SEPTEMBER, 1969
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Journal of

MILK and FOOD TECHNOLOGY

Official Publication

International Association of Milk, Food and Environmental Sanitarians, Inc.

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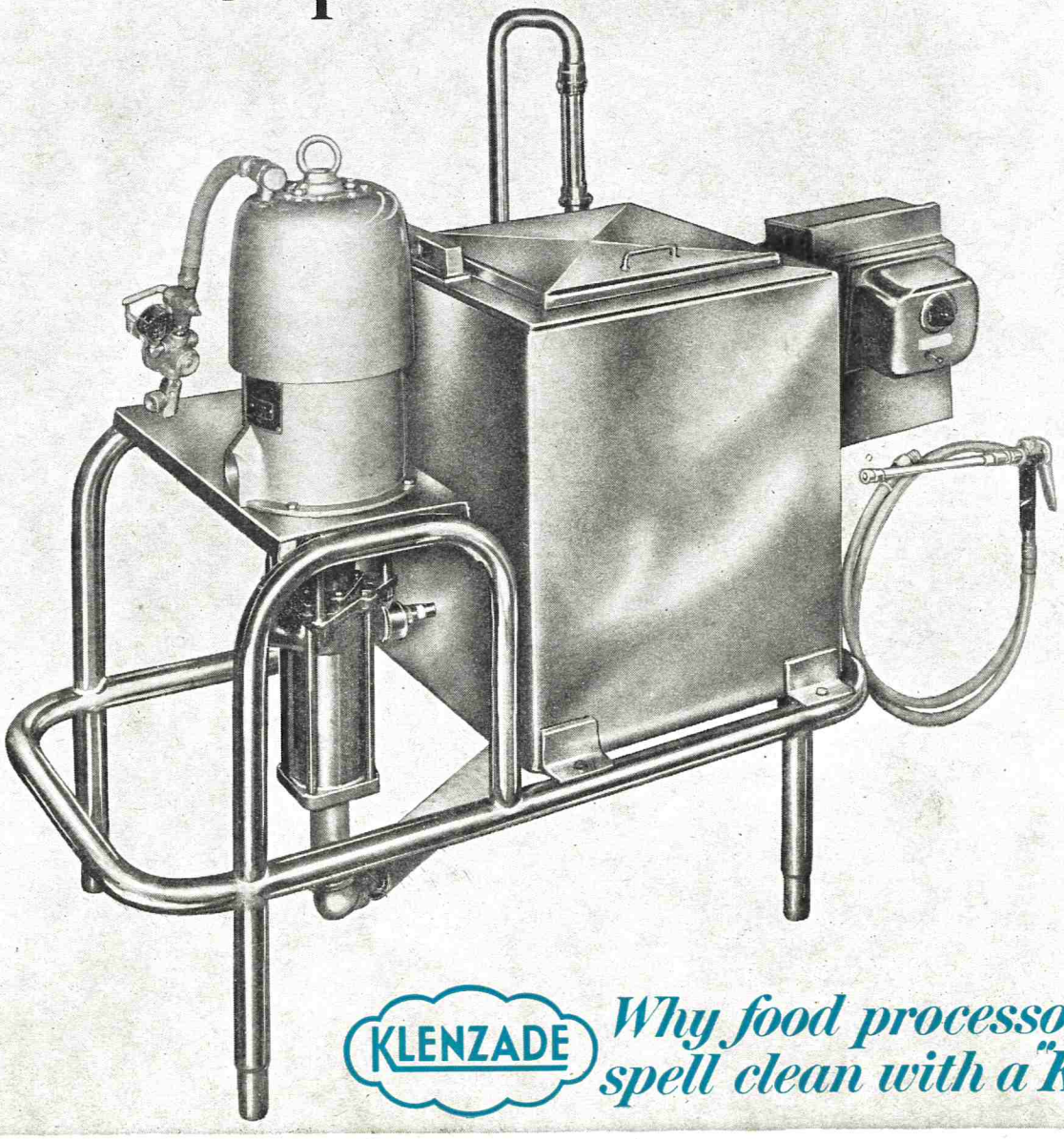

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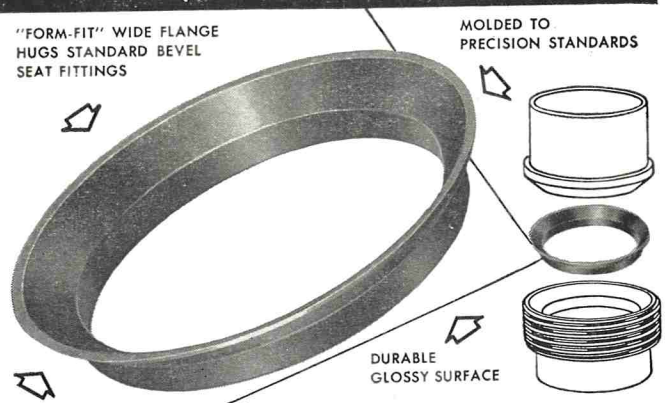

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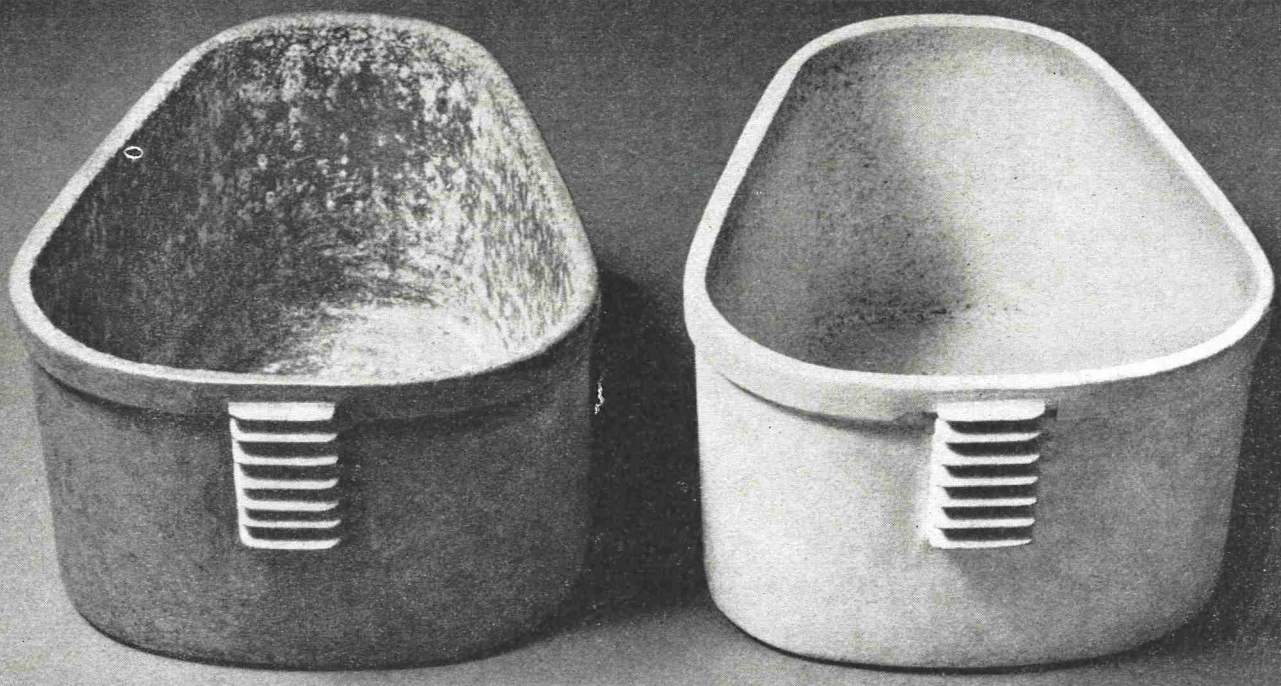

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II

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AMENDED REPORT OF THE COMMITTEE ON MANPOWER DEVELOPMENT AND UTILIZATION–ENGINEERING AND SANITATION SECTION AMERICAN PUBLIC HEALTH ASSOCIATION[1]

(Editor's Note: The report presented below is thought to be of interest to many IAMFES members. Permission to publish it has been received from APHA officials.)

As stated in the 1967 annual report of the activities of this committee, and as charged by the Section Council, this year has been devoted to completing the projects undertaken during the last 6 years. The Committee response to the specific charges is as follows:

1. *Completion of collection of data on the education and qualifications of sanitarians for the Committee on Professional Education.* These completed data are appended to this report. It should be noted that the Committee is particularly indebted to Mr. Nicholas Pohlit, Executive Director, National Association of Sanitarians for the material in Sections IV, V, VII, and VIII.
2. *Follow up on efforts to secure adoption of resolution on the description of the sanitarian.* The adoption by professional organizations of this resolution to accept the Dictionary of Occupational Titles as the standard description of the sanitarian is status quo. It was adopted by the International Association of Milk, Food, and Environmental Sanitarians, but the resolution was not accepted by the APHA Committee on Resolutions. It is of interest, however, that the *definition* of the sanitarian given in the first section of the material prepared for the Committee on Professional Education has been adopted by the Sanitarian Career Service Board of HEW as the definition to be employed by that agency. For the first time, there is likelihood that a single definition for this category can be generally adopted. This has been made possible by the completion during the year of the mechanism for certification of baccalaureate programs in environmental health.
3. *Surveillance and reporting on the U. S. Civil Service Commission action on establishment of proposed sanitarian and aide series.* Mr. Loften of the Commission has informed us that a draft of the series will be ready by the first of the year. It is admitted that work on this series has been slowed or set aside to give time to more pressing matters. It appears that they work on items in response to pressure, and this has not been applied with regard to the sanitarian series.
4. *Review existing statements relating to the qualifications, duties, and responsibilities for environmental technicians and submit recommendations in this connection.* There is attached the third draft of a statement on this subject which is submitted to the Section Council for whatever action it deems appropriate.
5. *Develop recommendations as to future activities of the Committee.* Attached is a list of recommendations submitted and reviewed by the Committee members.

Committee on Manpower Development and Utilization

Richard F. Clapp, *Chairman*
Harold S. Adams
V. Harry Adrounie
John R. Fleming
Ralph C. Graber
Alphonse Haettenschwiller
Jack B. Hatlen, Jr.
Gilbert L. Kelso
Darold W. Taylor
Edgar E. Diddams (*Section Council Liaison*)
Frederick K. Erickson (*USPHS Liaison*)

[1]Per meeting of the Committee held November 11, 1968.

I. Definition of the Sanitarian

The Sanitarian, qualified by successful completion of an accredited baccalaureate program in environmental health and by creditable field experience, is prepared to plan, organize, manage, execute, and evaluate the many facets of the environmental health program for which he is uniquely fitted.

II. General Scope of the Field

Sanitarians are employed by health agencies at all levels of Government, by a number of other Federal Departments including Interior, State, and Department of Defense, by various other state and local departments having environmental health responsibilities, by educational and medical care institutions, by a variety of industries, and by environmental health consulting firms.

Increasing sanitarian personnel competency, changes in sanitation program management and emphasis in health agencies, personnel specialization, and the emergence of the sanitation technician have broadened and elevated the sanitarians' responsibilities and activities in these agencies. Depending upon specific assignment, an individual may be engaged principally in administration, consultation, teaching, research, field practice, or a combination of these.

