: he showed his teeth too much.

"What made me think of it, there's one or two of these fellows on the radio they get to talking about toothpaste or soup or pills or whatever they're hired to talk about and they put so much sweetness in their voices—well, it reminds me of a relative of mine that took her first sea trip. She was out in a deck chair and getting along pretty good 'til the steward gave her some tea with too much sugar in it. They say one swallow don't make a summer but it made her spring—and she just made it.

"It's some like these diplomatic exchanges we've been hearing about the last couple of years: some of 'em are so diplomatic nobody takes any stock in 'em Like a Mayor said to me, a few years ago the health officer they'd had for a good many years was quitting and they were considering a fellow that worked for the —anyway, he didn't live in that town. The Mayor asked me what I knew about him. I told him he knew his stuff, all right, and he was a hustler but I was afraid he wasn't any too diplomatic. 'Well the Mayor says, 'we've had more diplomacy'n anything else the last fifteen years. Now we'd like a little action.' Of course it takes diplomacy to get things done but too much of it, the same as an over-done smile, it's liable to defeat its purpose by stirring up distrust instead of good feeling. Of the two I'd rather be disliked than distrusted.

"Maybe it's a little off the subject but you take this 'make-up' business of women: when it looks natural it's fine. The right kind of touching up, it'll take off ten years or so and it not only improves their looks but it's good psychology. But when I see one that I'd guess was born at least as long ago as I was that's got on more color'n she could've had when she was sixteen, it makes me suspect she's older'n she looks. You know —whether it's smiles or cosmetics, when they're put on too thick they're liable to be covering up something!"

Control of Typhoid. *Gaylord W. Anderson. The Commonhealth—Massachusetts Department of Public Health,* Vol. 26, No. 3, July, August, September, 1939, pp. 167-169. *Pub. Health Engin. Abs.* xx, Mi. 16.

The author tells of three typhoid fever outbreaks. One community had forty-four cases of typhoid during the five years preceding the discovery of a carrier, while only five cases were reported during the five years following. It was discovered that a farmer who had had typhoid a number of years ago was selling butter in the city. Studies showed him to be a carrier—farmer had gall bladder removed. Another community had ten cases of typhoid during a single year. The cases apparently had nothing in common until a boy who came down with typhoid told of working in a restaurant run by a woman who said she could sympathize with him as she too had had typhoid. Examination showed her to be a carrier. After she quit the restaurant typhoid stopped.

Several cases of typhoid occurred on streets in a manufacturing settlement. A connection between the public water supply and a polluted fire supply was found. A check valve between the two supplies was to be held open by a pair of overalls that had been sucked up from the river during fire pumps weekly test. The connection was broken and the typhoid disappeared.

Endicott Times Editor Speaks Out

The following editorial which appeared in the Endicott Times of January 4 speaks for itself. We quote:

"I'll Take Mine Pasteurized!"

"The value of proper supervision of the milk supply of a congested population area is being continuously demonstrated thruout the State by the freedom of most of these areas from serious epidemics. There still remain the negative demonstrations, however, where the same lesson is taught by 'horrible example.' Just a few weeks ago a milk-borne epidemic broke out in Horr... The December 25th issue of 'Health News' contains an account of some eighty cases of gastroenteritis in Frewsburg, traced to a raw milk source.

"These, and the numerous examples of serious outbreaks in the past, seem ample proof of the medical authorities' contention that milk is an attractive range for homesteading by many types of malignant germs, and particularly those of the streptococci family. For that reason, since milk is most universally used for human food, it becomes necessary to maintain strict regulation and supervision of its production and distribution. Such regulations quite often encounter bitter opposition from the champions of individual liberty. I have on my desk, for instance, a copy of an editorial which ... June 9th, 1939 in the Middletown Times Herald. The editor attacks a proposed regulation for Middletown which would ban the citizens of that municipality from bringing in raw milk, even for their own consumption. He refers sarcastically to pasteurized milk as the 'sterilized-cooked' article, and endeavors to place constitutional approval upon the right of any individual to satisfy his preference for raw milk.

"Well, now let's take a look at all sides to the question. I never saw a question that didn't have two sides. If it doesn't have two sides it isn't a question. I'll match my enthusiasm for individual liberty against the Middletown editor's any time. And I'm just opposed to unwarranted governmental interference with individual freedom as any man in the country. But I put the emphasis on 'unwarranted.' Past experience with epidemic disease traced to infected raw milk give considerable warrant for limiting the distribution of raw milk. I haven't forgotten that epidemic of scarlet fever in Owego a year or ... The village board there appear to have determined it wouldn't be forgotten, also, by barring raw milk: For you see it has been the policy of government in America to curb the individual when the exercise of individual 'rights' interfered with the rights of his fellow citizens. That's why you drive on the left side of the road. That's why you can't park in front of a fire hydrant, altho that is quite often the only space available, and there isn't any fire in town either. But you are forced to inconvenience yourself no little, and drive several blocks out of your way. Why? Well THERE MIGHT BE A FIRE! You see, government protection of the rights of all at the expense of the individual's unlimited freedom enters the field of possible damage to others as well as actual. That's the way it is with raw milk. It may be all right. But the government's regulations concerning it are based on the fact that past experience warrants the assumption that it may be all wrong!