In colleges and universities, sanitarians hold faculty appointments and teach at the undergraduate and graduate level. An increasing number of these schools, as well as medical care institutions, employ full-time staff to maintain environmental health surveillance and to provide consultative, educational, and direct services in this area.

In industry and in commerce, they are engaged in product quality control, sanitation consultation and supervision, trade association work, and serve as technical sales representatives.

In official health agencies, they constitute the second largest single group of employees being exceeded only by public health nurses. The broad aspects of the sanitarian's activities touch upon many phases of community life. This calls for sound knowledge in the physical, biological, and social sciences and their application to the great variety of

activities involved in a complete public health program.

III. Functions and Duties of the Sanitarian in the Health Agency

Under the general supervision of the health officer or other person in responsible charge and within limitations of stated policies, the sanitarian applies his special knowledge of environmental health concepts and methods, gained through professional training in the physical, biological, and health sciences, to the identification, control, and elimination of health hazards in one or more areas of the environment. His duties are to advise, administer, supervise, or perform professional and scientific work in the promotion of a clean, safe, healthful environment and the prevention of disability or the spread of disease. The work includes planning, developing, advising on, executing and maintaining surveillance of programs in such fields as: the collection, treatment, and disposal of community wastes; housing; milk, food, and shellfish sanitation; prevention and control of air pollution; recreational facilities and areas sanitation; insect and rodent control; water supply sanitation; safety and accident prevention; institutional sanitation; swimming pool and bathing area sanitation; and elements of occupational and radiological health. He directs and supervises the work of sanitation technicians and aides. The sanitarian may carry out research activities in technical areas of environmental health or in the methods and practices in the effective delivery of services. He may direct and participate in inservice and on-the-job training of personnel in his program.

As a member of the public health team of professionals, his responsibilities include assistance in epidemiological investigations, the conduct of surveys, and the analysis of data obtained thereby; the identification of sanitation problems and education of the public in regard to such problems; evaluation of environmental health laws and regulations and their enforcement and the formulation of recommendations for necessary changes; the organization of community groups interested in environmental health programs; and the promotion of sanitary practices through the use of the various publicity media.

IV. Opportunities for Professional Advancement

Opportunities for advancement by sanitarians in the field of environmental health are growing rapidly with increased emphasis on environmental control in an increasingly urban and highly populated society.

The sanitarian today must possess a total public health concept; must be technically proficient in all the environmental sciences; must be capable of communicating readily with all segments of the population; must be persuasive and diplomatic; must recognize community needs; must have understanding of social and cultural backgrounds of the people within his community; must stimulate interest in long-range planning for environmental health needs; must conduct surveys to define the scope and magnitude of community problems and communicate these to people through community resources; and must encourage political subdivisions to enter into joint agreements for solution of common problems.

In order to keep pace with the changing public health, he must continue to change and be sensitive to the environment in which he works. He must appreciate the significance of ethnic backgrounds and cultural patterns of the people with whom he is working and the economic situation of the various communities with which he is associated.

He must attain a proficiency in developing and implementing a program plan in environmental health which meets the needs and wants of the communities he serves and which is interrelated with the total health planning of the community. He must develop the knowledge and skills of problem-solving techniques and interpersonal relationships with an ability to identify the power structure in a community. He must, in essence, therefore, concern himself with the conservation and control of the environment through the utilization of the social, behavioral and environmental sciences.

Classification of personnel on the basis of duties and functional responsibility is commonly used in commerce and industry. A system of classification serves to encourage persons in lower grades to aspire to higher positions. Attainment of positions of a higher grade should be based on merit and demanstrated ability to assume and carry out responsibility and upon experience. Promotions should be based upon an appraisal of technical qualifications, personal attributes, and the successful demonstration of leadership qualities.

Classification and Job Description for Public Health Sanitarians

Sanitarian Trainee: Requires baccalaureate degree in environmental science, biological sciences or basic natural or physical science relating to environmental health.

Position is entry to profession. Training level work is performed under close instructional supervision to prepare trainee for proficient performance as Sanitarian I.

Sanitarian I: Requires baccalaureat degree in environmental science, biological or basic natural or physical science relating closely to environmental

health. Field training preferred. Registration preferred.

This is the basic position of the professional sanitarian. Person conducts field investigations and surveys, assists in educational programs, and enforces public health laws.

Sanitarian II: Requires baccalaureate degree in environmental science, biological or basic natural or physical science relating closely to environmental health. Registration and 2 years' experience as professional sanitarian required.

Position entails advanced professional work in environmental health and planned field and office activities of more than ordinary difficulty. May be assigned responsibility for specialized phases of a program and limited supervisory responsibilities over environmental health personnel.

Sanitarian III: Requires baccalaureate degree in environmental science, biological or basic natural or physical science relating to environmental health. Inservice training or graduate courses preferred. Registration and three years' experience, including supervisory and administrative, required. A masters degree in an appropriate area of study, plus 2 years' experience, may be substituted.

Position entails supervisory and advanced professional work in environmental health. May include responsibility for supervising a group of professional sanitarians or assisting in technical supervision of a major phase of an environmental health program.

Sanitarian IV: Requires baccalaureate degree in environmental science, biological or basic natural or physical science relating to environmental health; masters degree in an appropriate area of study; registration, plus 5 years' experience including administration and supervision.

Position entails highly responsible supervisory and advanced professional work in environmental health. It may include planning, directing, and coordinating environmental health activities in an assigned region. Person may function as a section chief in planning and directing a major phase of an environmental health program, or as an assistant director of environmental health.

Sanitarian V (Director of Environmental Health): Requires baccalaureate degree in environmental science, biological or basic natural or physical science relating to environmental health; masters degree in an appropriate area of study; registration and 8 years' experience including administration and supervision.

Position entails highly responsible supervisory and advanced professional work in environmental health. Person is responsible for overall management of all activities of an environmental health unit, for formulation of policy and policy making procedures, and for securing and maintaining a well-trained staff.

This position would be found in large local health departments, in state departments of public health, in Federal government, or industry. It would involve the direction of personnel in a bureau or division, program planning, assistance to other members of the public health team, and advisory assistance for both administrative guidance and program evaluation. Such a position should be held by a person who has technical competence, demonstrated ability to work effectively with others, and leadership qualities.

V. RECOMMENDED EDUCATION BACKGROUND

As the demand for sanitarians increases, the need for educated and trained sanitarians from colleges and universities, and the college graduates most ready to step into the field are those who have participated in undergraduate programs in environmental health. Graduates with an orientation to public health and environmental health reduce the length of time required for new personnel to become productive in environmental health.

During the past few years, a resurgence of interest in undergraduate programs in environmental health has resulted from increased emphasis on environmental health programs and the need for more sanitarians in Federal, state and local programs.

Accreditation is an important step in upgrading and solidifying the professional status of the sanitarian and also benefits the schools and students. The National Association of Sanitarians has established a national accreditation council to set up a program for accrediting environmental health curricula. The typical curriculum recommended by the National Accreditation Council for Environmental Health is given in Appendix A. There are currently 31 colleges or universities offering such an undergraduate curriculum. They are listed in Appendix B.

The first requisite of a sanitarian is a bachelor's degree from an approved university in environmental sciences, biological, physical or chemical sciences. However, recruitment and retention are substantially improved by incentive programs such as internships and residencies.

In May 1968, the Bureau of Health Services, U. S. Public Health Service, initiated an intern training program. The program is for one year, and emphasizes broad, multi-program training and practical field experience in environmental health at accredited health agencies. The purpose of the program is to bridge the gap in professional development of young college graduates from academic study to practical application. Primary program control is

qualifications for the profession and then to give recognition to the sanitarian as a professional member of the public health team.

The sanitarian who is technically equipped to function effectively in public health will unquestionably gain professional status through a properly enacted registration act. Such acts should not be so restrictive, however, that personnel with long experience and demonstrated ability are excluded. Registration generally deals with recruitment of new employees who must qualify through educational preparation and experience.

Registration for professional workers must be based primarily on demonstrated ability to perform effectively in a field where application of technical skills is required for the betterment of the health and environment of fellow man. Attainment of this professional knowledge comes primarily from practical experience with a health agency and through serious study of organized knowledge at a university. Therefore, to have meaningful registration, entrance qualifications should be at the professional level.

Statutes enacted in 31 states before 1968 for registering (licensing) of sanitarians varied in coverage and type. Twenty of the states had voluntary registration laws covering only use of the title (registered sanitarian, sanitarian, professional sanitarian, and sanitary inspector). Ten states had compulsory laws, but California's compulsory provisions applied only to sanitarians employed in local official agencies.

The licensing body acts independently in 19 states, with power to issue, suspend, and revoke licenses. The department or board of health, acting on the sanitarian board's recommendation, is responsible for issuing licenses in the remaining states. In 12 states, temporary licenses are available to trainess who have met all requirements except experience.

Written examinations are required in all licensing states; fees are usually $10 to $25. Renewal fees in the 27 states with this requirement range from $2 to $20. Fees for reciprocity or endorsement, available in 21 states, are from $5 to $25.

Annual renewal is required in 26 states and biennial in one; however, no renewal is needed in two states. The statistics on licenses issued considerably underestimate the numbers of sanitarians engaged in practice. States now having registration acts are shown in Appendix D.

The National Association of Sanitarians has worked with the Professional Examination Service, American Public Health Association in establishing a uniform professional examination and uniform standards for professional registration. Uniformity is necessary to establish the field as a profession. The uniform examination is now being used by approximately a half of the states that presently have registration laws.

APPENDIX A

NATIONAL ACCREDITATION COUNCIL FOR ENVIRONMENTAL HEALTH CURRICULA

Typical Curriculum Leading to a Bachelor of Science in Environmental Health

I. Background Areas _____(120-135 quarter hours)

A. Communications, Oral and Written
English Composition, Report Writing[1], Public Speaking.

B. Humanities
Philosophy Literature, Art, Music, Drama.

C. Social Sciences
Economics, Sociology, Psychology, Anthropology.
Political Science, Human Relations.

D. Mathematics
Introductory Algebra and Trigonometry.
Analytic Geometry and Calculus.

E. Chemistry
Inorganic, Organic, Biochemistry, Nuclear Chemistry

F. Physics
Mechanics, Heat, Light, Sound, Magnetism, Electricity.
Modern Physics

G. Biology
Zoology, Physiology, Ecology

II. Core Areas _____(45-60 quarter hours)

A. Microbiology
General Applied (Environmental), Immunology, Virology.

B. Biostatistics

C. Epidemiology

D. Community Health Education

E. Public Health Organization and Administration

F. Environmental Health _____(18-24 quarter hours)
Water and Waste Water, Food and Milk, Air, Vectors, Shelter, Solid Wastes, Accident Prevention, Occupational Health, Recreation

G. Field Experience, Radiological Health

[1]Desirable

APPENDIX B

COLLEGES OR UNIVERSITIES OFFERING UNDERGRADUATE CURRICULUM

Troy State College, Troy, Alabama
California State College at Los Angeles
California State College at Fresno
California State College at San Jose
Florida State University, Tallahassee
University of Florida, Gainesville
Southern Illinois University, Carbondale
Indiana State University, Terre Haute
Indiana University, Indianapolis
Louisiana State University, Baton Rouge
McNeese State College, Lake Charles, La.
University of Massachusetts, Amherst
Ferris State College, Big Rapids, Mich.
Montana State University, Bozeman
University of Missouri, Columbia
Rutgers University, New Brunswick, N. J.
California State College at Sacramento
California State College at San Diego
California State College at Long Beach
California State College at San Fernando Valley (Northridge)
University of Oklahoma, Norman
Oregon State University, Corvallis

the responsibility of the National Council on Sanitarian Intern Programs of the National Association of Sanitarians.

Residencies have been established for sanitarians on a higher rung in the ladder. The U. S. Public Health Service established this program July 1, 1968, with the objectives of building professional competence, providing better utilization, attracting and retaining sanitarians in the Public Health Service, and preparing sanitarians for top management or specialized postions in the environmental health field. The programs are two years in length and are directed to program specialists and program managers.

The specialist is primarily directed toward post-graduate study in a specialty field; however, he will study management areas and administration found in the MPH program. Management residents will stress broad management concept with exposure to certain types of specialization.

VI. Graduate Education

Agencies requiring the servicees of professional santitarians for higher grade appointments prefer those whose preparation has included work at the graduate level. In general, professional competence is recognized and enhanced with the attainment of the master's degree. The graduate degree is one of the requirements for acceptance as a *Diplomate* in the American Intersociety Academy for Certification of Sanitarians.

It is, therefore, recommended that sanitarians wishing to advance to supervisory administrative positions in public health take graduate work resulting in a master's degree to supplement their undergraduate training and their work experience. While the MPH is commonly sought by sanitarians, the worker in an environmental health sub-specialty may more profitably do graduate work immediately related to that speciality. The sanitarian working exclusively in radiological health, for example, might seek graduate study in the health application of biophysics.

Those accepted for graduate study in schools of public health or at the graduate level elsewhere should select such courses which place emphasis on public health administration, planning, epidemiology, public health law, statistics, environmental health, community health organization, and personnel management and supervision. Schools of public health currently offering graduate training for sanitarians are listed in Appendix C.

In view of current and anticipated manpower needs, sanitarians with research capabilities and interests in teaching or further specialization should consider working for a doctoral degree. Some graduate schools will now accept qualified applicants in the sanitarian category for PhD programs.

VII. Future Outlook

Employment opportunities for well-trained and qualified sanitarians are exceptionally good. Currently, the supply of persons trained in the environmental sciences and public health falls far short of the demand. Indications are that there is little likelihood of any marked change in the immediate future. During the Third National Conference on Public Health Training held in Washington, D. C., August 16-18, 1967, it was estimated that with new programs in environmental health, 29,000 sanitarians will be required by 1970.

Sanitarians are being employed by Federal, state, and local health agencies, or find lucrative positions in industry, when they apply their specific knowledge to quality control within the plant, or use their research skills to develop better products for use in kitchens, institutions, water and waste control, or other manufacturing areas related to environmental health. Perhaps within the next decade, 50% of the sanitarians will be employed by private industry. As specialized education in environmental health becomes more prominent, there will be increased demand and opportunities will become available in areas other than government agencies.

As state and local health agencies expand their activities, the employment of sanitarians will increase rapidly. Health program planning and evaluation, broad health program management, bio-medical and hospital science, broad professional training program management, radiological health, occupational health, model cities, urban renewal, better land use, consumer protection, water pollution, noise and air pollution, are expected to require the services of more trained personnel as health dangers grow under the stimulus of an expanding highly technical civilization.

Not only in the United States, but increasingly large areas of the world today are acknowledging that high standards in environmental health are a must if progress is to be made. There is a demand for sanitarians in the Peace Corps, the World Health Organizations, the Agency for International Development, and the Red Cross – just to name a few. The demand for sanitarians is expected to continue to grow. With the chance to employ his talents almost anywhere in the world, the sanitarian can look forword to an exciting, useful, and rewarding career.

VIII. Registration for Sanitarians

The purpose of registration for sanitarians is first of all to establish minimum training and experience

Portland State College, Portland
South Dakota State University, Brookings
E. Tenn. State University, Johnson City
Brigham Young University, Provo, Utah
Utah State University, Logan
University of Washington, Seattle
Washington State University, Pullman
George Washington University, Washington, D. C.
Wisconsin State University, Eau Claire

APPENDIX C

SCHOOLS OF PUBLIC HEALTH CURRENTLY OFFERING GRADUATE TRAINING FOR SANITARIANS

University of California School of Public Health
Columbia University School of Public Health
University of Hawaii School of Public Health
School of Public Health, University of Texas at Houston[1]
University of Michigan School of Public Health
University of Minnesota School of Public Health
University of North Carolina School of Public Health
University of Pittsburgh Graduate School of Public Health
University of Oklahoma School of Medicine, Department of Preventive Medicine and Public Health
University of Puerto Rico, Department of Preventive Medicine and Public Health
University of Toronto School of Hygiene
Tulane University School of Medicine, Department of Public Health
Yale University School of Medicine, Department of Epidemiology and Public Health

[1]Not yet accredited.

APPENDIX D

STATES NOW HAVING REGISTRATION ACTS

Alabama
Arkansas
California
Colorado
Connecticut
Florida
Georgia
Hawaii
Idaho
Illinois
Indiana
Kentucky
Louisiana
Massachuetts
Michigan
Mississippi
Montana
Nebraska
Nevada
New Mexico
North Carolina
Oklahoma
Oregon
South Carolina
South Dakota
Tennessee
Texas
Utah
Washington
West Virginia
Wisconsin

DESCRIPTION, QUALIFICATIONS, AND DUTIES —ENVIRONMFNTAL TECHNICIAN

The environmental technician, qualified by successful completion of an associate of applied science degree in an environmental field, or by equivalent certification in this area, and by creditable field experience, is prepared to assist the professional staff of his organization in carrying out environmental activities.

The nature of his activities will vary widely depending on the content and emphasis of his training and experience. Two year curriculums provide general technical environmental instruction. Specialization usually requires further training and experience. The environmental technician works under the direction of an engineer, a sanitarian, or other qualified professional staff member; the environmental technician, in turn, may provide direct supervision to personnel frequently identified as environmental aides.

He may be employed by a health agency at any level of government and by a variety of other Federal, state, or local governmental organizations, such as those concerned with agriculture, conservation, recreation, public works, or water pollution control. Positions are available in medical care institutions and in colleges and universities. Industrial employment includes technical activities in the sanitary supervision of production and processing, the control of industrial environmental pollution, in the hospitality business, in vector control service organizations, and in environmental consulting firms.

In his career development, the environmental technician progresses from entering to highest grade through a number of steps on the basis of satisfactory job performance, successful completion of inservice and on-the-job training courses, and time in grade. Transition from technician to sanitarian or engineer is possible only through graduation from the baccalaureate program required for entrance to those professions.

RECOMMENDATIONS THAT HAVE BEEN PROPOSED FOR COMMITTEE ACTION FOR NEXT YEAR

I. Investigate and report on the opportunities in government and industry for summer employment of students in environmental health, and identify steps to be taken in the promotion and implementation of such employment for the purpose of:
   A. Recruitment.
   B. Furnishing the practical training component of undergraduate environmental health curriculums.
   C. Serving as inservice experience as part of an individual's career development program.

II. Determine the career ladder for environmental health aides and technicians.

III. Investigate ways and means of promoting counseling at the undergraduate level designed to bring personnel into the environmental health field.

IV. Develop an APHA brochure on the sanitarian.

V. Work closely with the Civil Service Commission and encourage the Commission to complete development of the Civil Service Commission series for sanitarians and for technicians and aides.

VI. Develop and recommend a plan or method by which registration (licensure) of sanitarians can be made uniform in all the states.

SANITARIAN'S JOINT COUNCIL DEFINITION

"A Sanitarian is a practitioner who through education, training, and experience, acquires the skills in the prevention and correction of environmental deficiencies resulting in health problems, and those factors contributing or causing them, and the art to work with social institutions to effect positive changes in the environment for the benefit of man."

WHAT WILL DINNER BE 15 YEARS FROM NOW?

Food industry authorities say that two-thirds of 1984's food products still are to be developed. But food technologists already are working on the menu and Mother's cookbook well may be a collector's item within a decade and a half.

While most current food innovations will be used by food processors and manufacturers, direct supply to the consumer will be immediate as application and production techniques are developed.

Would you believe powdered catsup and mustard for snacks, salad bases and sauces? Or concentrated wine powders (sherry, sauterne and Burgundy) for the growing gourmet convenience foods market? How about powdered cranberry juice for beverages, desserts, gelled salads?

Or . . . anyone for new high protein products such as spun protein fibers or dehydrated cubes of simulated meats both made from soybeans? Such products and many others are used in developing new products or improving existing products of food processors and manufacturers. With them goes the offer of technical services to assist potential users in food product development.

There is a new corn syrup, said to be the sweetest available, which contains fructose, one of the important natural sugars. Also being introduced is a new sugar substitute which is approximately 250 times as sweet as sucrose, the common table sugar made from sugarbeets or sugarcane. The new sweetener, not related either to the cyclamates or to the saccharin-based sweeteners currently in use, is said by both trained and untrained tasters to be the closest approach yet to the flavor of sucrose.

For bakery, confectionery and other industries that use flavorings and juices, there is a new line of dehydrated fruits: strawberry, raspberry, blackberry, blueberry, cranberry, pineapple, apple, tomato and orange in various forms and formulations for a wide range of applications.

And, speaking of flavors, now there are "flavor islands," jelly-like spheres of flavor encapsulated in an edible film for use in products such as ice cream, frozen desserts and baked goods.

Also contributing to food technology and processing achievements are concerns producing machinery for food processors and manufacturers, scientific equipment for various quality, nutrition and processing control and testing. For, once a new food or product has been developed, its commercial application is not feasible until equipment to manufacture, test, handle, package and transport it has been developed.

Your compact kitchen probably wouldn't hold it, but there is a new continuous cooking extruder. It is reported to cook and extrude curls, balls, stars, ovals, rounds, shells, chips, flakes, and other forms for cereals, snack foods, starches, meats, and meat products. The shape of foods to come will be varied.

Nor would your home kitchen be interested in a series of conveyorized industrial microwave ovens which cook by "molecular excitation" as foods pass through it.

The firm which manufacturers the oven demonstrates it dramatically by running through frankfurters and then ice cubes. The molecules in the hot dogs become excited and warm up the food. But ice molecules don't get excited and come through the trial without melting. A word of warming to Baked Alaska lovers: ice cream molecules are excitable, and who needs hot ice cream?

Commercial food processors know the value of new applications, such as the microwave oven, which will speed up processing time while decreasing product handling in the spreading systems approach to building foods.

Electronics applications are important in food science in the areas of research and development, various tests of food materials and in the wide field of quality control. An example is a 16 channel, full solid state, particle size analyzer. Not only does this small piece of equipment count and size the particles in a sample entered into it, but it also returns a complete readout on a high speed tape printer in less than 20 sec.