"Now I haven't heard of anyone kicking about his individual liberty being tampered with because he can't buy arsenic without government authority. But if you take arsenic and die, you're the only one that gets hurt. Arsenic poisoning isn't infectious or contagious. But these milk-borne epidemics don't stay within the limits of 'individual liberty.' They trespass on the realm of individual liberty other people set up, who try to protect their own health and that of others by the use of products KNOWN to be safe. That's why there's more reason why the government should interfere with the 'milk guessers' than the purchasers of arsenic. I haven't heard anybody attack the illegal aspects of suicide. For it is against the law to commit suicide. But the law against murder is even more desirable. And when a fellow wilfully ignores the danger signals on milk that may be infected, and introduces into his community an epidemic that may kill a number of people before it runs its course, what are you going to call him? I say to you Mr. Middletown editor, that he is no more blameless than the man who points a gun at another and pulls the trigger, killing him 'accidentally' because he didn't know it was loaded! It must be pretty obvious from the result that HE DIDN'T KNOW IT WAS'NT LOADED! And the victim is just as dead as if his slayer had slaughtered him intentionally.

"That's the answer to the Times Herald in these statements: 'You know the farmer you patronize. You are familiar with his herd and barns. He is clean. His premises are clean. You don't have to take the word of a bureau inspector for that. His animals also are clean and, on the word of a regularly visiting veterinarian, entirely healthy.'

"What guarantee concerning the safety of milk is there in your acquaintance with the farmer? Every dairyman that ever sold a quart of infected milk must have been known by a great many people. You'll get just as sick on infected milk if the dairyman is your best friend as you will if he is a total stranger to you. How do you know his premises are clean? When diseases are caused by micro-organisms

so small that high-powered microscopes are necessary to enable the human eye to recognize a colony of them, what sort of gimlet-eyed marvel are you to pass on the cleanliness of the premises! Not even the trained health inspector can do it with confidence. That's why he insists on playing safe by pasteurizing the milk! After he's done his best, he still isn't willing to stake his reputation on the safety of raw milk. Why should you stake the health of yourself, your family, and your community on your superficial verdict of cleanliness? 'You are familiar with his herd and barns.' Listen, mister, I don't care if you're even in love with the innocent-looking brown-eyed Jersey in his herd and on speaking terms with all the rest. That doesn't have a continental thing to do with whether the milk is safe or not! And the visiting veterinarian can't give you a clean bill of health FOR ANY HERD THAT WILL BE EFFECTIVE FOR TWENTY-FOUR HOURS AFTER HE'S MADE HIS EXAMINATION! Don't forget that. That's why pasteurization is urged. It takes care of what the best-trained eye can't see; and it takes care of conditions that arise between visits of the veterinarian. And most of us know that, of necessity, his visits can't be too frequent.

"Now one more point; the Middletown editor states that if you live outside the 'imaginary' line marking the municipal boundaries you can buy all the raw milk you like and it's all right. But if you cross that line you are guilty of a misdemeanor. He says the fellow on the other side of the line is entitled to equal protection with the chap inside the line. Now that's one point on which I can agree with him. That's a worthy objective toward which to work! Of course, that isn't what he means. What he really means is that the fellow inside the line should have equal privileges to menace his family's health and that of his neighbors as the law allows the chap outside. And I don't agree on that!

"It is assumed that municipal boundaries enclose a thickly populated area where contacts with infection are enforced upon the citizens because of the proximity of residences. Of course, I know that a great many municipalities do extend their boundaries as far out in the country as possible! But generally speaking, the municipality deals with the problem of congested population. If a fellow lives on a farm, and there's scarlet fever there you don't have to go there. But if he lives in the other side of the same house with you, that's a different story! That's why I think the State should set up sanitary districts on the basis of density of population, regardless of municipal lines.

"I used to be a very sincere defender of individual liberty as it affects raw milk. But I had to face facts. The rest of my former colleagues will have to face them sooner or later, also. Heating milk to temperature of 143 to 145 degrees and holding it there for a period of thirty minutes, isn't too difficult. In the face of milk-borne epidemics in the State from 1917 to 1938 which affected the health of 8,382 people and involved 1,203 cases of typhoid, 123 cases of diphtheria, 1,442 cases of scarlet fever, 4,452 cases of septic sore throat, 311 cases of dysentery, 11 cases of polio, and 840 cases of gastroenteritis, I'll take mine pasteurized!"