The particle analyzer zips through its job, counting particles one-by-one up to 4,000 per sec. Oh, yes, it counts particles from below one micron to over 200 microns. That's pretty fine, even if you're worrying about flour particle size in a batch of a million or so biscuits or the yeast in a brewery full of beer.

The list of innovations in food products, food processing machinery and services is long and will be growing year by year as food technologists apply their sciences to what we eat.

FUNDAMENTALS OF MECHANICAL RECIRCULATING CLEANING[1]

I. HIGH-PRESSURE LOW-VOLUME CLEANING

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"High-pressure low-volume cleaning" is seldom "re circulation cleaning" as we know it. Instead, it is better classified as a "one shot" cleaning process, for only on rare occasions is the cleaning solution recovered and reused.

The primary use of high-pressure low-volume equipment is to mechanically clean areas which cannot be recirculated and which do not lend themselves to brush washing. It has advantages over hand cleaning in that stronger detergents may be used and the spray covers irregular surfaces better than a brush.

High pressure systems are available in many forms. Some only contain the basic components to make up a system, whereas others have many refined features. The basic system consists of a positive displacement pump, a power source to drive the pump, a hose, and an applicator. Each of these components will be discussed below.

THE PUMP

The pump must be a positive displacement unit, usually of the piston type. Pressure is built in the system by restricting the discharge. Under normal operating conditions this restriction creates a discharge pressure of 550 psi to 600 psi.

This pressure has the work capability of a man brush-washing a surface. In other words, operation of a high pressure system at 550 psi to 600 psi will not effectively increase the cleaning force on a given surface; but, it will greatly increase the efficiency of the cleanup. Many areas which cannot be effectively scrubbed will be cleaned by the penetrating sprays. This is the reason detergent selection is so very important in units of this type. We should note that, in order to obtain a measurable degree of cleaning through impingement alone, it is necessary to obtain pressures above 800 psi.

High pressure pumps are very susceptible to abrasion which can be caused by undissolved detergent being carried through the pump, or by operating a pump at too high a temperature. Either one will cause seal wear which, in turn, causes leakage and loss of pump efficiency.

THE MOTOR

The system driving mechanism is very critical. Undersize it and the efficiency of the system drops. For electric systems in continuous operation a 1 to 1-1/2 hp unit is necessary. On electric systems a pressure-diversion valve is also necessary to prevent overloading of the motor and pump. Such a valve diverts solution back to the solution tank or to the suction side of the pump at the preset pressure.

On an air powered system, a diversion valve is not necessary because the head may be stalled with no adverse affect. Also, the final output pressure is directly related to the input pressure, and therefore easily controlled. Damage to air systems usually occurs from over-cycling caused by excessive fluid flow, rather than from excessive pressure as with electric systems.

HOSE AND WAND

The hose and wand are simply a means of transporting the solution under pressure to the job. The tip or nozzle, although quite small at the end, determines the cleaning effectiveness of the system. It also establishes the discharge pressure. Too large a nozzle causes pressure to fall off rapidly. Too small a nozzle reduces effectiveness of the spray through atomizing the solution which destroys its impingement. Too wide a spray pattern simply wets the surface; too narrow a pattern accomplishes very little cleaning for the time spent. Therefore, nozzles must be selected just as detergents, for the job at hand. They must be in balance with the system being used.

Rate-of-flow is related directly to the type of soil being removed. Small flows of 1 to 2 gpm will easily remove accumulated soil. However, flows of 2.5 to 3.5 gpm are necessary to remove soil which has adhered to the surface because of cooking or crushing of the product.

As was said earlier, high pressure systems come in many forms. Some incorporate a heating unit, some utilize venturi detergent feed systems on the suction side of the pump, and many systems use a constant water supply to give greater flexibility and longer operating times. A centralized system utilizing large capacity (20 to 50 gpm) pumps, automatic detergent

[1]Presented at the 55th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., St. Louis, Mo., August 18-22, 1968.

feed, and temperature controls greatly increases the utility of high pressure cleaning. However, such systems are expensive and therefore lend themselves primarily to larger processors. Portable systems lend themselves quite well to plants requiring from one up to five cleaning units.

Properly used, high-pressure low-volume cleaning can be an asset to any sanitation program. Superior cleaning with reduced labor costs are the benefits derived from such a system.

FUNDAMENTALS OF MECHANICAL RECIRCULATING CLEANING[1]

II. RECIRCULATION CLEANING

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This discussion is directed to the possibilities of proper and constructive application of mechanical recirculation cleaning in the baking industry. Mechanical cleaning is one of a number of techniques that may be effective in cleaning product contact surfaces.

At the outset, we must recognize two factors that would require attention as they relate to cleaning and sanitizing. The first of these is the prevention of possible infection, in effect breaking the channel of infection or transmission of organisms from a source to the consumer. Second, the awareness that cleanliness has a tremendous impact on food flavors.

In manual cleaning procedures, the hands are the prime culprit for transmission of undesirable organisms. It is important that all people who are involved in the food processing industry understand that 98% clean is actually 2% dirty; and it is the 2% that is the problem area in any food processing operation.

Soil on equipment surfaces is derived partly from ingredients, and partly from the water used in the mixtures. When water is applied to soiled surfaces it does much the same as water does on a freshly waxed car surface. The water tends to form beads and does not sheet off cleanly as it will when the surface is free of either protein, fat, or other deposits that are unnatural to a clean surface. Mineral deposits are sometimes a real problem and require special consideration, but can be controlled with proper regimen.

Mechanical cleaning, for the purposes of this discussion, shall be defined as "a technique of cleaning surfaces with a recirculating solution which is applied by mechanical means." The possibility of effective use of recirculating techniques in the baking industry will be examined and the feasibility of permanently installed line circuits in this application will be discussed.

With this in mind, it must be thoroughly understood that all permanent systems will have some parts, or some short sections, that will come down and, therefore, must be manually washed and sanitized. When manual cleaning is required, the proper techniques of rinsing, washing, post-rinsing and sanitizing before re-installing the sections are very vital to successful operation.

A recirculation system may be very simple and may include only a solution vessel, a recirculating pump, and a pipe circuit from the pump and return to the solution vessel—or it may be a very sophisticated, and to many, a complicated system involving vessels, air valves, controllers, programmers, sensors for detergent concentration and solution temperatures, pressures, and many other features. Equipment conforming to sanitary design standards is not necessarily well suited to cleaned-in-place (CIP) techniques. On the other hand, equipment to be effectively cleaned in place must be of a sanitary type, designed for CIP. "Sanitary" equipment is designed to allow maintenance of the equipment in a clean condition, whether by CIP techniques or manual cleaning. Certain types of "sanitary" equipment, as presently designed, cannot be CIP. An example is a piston type high pressure pump. The equipment is considered sanitary in design, however, in that it is readily disassembled and the various components can be easily cleaned manually.

CIP design requirements must include the basic principles governing 3-A sanitary design, and construction criteria. All surfaces in contact with the food must be visible for inspection, or the equipment must be readily disassembled for inspection, or it must be demonstrated that routine cleaning procedures eliminate possibilities of contamination from bacteria or insects. All surfaces in contact with the food must be readily accessible for manual cleaning; or, if in-place cleaning techniques are used, it must

[1]Presented at the 55th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., St. Louis, Mo., August 18-22, 1968.

be demonstrated that the results achieved without disassembly are equivalent to those obtained with disassembly and manual cleaning.

For the simplest of these systems to be effective, the following design (plan) and construction (installation) criteria must be observed.

1. All materials used: metal, plastic, rubber or rubber-like material, or glass, must be of proper composition to withstand the pressure, time, temperature, and the concentration of the solution to be used; and the finish of the material must be such as to enhance and not hinder free circulation.

2. The solution vessel should be of sufficient size to assure a full circuit during the cleaning operation, or provision must be made to include a "water add" capability. In the baking industry, as CIP becomes more prevalent, parts washers may be used to advantage as solution tanks in mechanical cleaning circuits.

3. The pump used as the circulation pump must provide a capacity to maintain an effective rate of flow, approximately 5 ft per sec, and should also be of sufficient capacity to maintain a full flow and head through the system. These solution pumps should be of a design with self-cleaning properties, and preferably installed in such a way that they may be self-draining. The recirculation pump is one of the most important factors and must be sized for the job to be done.

4. The line circuits may be one of two types, or a combination of the two: *(a)* takedown, and *(b)* permanent. From a cleaning and sanitizing point of view, it is best to have as much permanent installation as is possible and mechanically practical. As you can readily understand, the more pieces or parts that are required to be taken down and manually cleaned, the more probability there is of recontamination in the course of doing this operation. In the installation of the permanent line circuit, there are, of necessity, certain "make - break" points and these of course must be provided with fittings that are readily removable. A standard takedown assembly uses paper gaskets; a more desirable takedown CIP assembly uses self-centering composition gaskets. In any event, the necessary make-break points should be so installed that they are convenient to operate and do not require forcing the line out of alignment in the process of installation or removal of the break elbows or fittings. The permanent circuits may be made with special fittings or welded, except for the required inspection points. Inspection ports were mandatory at one time, but with experience it was found that elbows and valves provide equally satisfactory inspection points and do not complicate the problem of the circuitry. There are a number of different types of CIP fittings. But the importance of using the proper gaskets for the fittings involved, so that there is a continuous surface on the inside of the line circuit, cannot be overemphasized. The inner surface must be relatively smooth and continuous if cleaning is to be effective.

5. Another important point, and one of significance and importance for satisfactory circulation, is the manner of supporting the lines. Hangers and supports must be sufficiently close to support the lines in a continuous plane (without dips), graded to drain at convenient points, such as valves or other disconnect points. Proper support and installation protects against leakage at joints. When fittings are not tight, leaks result in loss of solution, damage to floors and equipment, and general unsightliness. On the suction side, leakage interferes with flow pattern and pump efficiency. The more welding that can be accomplished, the greater the reduction in this most serious problem.

Insulation at the hanger support clamps is desirable to minimize the possibility of corrosion as a result of any dissimilarity of metals between the pipe and the supports.

It is also advisable, wherever possible, to keep valves and removable parts at a level that is most accessible to the operator. There are two types of air-valves in popular use; one uses an 'O' ring in a straight bore, the other uses a stop against a shoulder surface. In the installation of valves, thought must be given to the capability to drain, depending on the type of valve that is used. Tangential outlets are available to assist in proper drainage.

It should be possible to clean by mechanical recirculation the heat exchangers currently in use in bakeries. However, proper circuitry and pumps are a must to accomplish this job in a satisfactory manner.

It has been suggested that considerable spray-cleaning could be effected in the continuous fermenting operation, but the equipment design in all instances does not lend itself to spray-cleaning. As an example, reference can be made to the fermenting tank, the V-4 tank. The paddles and baffles in this type of vessel make it difficult to properly apply spray-cleaning techniques. Much of the other equipment, such as vertical and horizontal tanks, could well be cleaned by spray techniques, with the application of proper sprays and proper circuitry. In any event, the proper sprays for the application must

be selected very critically if the proper results are to be attained.

Smaller equipment, in most instances, can be cleaned by low volume high pressure or manual techniques in a better manner, and normally in less time. Much of the other equipment in the present continuous mix operations must, of necessity, — because of design — be manually cleaned and taken apart at the proper intervals for both cleaning and inspection.

Other significant items to consider, where equipment is a part of the system, has to do with the actual construction. Does it lend itself to spray-cleaning in the circuit? Or is it designed so that it cannot be properly spray-cleaned — and so, therefore, must constitute a hand-cleaning or manually cleaned part of the system?

Where flexible connections are required, Tygon tubing is in most common use. For the most part, the connections are "suspect," and must be inspected often and carefully. Work is being done to develop a fitting that will be convenient and can be made more sanitary in application.

It is often better to plan time sequences in cleaning that permit separate cleaning of vessels in a separate circuit. This is programming in which the service of a knowledgable planner can be invaluable for he can build greater flexibility and utility into a mechanical cleaning system. Providing for cleaning as equipment is available promotes better sanitation in the plant, reduces contaminant buildup, promotes better maintenance, and is a real labor saver. The inclusion of some permanent solution lines (both feed and return) will materially improve this capability.

The discussion to this point has been related to "hardware." But, this in itself will not do the cleaning and sanitizing. Water supply (quantity and quality), plus a proper chemical solution, are the other ingredients which, if applied at the proper concentration, temperature, and time will provide clean surfaces each time the recirculation technique is put into motion.

The logical sequences for the application of water and chemical solutions apply: pre-rinse, wash, post-rinse with acidic water conditioning (advisable in most water), drain, cap, and sanitize just prior to use. Potable water rinses are advisable in yeast lines if sanitizer used is inhibitory to yeast development in any residual quantity remaining in the line. Remember, the cleaning in a recirculation circuit is accomplished by a chemical solution flooding, which in effect digests, dissolves, dilutes, suspends, and finally, removes the soil by draining.

If properly installed, recirculating systems for cleaning have a much higher probability of providing satisfactorily cleaned product contact surfaces than manually cleaned takedown equipment, or circuits, or even circulation cleaned equipment and circuits that must be, because of construction, dismantled to replace gaskets and other single use appurtenances.

With some consideration to re-evaluation of equipment and systems layout much greater use of permanent CIP can be effected. Some improvement in finishes or possible partial redesign of some individual equipment, such as the incorporator, would make possible the same degree of use of CIP found in the fluid milk plant.

The greater the human involvement in manual or mechanical cleaning, the greater the chance or probability of oversight and uncleaned or cleaned (but subsequently contaminated) surfaces in the circuits at use time. As proponents of circulation cleaning often comment, proper "head work" will materially reduce the need for "hand work."

INTER-RELATED RESPONSIBILITIES FOR MILK PRODUCTION AND QUALITY CONTROL[1]

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ABSTRACT

The capacity to work cooperatively, industry with the various agencies, concerned with milk production and quality control has been demonstrated. Cooperation among the agencies having responsibility in milk control, in a period of a looming budget crisis, is more imperative than ever. While all the problems bearing on the public health aspects of milk control have not been solved, there do not appear to be any serious threats beyond the problem to provide maintenance efforts to assure continuance of the gains made. For the maintenance program it seems a very high level of cooperation among regulatory agencies is necessary and continued efforts of industry to work with regulatory bodies must be encouraged. Solving of new problems may have to be undertaken without added resources, therefore making it necessary to develop better techniques to tackle new tasks without losing control in the older and more traditional areas. Interrelated efforts which were carefully developed in the past will be needed to supplement as well as complement to prevent deficits from affecting the whole coordinated milk control program.

Those readers who go back to the earlier dates, the late twenties, will recall that milk control was a function of local government which, because of the emergency of the time, required milk regulatory agencies to develop rules which its representatives enforced against varying degrees of resistance. A good deal of the work was by-rule and by-gum, much lacked any scientific bases. In fact, as Professor Adams described it in his editorial on 50 years of milk control, those were the times before any depth of knowledge in bacteriology was available to the industry.

It wasn't very long before milk producers began to recognize the need for rational regulation. They found it unsatisfactory to carry out the instruction of an inspector who had in many instances little more, if any, knowledge of their needs than they. Yet his approval was necessary to market their product. Producers sought the help of the universities whose studies disclosed the elements of a science, later developed as dairy technology. Principles were recognized which formed the rationale for laws, regulations, rules, guidelines, and standards. The universities influenced regulatory agencies to follow the scientific course. Thus was established a relationship which permitted all factors to live in its own sphere-industry, university, and government. Each, while working by itself, related to one another.

During succeeding years the relationship developed beyond this and evolved closer ties. Instead of working by itself they worked together. Special problems were pin-pointed, such as farm practices, equipment sanitation, bacterial standards, and many others. Industry and regulatory groups formed study committees from which evolved some of the most fundamental developments in sanitation and quality control.

ACHIEVEMENTS BY COOPERATION

These committees were responsible for the development of *Standard Methods for the Examination of Dairy Products.* This valuable work was needed to give meaning to the measurable factors of safety and quality of milk and milk products, to provide the basis for discrimination, and to fix worth. After this, uniform standards would be valid and would lead to a much freer exchange of milk and milk products, between localities, thus opening new markets for the benefit of consumer and producer alike.

Joint committees of industry and government have worked for over 30 years, to my knowledge untiringly, at standards for equipment construction. Their efforts carried over into metallurgy with studies on the effects of metals on milk, the types of metals which would resist the effects of cleaning chemicals and cleaning practices, the facility for fabrication of cleanable equipment to make cleaning easier, and fabrication of more durable equipment. These committees considered also standardization and interchangeability of parts so that maximum utilization of equipment was possible. The work of this group caught the fancy of others, among them the restaurant industry, automatic vending machine producers, the bakers, and frozen food packers. Its results were recognized as superior because they were developed cooperatively and objectively with industry and government. The other food industry groups set up their task forces to work similarly in the public service.

Other milk industry committees concerned themselves with the physical health of dairy cattle. They involved in this problem the veterinary profession and university resources, whose findings were trans-

[1]Presented at the 55th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., St. Louis, Missouri, August 18-22, 1968.

lated into governmental action resulting in major disease eradication programs.

One hard working committee produced bacteriological references, another design and construction standards for milking equipment and bulk tank operations. Many more made important contributions.

We hear of partnership of industry and government in many parts of the American economy but where has this been so well demonstrated as in the inter-relation of responsibility of regulatory agencies and the milk industry?

The illustration of close cooperation to achieve a final good which I have outlined is taken for granted by some of the newcomers in this field. To them it appears as if the results were easily won agreements. Each achievement was hammered out piece by piece. Friendships were made and lost in the effort. At times tempers ran high and at times the goals, when within sight, were almost lost. The going was not always easy. The test, in all instances, was to find a result which would improve the product and would not encumber the industry.

There are times when legislation can produce faster results. This is frequently possible to meet a local situation. Where the orderly marketing of milk and milk products was affected resulting in creation of various practices with health implications or which are destructive, government has been called in by industry to moderate the effects on the producers, on the market, and on the consumers. By these arrangements of industry and government most of the sectors involved in milk economics were served while at the same time the consumer received an improved product, priced competitively.

NEW PROBLEMS

I could go on and recite many outstanding examples of inter-relationship of government and industry bearing on milk control. These, though meritorious achievements are somewhat behind us.

We now find ourselves living in an era profiting from the benefits derived through the struggles of the recent past. What new challenges face us? What new concepts in diet and nutrition, improvement in technology, and other developments of the present will require further employment of this relationship?

New dietary concepts such as foods for low calorie intake, and reduction in milk fat consumption have stimulated the production and marketing of new products, some of which may seriously affect milk production. These new food items must obviously be regulated. Some are potentially hazardous as a result of their composition and method of processing and some are improperly represented to the consumer. Many well known marketers are involved in production and distribution of these items and are generating conflicts bearing upon their own interests. These conditions will require governmental intervention and regulation. Industry will probably adjust to the solution.

Which firm on its own will do such needed soul searching as to develop its own code of good manufacturing practices and ethical labeling and advertising? How many will join together, if permitted by anti-trust restrictions, to do this as a group? The answer is obvious. Thus it becomes the responsibility of government in the interest of consumer protection, primarily, and industry incidentally to step in with suitable controls. In spite of the acknowledged benefits in the past, to all sectors, industry-government relations will with each attempt to regulate it, be initially in an atmosphere of mutual suspicion of motives. What new bureaucratic harassment is built into this regulation or that? What money making angle or "chisel" is industry pushing? These are the early suspicions and the mistrusts which must be overcome originally before constructive results follow. It just is regrettable that the energies of good committees are exhausted merely in arriving at the establishment of better rapport. Through the work of an association such as this which includes in its membership, government and industry, problems are recognized as problems and controls, limiting as they may be, are accepted for the consumer good.

New products cannot be regulated out of the market if they are wholesome. They are here. They will remain as long as they are acceptable to the consumer. They will have their place in the sun but they cannot cast their shadow to exclude the sunlight and the air from those products with which they contend. Consequently a "reproachment" is necessary which government will seek with the help of the milk and milk products industry.

New technologies in production are reported from time to time. Each develops its own maladjustments with respect to the whole. Accomodations are generally developed by industry, regulatory agencies, or both. Bulk tank collections, lower holding temperatures, new sanitizers, different dairy farm practices, each of these changes have resulted in a chain of events, many involving clashes with fundamental concepts. By cooperation, related interests find common grounds for understanding and resolution of difficulties.

SELF INSPECTION AND MUTUAL TRUST

The time also appears at hand when a higher order of industry reliance for plant maintenance can be broached. In fact this will be in the form of the development of self-certification agreements similar

to those now in use experimentally between the United States Food and Drug Administration and major food producers, wherein inter-related responsibilities are assumed or shared. This will release inspection time of officials for new problem solving and assure an adequate maintenance level in old areas of control.

Self certification is a modification of the self inspection programs which were developed in many localities to promote industry supervision of dairy farm sanitation as an aid to budget limited regulatory agencies. This has a long history of proven results. By this means farm practices were improved and milk quality was upgraded. The new expanded technique however, includes a formal written agreement between plant and government to carry out continuous surveillance to maintain a high level of sanitation and superior manufacturing practices.

With high minded, consumer interested management, this cannot fail. Actually no form of official inspection will succeed if management does not cooperate. If management does, then is not official inspection for the "bad guys?" The ultimate test of the value of our relationship, government to industry, is that we should have very few "bad guys."

But are we ready for this major advance in mutual trust? When will we be ready to enter into a self certification program, to give evidence of this mutual trust?

If we study the milk codes of the various states and the major cities we can find general agreement in fundamental requirements. The format of the laws may be different, the language may vary significantly but the sense is common. There are many milk control programs which have been officially evaluated and are rated high by trained appraisors. Yet parochialism in many localities remains and good supplies are kept out. The walls of the old milk shed have not tumbled down. And where such supplies are admitted there are localities which still send their representatives hundreds of miles to other states to gain information which is as near as the telephone.

Most of us pride ourselves on the fact that we have not had any recorded milk-borne disease outbreaks for many years. According to the United States Public Health Service reports many localities have such enviable records. Furthermore, millions of travellers cross the country from East to West, from North to South, who drink milk and consume milk products wherever they stop and seem none the worse for the experience.

Have we not arrived at a milestone or perhaps a crossroad where a change of direction is indicated, and where our experiences and energies can be turned to the new challenges ahead? When can we accept with mutual confidence the effectiveness of the control program of the state or local agency having responsibility for the milk supplies shipped to our respective jurisdictions. Industry may oppose freer exchange of supplies charging that the regulatory agencies of other supplies fail to maintain minimum standards. There are some agencies engaged in milk control which for reasons of their own also oppose freer exchange of supplies. If this is so, what has become of our vaunted industry-government relationship?

INTER-STATE AGREEMENTS

What appears necessary is a program wherein the States enter into formal agreements upon specifications, controls, standards, methods and reporting procedures. If supplies fall within the agreed upon conditions, there would seem to be no reason for the barriers to free milk movement. Milk control must continue as a State function. I do not see the need to involve "Big Brother," but I believe his code should be the basis upon which agreements should be drawn between State and State. His code has been a work of collaboration—industry and government and requires a high level of milk production performance.

GREATER NEED FOR COOPERATION TODAY

Does all this sound like pie in the sky? It is not meant to. The increasing cost of government has already pinched many program budgets. More programs will be affected. Most agencies are having problems in staff recruitment. With staff shortages, and tight budgets, curtailment of certain services are foreseeable. To maintain the present high standards of milk supplies will call for a cooperative effort. There will not be any room in tight budgets for the luxuries of overlapping and duplicating inspection programs. More demands will be made for greater utilization of existing acceptable control programs. That this must go forward is not academic. It is real. One agency will be called upon to assist in those parts of the program in which the other has been hit by retrenchment and other limitations. The highest form of inter-relationship will be necessary not only from State to State but also industry to State. Therefore reciprocal agreements between control agencies and self certification between industry and regulatory agencies loom as expedients to hold the hard won great gains made in the past.

Everyone will agree that the consumer takes the wholesomeness of milk for granted. I believe that legislators do too. In the light of experience and the record, it would be difficult to go to the legislature to get the added appropriations for milk control on

a public health need basis. It would be expected that control of milk safety and quality would be held on a maintenance basis by public health agencies.

RELATED AGENCIES

Since most of this discussion has been related to milk control from the standpoint of public health, it would seem that the only official agency involved in milk regulatory work would be public health departments. This, of course, is not so. Milk production control is also a function of State Departments of Agriculture and Markets which, likewise, undertake to enforce the public health aspects of milk quality although involved in other facets of milk economics. Throughout this discussion and its reference to industry-government cooperation it was not the intention here to highlight industry's cooperation with Health Departments alone. The responsibilities for the regulation of the milk industry involves also federal and state agencies which exercise control to assure orderly marketing so that the producer's interests are protected and to establish incentives for quality production. Here too, industry has played a very significant role in cooperating with milk marketing programs.

There are other agencies which had an input into the regulatory aspects of milk which are concerned with fair packaging and labeling. Here too, if the past is any indication, industry and these other regulatory agencies will cooperate to make this more recent program more meaningful so that not only are consumer interests protected by proper labeling and packaging but the industry is not burdened with regulations which may present a new set of problems.

It has recently come to my attention that the newly organized Consumer Protection and Environmental Health Services of the Department of Health, Education, and Welfare has charged the Federal Food and Drug Administration in addition to its other responsibilities, with surveillance of product safety of milk as well as other foods. This, of course, introduces another agency with related responsibilities for milk production and quality control.

COMMON RESPIRATORY VIRUSES SENSITIVE TO INBITORY EFFECTS OF POLY I:C

In human cell cultures and in laboratory animals, common respiratory viruses of man have been found sensitive to the inhibitory effect of poly I:C--a chemical inducer of interferon. These finding were reported recently by David A. Hill of the National Institute of Allergy and Infectious Diseases, National Institutes of Health. At the same time, Dr. Hill stressed that his research did not mean that poly I:C could now be expected to wipe out respiratory diseases in man.

Dr. Hill carried out these latest studies of poly I:C with Dr. Samuel Baron (NIAID), who reported last year that use of the drug cured in rabbits an otherwise fatal eye disease. Poly I:C, a synthetic double-stranded RNA (ribonucleic acid) composed of polyinosinic acid and polycytidylic acid, has been shown to be an effective inducer of interferon—a natural body substance which seems to play an important role in normal recovery from viral and some other infections.

To assess the *in vitro* effect of poly I:C on three common human respiratory viruses, Drs. Hill and Baron treated human embryonic kidney cell cultures with varying small amounts of the compound. After the cells were incubated overnight, the drug was removed and one of three human viruses—influenza A2, respiratory syncytial, or parainfluenza, type 1—was added to each culture. In order to measure any observed effect of poly I:C, the scientists inoculated other poly I:C-treated cultures with vesicular stomatitis virus (VSV)—an animal virus whose known sensitivity to interferon makes it useful as a standard.

These studies showed that poly I:C is capable of inducing human cells to produce interferon and that this protects the cells from infection by the human respiratory viruses tested. Furthermore, these viruses proved as sensitive as VSV to poly I:C-induced interferon.

In vivo studies were carried out in mice who were first given, intranasally, a small amout of poly I:C and then, in the same manner, a dose of Influenza A2. Control mice received saline solution intranasally, before their virus inoculations.

The *in vivo* studies showed that significant protection from Influenza A2 infection can be produced in mice by administering poly I:C directly to the upper respiratory tract as long as 30 hr before virus inoculation. This intranasal method of application induces interferon production in cells at the site of initial viral replication, without subjecting the whole animal to the effect of the drug. Although protection in mice could only be demonstrated when relatively small doses of virus were used, the scientist believe this represents a situation similar to that occurring in natural virus infection.

Since other investigators have previously shown that the process of adapting human influenza virus to the point where it will infect mice increases its sensitivity to interferon, the NIAID scientists asknowledge that this factor may have played a role in results of their animal experiments. They suggest, however, that these results—when considered in conjunction with the observed effectiveness of poly I:C in human cell cultures—indicate that interferon inducers, such as this compound, are potentially useful for control of human respiratory infections.

CURRENT AND FUTURE STATUS OF THE GRADE A MILK PROGRAM AND ITS IMPLEMENTATION BY THE PUBLIC HEALTH SERVICE[1]

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This paper will discuss the current and future status of the Grade A Milk Program and its implementation by the Public Health Service. To determine our current status, a description of the broad aspects of our milk sanitation program should be outlined. The Public Health Service is concerned with fluid milk, fluid milk products, frozen desserts, and dry milk products intended for use in the reconstitution of or manufacture of pasteurized milk products. Although not germane to Grade A milk, we are currently establishing standards for raw milk for manufacturing processes, as well as standards for dry milk products distributed in consumer size packages. Our current objectives are to promote the establishment of effective and well-balanced programs in each State; to encourage the adoption and uniform application of our 1965 *Pasteurized Milk Ordinance* by States and municipalities; and to provide technical assistance to State and local agencies and to industry on problems that have public health significance.

To implement these objectives, the Service engages in a number of coordinated and related activities that can be grouped broadly into six major categories: *(a)* develop recommended sanitation standards, technical procedures, and other guides; *(b)* conduct research and investigations; *(c)* provide technical and advisory assistance to States, municipalities, and industry; *(d)* provide education and training; *(e)* develop sanitary criteria for the design and construction of dairy equipment; and *(f)* administer the Interstate Milk Shippers program responsibilities.

With the exception of the direct statutory responsibility for control of the sanitary quality of milk served on interstate conveyances, the role of the Public Health Service in the area of Grade A milk is based upon a voluntary relationship with the States, municipalities, and the industry. Such relationship is established through the personnel and facilities in our headquarters office and the program representatives in our nine regional offices.

BEST KNOWN OBJECTIVES

Probably two of the best known objectives mentioned are developing the recommended sanitation standards and administering the Cooperative State-Public Health Service Program for the Certification of Interstate Milk Shippers.

The current standard for Grade A milk and milk products is the *Grade A Pasteurized Milk Ordinance —1965 Recommendations of the United States Public Health Service.* This ordinance represents the 13th revision since our first publication in 1924 and replaces our publication of 1953. It has been adopted in its entirety or in its substantial equivalency by 22 States, 90 counties, and 103 municipalities. The rapid progress made by dairy technology challenges us to maintain a constant vigil on new processing techniques and instrumentation so that our interpretations will best reflect current trends and still protect the public's health. In developing the 1965 *Pasteurized Milk Ordinance,* we solicited more groups and individuals for comments than for any of the previous revisions; over 3,000 comments and suggestions were received. The document, therefore, is not a product of the Public Health Service alone. We are most pleased with the response given by the States, counties, and municipalities adopting the Ordinance and the confidence expressed by the National Conference on Interstate Milk Shipments accepting the document as the common standard for milk sanitation.

The Cooperative State-Public Health Service Program for the Certification of Interstate Milk Shippers has maintained its strong identity since the first National Conference on Interstate Milk Shipments held in 1950 in St. Louis, Missouri. Subsequent National Conferences have been held biennially to provide a forum for the discussion and resolution of problems relating to milk sanitation and its interstate shipment. The Conference has adapted itself nicely to the trends developed from several sources, and it is our pleasure to administer the Interstate Milk Shipper Program. Our statistics, as of July 1, 1968, show that there are 157 Milk Sanitation Survey Officers representing the 49 States participating in the establishment of milk sanitation ratings; further, there are 1,487 milk shippers listed in the July 1, 1968, publication *Sanitation Compliance and Enforcement Ratings of Interstate Milk Shippers.*

[1]Presented at the 55th Annual Meeting of the International Association of Milk, Food, and Environmental Sanitarians, Inc., St. Louis, Missouri, August 18-22, 1968.

FUTURE STATUS

In discussing the future status of the Grade A Milk Program, one must understand that the Public Health Service has undergone and is still undergoing a reorganization of major proportions. We are, therefore, unable at this time to satisfactorily answer many questions that occur to you. We know, however, that Mr. C. C. Johnson, Jr., Administrator of the Consumer Protection and Environmental Health Service, and Dr. Herbert L. Lay, Commissioner of the Food and Drug Administration, are eminently qualified for their positions by experience and training and are dedicated to strengthening and further developing programs under their administration. As an example, they have commented recently on our participation with the 3-A Sanitary Standards Committees, and both of them have assured continued support of this important voluntary, industry, regulatory program. We, therefore, have no reason to think our basic activities and responsibilities with respect to States and the Interstate Milk Shippers program will necessarily change. Rather, our future overall milk sanitation program should make it possible for us to render even more service.

ORGANIZATIONAL CHANGES

Some basic changes that have occurred in the reorganization can be related to you. The Public Health Service has been divided into three major groups: National Institutes of Health, Health Service and Mental Health Administration, and Consumer Protection and Environmental Health Service. The structure of the Consumer Protection and Environmental Health Service will be of most vital interest to you. This Service is broken down into three groups; Consumer Protection Administration, Environmental Control Administration, and Air Pollution Control Administration. The responsibility of the Consumer Protection Administration has been expanded by the transfer of related programs from other units of the Public Health Service. Programs transferred include: pesticides, product safety, milk and food protection, interstate carrier sanitation, shellfish certification, and poison control. Task forces are busily engaged at this time in determining the best possible way to effectively merge these functions so as to most effectively fulfill vital objectives well known to all of us.

RECIPROCITY LACKING

We strongly feel that although concern is paramount for the continuation of the existing program within the guidelines and applications as we all know them, we should turn over the coin, so to speak, and examine what concern should be generated by the other half of the partnership. How much attention has been paid to Mr. Richard Vaughn's statements made at the last National Conference of Interstate Milk Shippers? I quote from part of his paper, "The lack of reciprocity on the part of some areas still constitutes a problem in respect to the free movement of milk and milk products of high sanitary quality between States and municipalities. We feel the duplication of inspection or the use of milk sanitation regulations as trade barriers embarrasses the Conference in general, and the milk control agencies in particular. The Service can only encourage the complete acceptance of the philosophy of reciprocity as promoted by the NCIMS. We urge those areas having provisions in their State or local laws requiring the inspection of milk shipped in from points beyond the limits of their routine jurisdictions, or having unwarranted requirements that place undue economic burden on the industry, to make all effort possible to cause the elimination of such provisions in their laws. Sixteen years of experience has indicated that the principles of the NCIMS can and do work for the benefit of the consumer, the milk control agency and the industry" *(2)*.

UNIFORM LABELING

Further, let me point out that after many years uniform labeling of milk and milk products still follows the same worn path as does the lack of inspection reciprocity. How seriously do we take the problem of placing the dairy industry in the position of preparing several different labels for a product that remains qualitatively the same?

REGULATORY—INDUSTRY RELATIONSHIPS

If at this point you feel I have turned over the coin from the Public Health Service to you, I have done so because authorities vested with the responsibilities of charting our future course will certainly look at the wake we have created behind us.

We are looking forward to our work under the reorganization with renewed vigor, and we are extremely optimistic about the future of our fine working relationship with both regulatory and industry representatives. There are some definite plans for the future that, if implemented, will make stronger the bond that unites us in our common objective. Let me give you just one example of our thinking as we anticipate growth of the Cooperative State-Public Health Service program for the certification of interstate milk shippers and it becomes imperative that we redouble our efforts to maintain the high level thus far achieved. In the past, the Public Health Service has held annual regional seminars for the State Milk Sanitation Rating Officers to promote

uniformity in the interpretation and enforcement of Public Health Service recommended ordinance and in the methods of surveying milk supplies. Now we feel that it would be advantageous if a National Seminar for State Milk Sanitation Rating Officers could be arranged and sponsored by the Public Health Service.

I know that I am unable to answer all the questions concerning our implementation of the Grade A Milk Program within the framework of the reorganization presently underway. At this point, the specific organizational structure and name is not important, but what is important is that our mission and purpose will continue because it is a vital component of public health protection. Be assured that we will be working together toward controlling the hazards to human health and making our environment a better place in which to live.

REFERENCES

1. Faulkner, J. D. 1959. The role played by the Public Health Service in milk sanitation. 1959 Milk Sanitation Report.

2. Vaughn, R. D., and R. A. Belknap. 1967. The report of the U. S. Public Health Service to the National Conference on Interstate Milk Shipments. J. Milk Food Technol. 30:145-149.

REPORT OF THE JOURNAL MANAGEMENT COMMITTEE, 1967-1968

1. Consideration was given to the problem of a replacement for William Dixon, deceased, and to ways and means of strengthening the Journal since consolidation of NAS and IAMFES is no longer imminent. It was recommended by Thomasson and Marth that an attempt be made to expand the activities of the editor and managing editor to replace the work of the associate editor, Dixon. It was recommended that Thomasson assume responsibility for news, events and Association affairs, and that Marth be responsible for all papers including research, technical, general interest, "grass roots," and similar papers. The Committee recommends that this arrangement be tried for at least one year.

2. The Committee recognizes the need to increase the effectiveness of the Journal in every way possible. It strongly recommends that the Executive Board establish a separate operating budget for the Journal so that Journal operating costs may be more properly identified from Association operating costs. The publishing of the Journal is a service activity of the Administrative affairs of the Association. This activity properly should be budgeted with funds by the Executive Board; the *actual* publishing costs of the Journal can then be more clearly identified and accounted. In this procedure, all monies received would be regarded as income of the Association. This is the regular practice in accounting procedures in publishing of Journals by other professional associations. In this procedure *all* office costs are properly chargeable to total Administration costs. Journal costs would include printing, editor salaries, journal mailing.

3. Professional and scientific journals are finding it necessary to make a page charge to cover the increasing costs of publication. The realistic page charges are generally equivalent to actual average page costs of publishing the journal (total journal costs divided by total pages published). A quick estimate on the basis of available figures from the current Association financial report indicates a page cost of some $40.00. The *Journal of Dairy Science* and *Journal of Food Science* and *Food Technology* currently have a page charge of $20.00 and $30.00, respectively. It is for the above reasons that the Association should endeavor to obtain more accurate actual journal printing costs.

4. The Journal Management Committee strongly recommends the prompt establishing of a page charge for all scientific and technical articles submitted for publication in the Journal. The Journal now has on hand 15 papers edited and ready for immediate publication (3 months backlog), 19 papers in various stages of editing (3 months backlog), and 28 papers potential from the 1968 annual meeting (5 months backlog) plus additional papers to be submitted during the year. It is essential to keep the interval between date of receipt of a manuscript for publication and its publication date to 3 months in order to continually attract high quality manuscripts. Because of the increasing output of research information from laboratories, there is an increasing output of manuscripts for publication. The Association should be prepared to increase the scope of its service to its service to its members by increasing the number of pages and the number of articles published. The publishing of technical and scientific papers in the Journal can be more nearly self supporting. Generally, funds are available in research laboratories from research funds for the publishing of research information. Some economies probably can be introduced by reduction of type size, use of 3 columns, etc.; there is a possibility of printing news and Association affairs and information as a separate quarterly using less expensive paper. These are matters requiring study.

5. The Journal Management Committee recommends that further consideration be given to improved sectionalization of material in the Journal to enable making it adaptable to current library practices. Because of the deluge of printed material, libraries must discard superfluous material (retaining only technical papers and association affairs) before binding.

6. The Journal Management Committee proposes that each affiliate of the Association be offered a full page annually in the Journal by which they may report on the accomplishments, activities, news, events, programs, etc. This space can be made available in the Journal in lieu of other "fill in" news. It can be a means of increasing affiliate activity in the affairs of the Association, providing it with identity and service. The efforts in the past to increase this relationship between Association and its affiliates has not been wholly successful. Some affiliates publish a "news letter" which could well be arranged for publication in the Journal. The proposal should be tried.

7. The Journal Management Committee commends the editors of the Journal for the improvement and updating of the Journal and its publication.

DR. J. C. OLSON, JR. DR. K. G. WECKEL
DR. E. H. MARTH DR. F. W. BARBER, Chairman
DR. C. K. JOHNS

A MICROBIOLOGICAL EXAMINATION OF MUSCLE TISSUE OF BEEF, PORK, AND LAMB CARCASSES[1]

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ABSTRACT

A microbial examination was made of muscle tissue of beef, pork, and lamb carcasses. Samples were taken shortly after death and after 3 days of storage at 1 C. A majority of the samples did not yield isolates on blood agar plates. The following microbial types were isolated: *Staphylococcus, Micrococcus, Sarcina, Streptococcus,* coryneforms, *Bacillus, Clostridium, Flavobacterium, Pseudomonas, Moraxella, Alcaligenes, Acinetobacter anitratum* (*Herellea*), and yeasts and molds. Staphylococci were predominant among the isolates obtained from the three species. A large percentage of the staphylococci were coagulase-positive. Coryneforms also predominated in the lamb and beef samples. Warm muscle samples yielded a greater number of bacterial isolates than chilled samples. No psychrophilic bacteria were recovered from the samples.

Information on the growth characteristics and activities of microorganisms in foods is frequently obtained by growing isolates either singly or mixed in sterilized foods or in sterile synthetic media. The environmental conditions in these media differ greatly from those in the natural food. Hence, observations made with these media should be interpreted cautiously. To evaluate microbial activities in meat, sterile non-denatured muscle tissue would be a desirable medium. Although the literature shows some conflicting reports, it is generally accepted that muscle tissue of healthy living animals contains few or no microorganisms. The principal invasion of microorganisms occurs during the various processes related to handling, slaughtering, and dressing of animals *(2, 13)*.

Methods for obtaining sterile muscle tissue are described by Ockerman et al. *(25, 26)*. In one procedure, gnotobiotic tissue is used. In another, a plastic surgical isolator is employed to remove tissue *(longissimus dorsi)* from animals slaughtered under special conditions to avoid bacterial contamination. Both procedures require extensive equipment and facilities. Borton et al. *(9)* described a comparatively simple procedure for obtaining pork muscle samples relatively free of bacteria. The animals were slaughtered in a conventional manner except that special sanitary procedures were applied. The bacterial count of samples of the *longissimus dorsi* muscle was about 30 per gram.

[1]Technical paper No. 7803 of the Texas Agricultural Experiment Station, College Station.

Although a great deal of work has been done on the microbial flora of the surface of carcasses, cuts, and processed meats, few recent studies are available on the microbial flora of tissue at the time of slaughter and during refrigerated storage. Adamson *(1)* reported that a large portion of 804 lymph nodes from human corpses contained a variety of bacteria, with coliforms, micrococci, and streptococci predominating. Lepovetsky et al. *(23)* isolated bacteria from 15 of 23 lymph nodes, from 3 of 23 marrow samples, and from 2 of 23 samples of beef muscle. *Pseudomonas* and *Streptococcus* species were isolated from the muscle samples. Viable counts on the lymph nodes ranged from 70 to 764,000 per gram. The bacteria present in the lymph nodes belonged to the following genera: *Aerobacter, Alcaligenes, Bacteroides, Clostridium, Pseudomonas, Corynebacterium, Escherichia, Flavobacterium, Micrococcus, Proteus, Serratia,* and *Streptococcus*. One-third of the isolates were *Streptococcus* species.

This paper presents information on the number and types of microorganisms of muscle samples of beef, pork, and lamb carcasses slaughtered in a conventional manner.

MATERIALS AND METHODS

Samples and procedures. Twelve market-type hogs, 11 ewes, 5 bulls, and 6 slaughter-steers were used. All animals appeared healthy and passed State of Texas inspection. Except for 4 bulls, all animals were procured by the Department of Animal Science at Texas A&M University. The other animals were procured by and slaughtered at a local locker plant. Samples taken from one side of the carcass were used within 2 hr after death. The other side of the carcass was sampled after three days in a chill room at 1 C. Pork samples were taken in the following manner. After the carcass had been dehaired and washed, the ham to be sampled was thoroughly washed with 95% alcohol. The outside portion of the ham was removed with a 10-inch sterile stainless steel knife. This portion included the *biceps femoris*. The sample including skin and adipose layers was wrapped in a chlorine-soaked (500 μg/ml) towel and placed in a sterile container for transportation to the laboratory. The sample then was placed under a hood which had been sterilized by ultraviolet light. The *biceps femoris* was made available and a sample (1.75 X 15 cm) was taken from the interior of the muscle with a sterile stainless steel bore (31 X 2 cm). The point of entry was seared before the core sample was taken. The point of exit was treated similarly. Approximately one-half inch of each end was discarded. A 10 g sample was mixed with 20 ml sterile, de-ionized, distilled

water and blended for 3 min in a Waring blendor. One tenth milliliter portions of this homogenate were plated on blood agar plates (BAP) by the spread-plate method. Sets of plates were incubated at 4, 25, and 37 C, both aerobically and anaerobically. Additional 0.1-ml and 1-ml portions were placed in 10 ml of brain heart infusion broth (BHI, Difco) for enrichment purposes. Enrichment tubes were incubated at 4 C for 7 days and at 37 C for 3 days under aerobic and anaerobic conditions. After incubation, a loopful from each tube was streaked on BAP. Depending on growth requirements, isolated colonies were then placed on BHI agar slants or blood agar slants for further diagnostic tests.

Some modifications had to be made in the sampling of lamb carcasses. The animal was skinned before the large sample was taken. Because of the smaller muscle, only 5 g could be taken and this was from the *vastus lateralis* which is a little larger and easier to obtain than the *biceps femoris*. This sample was handled in the same manner as the 10-g sample from the pork carcass. To compensate for the difference in dilutions, the amount of lamb homogenate on plates and in enrichment tubes was doubled. The isolated colonies were handled in the same manner as mentioned previously. Beef samples were handled the same as those from sheep except a 10-g sample was taken from the *biceps femoris*.

Primary isolation medium. Blood agar plates and slants were prepared by adding 10% citrated sheep blood to trypticase soy agar (BBL).

Anaerobiosis. Plates and tubes were incubated in anaerobic jars with GasPak lids (BBL). The GasPak envelope was employed to generate hydrogen and carbon dioxide gases.

Microbial identification. After recording colony counts and colony characteristics *(31)*, gram-positive isolates were identified to the genus level by the scheme presented in Fig. 1. Gram-negative bacteria were screened by the schemes presented in Fig. 2 and 3. These schemes contain modifications and combinations of identification protocols presented by various investigators. Literature references are presented in appropriate places in Fig. 1, 2, and 3 to identify these reports. Identification was further aided by reference to *Bergey's Manual of Determinative Bacteriology (8)*. Microscopic morphology was observed in Gram stains (Hucker's modification). The stains of gram-positive bacteria such as *Corynebacterium* and *Micrococcus* were often readily decolorized presenting difficulties in establishing their Gram reaction. These organisms were streaked on MacConkey agar (Difco) to aid in this determination. Inocula from 24 to 48-hr cultures were also used to study additional characteristics. These included: NH_3 from arginine under anaerobic conditions *(35)*; motility by the hanging drop method *(31)* and in motility test medium (BBL); catalase (3% H_2O_2 on growth from BHI agar); coagulase production (Difco); cytochrome oxidase (1% aq. tetramethyl-p-phenylenediamine on filter paper with growth of BHI agar slants); production of spores (80 C for 10 min); carbohydrate utilization by the Hugh-Leifson procedure *(20)*; flagella staining (Difco); and sensitivity to pteridine compound $0/_{129}$ *(29)*.

RESULTS AND DISCUSSION

No isolates were obtained from any of the samples when plates or enrichment broth were incubated at 4 C. Data in Tables 1 and 2 show that staphylococci were predominant among the isolates. Coryneforms also made up a large percentage of the isolates from lamb and beef samples. Lepovetsky et al. *(23)* did not isolate these bacterial types from beef muscle. Their samples yielded only species of *Streptococcus* and *Pseudomonas*. More isolates were obtained from the samples taken immediately following slaughter. This is probably because some of the mesophilic bacteria did not survive refrigerated storage. The majority of the samples, with the exception of 2 beef samples, contained none or only a few bacteria. Maximum viable counts on BAP for ham, lamb, and beef samples were 700, 140, and 1,400 per g. Of the 65 samples (3 were accidentally used by others), warm and chilled combined, 46 did not yield isolates on BAP at 25 C and 44 did not yield isolates at 37 C.

The species isolated with the enrichment technique from lamb and beef samples belonged to the same genera as those recovered from BAP. In addition to the genera listed in Tables 1 and 2, ham samples yielded species of *Flavobacterium*, *Streptococcus*, and *Clostridium*.

The predominant isolate in this study belonged to the genus *Staphylococcus*. Staphylococci were encountered in 5 of the 12 ham samples, in 4 of the 11 lamb, and in 3 of the 11 beef samples. The fact that this organism is ubiquitous in nature raises the possibility of contamination either during sampling or handling. There are several observations which contradict this supposition. Although the same

TABLE 1. MICROBIAL FLORA ISOLATED FROM 12 HAM, 11 LAMB, AND 11 BEEF TISSUE SAMPLES IMMEDIATELY AFTER SLAUGHTER

Genus	Number of isolates from blood agar plates incubated aerobically and anaerobically at 25 and 37 C		
	Ham	Lamb	Beef
Staphylococcus[a]	72 (87.8)[b]	13 (40.6)	111 (55.5)
Micrococcus	1 (1.2)	2 (6.3)	1 (0.5)
Coryneforms	5 (6.1)	9 (28.1)	87 (43.5)
Bacillus	1 (1.2)	–	1 (0.5)
Flavobacterium	–	2 (6.3)	1 (0.5)
Moraxella	–	1 (3.1)	–
Alcaligenes	1 (1.2)	–	–
A. anitratum (Herellea)	1 (1.2)	–	–
Miscellaneous			
Yeast and mold	1 (1.2)	4 (12.5)	–
Unidentified	–	1 (3.1)	–
Total	82	32	201

[a]The percent coagulase-positive isolates from ham, lamb and beef samples was 59.7, 92.3 and 45.9%, respectively.
[b]Percentage of isolates.

TABLE 2. MICROBIAL FLORA ISOLATED FROM 12 HAM, 11 LAMB, AND 11 BEEF TISSUE SAMPLES AFTER STORAGE AT 1 C

Genus	Number of isolates from blood agar plates incubated aerobically and anaerobically at 25 and 37 C		
	Ham	Lamb	Beef
Staphylococcus[a]	14 (77.8)[b]	1 (25)	65 (52.7)
Micrococcus	1 (5.6)	–	17 (13.8)
Sarcina	1 (5.6)	–	–
Coryneforms	–	1 (25)	40 (32.4)
Bacillus	1 (5.6)	1 (25)	–
Pseudomonas	1 (5.6)	–	–
Unidentified	–	1 (25)	1 (0.8)
Total	18	4	123

[a]The percent coagulase-positive isolates from ham, lamb, and beef samples was 100, 100, and 87.7%, respectively.
[b]Percentage of isolates.

methods and techniques were used throughout the study, no isolates were obtained from a majority of the samples. In addition, adequate controls were included to check media, diluents, and equipment for sterility. If contamination from the exterior parts of the tissue would have played a role, then larger numbers of common contaminants such as *Pseudomonas* should have been encountered *(34)*.

The source of the coagulase-positive staphylococci in the experimental samples is uncertain. Jay *(21)* isolated coagulase-positive staphylococci from various market meats. Counts on egg yolk agar ranged from 0 to 15,000 per gram. These samples, however, were taken primarily from the surface of meats. The staphylococci then could have come from persons handling the meat. This route can be excluded with the present samples. However, micrococci have been isolated from the deep muscle tissue of beef *(23)*. In the experimental samples, they probably came from the lymph nodes and invaded the tissue. In properly handled meats (properly chilled during storage and heated adequately in food preparation) the present levels of staphylococci would be of little public health significance. On the other hand, contamination of utensils and equipment with staphylococci in the food preparation area could cause certain health hazards.

The data indicate that bacteria may or may not be absent from deep muscle tissue of healthy animals. The most significant finding, however, was that psychrophilic bacteria were not isolated from the tissue samples with the present technique. Tissue obtained with this technique then can be inoculated with single and mixed cultures to study changes caused by microorganisms in meats during refrigerated storage.

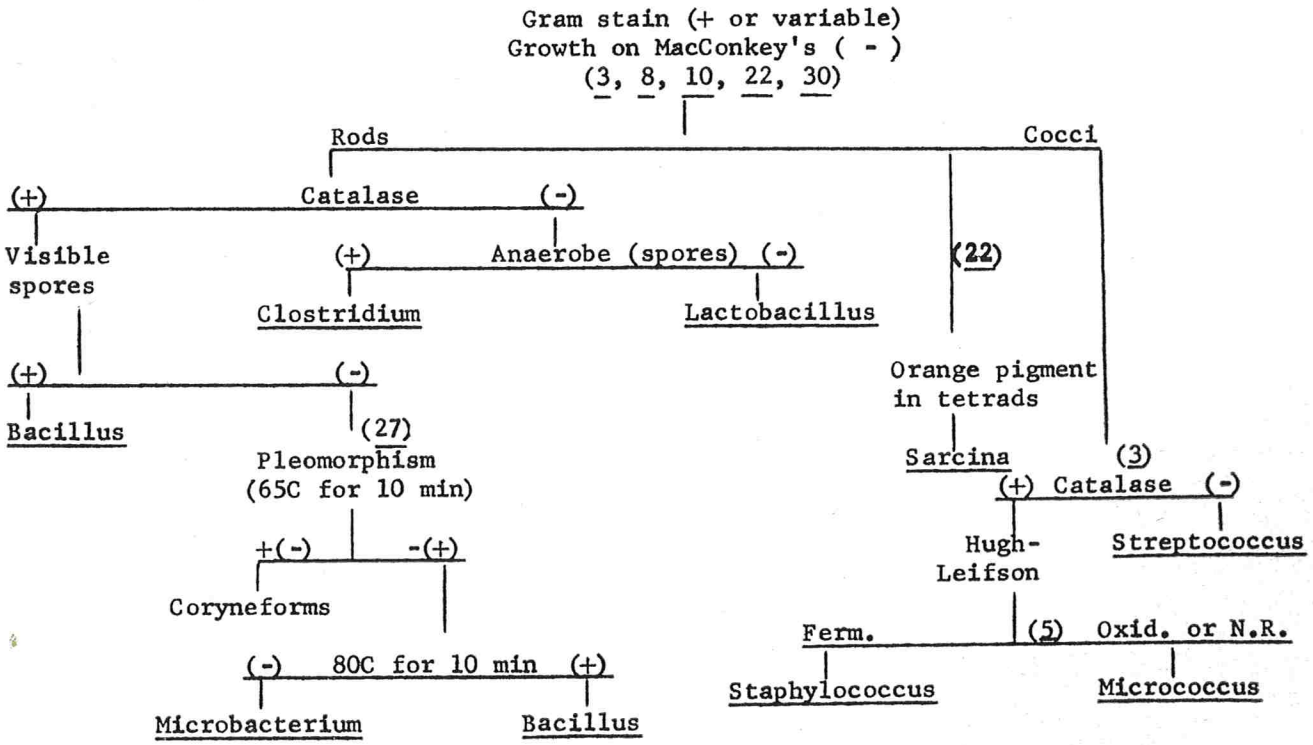

Figure 1. Scheme for identification of gram-positive bacteria. Numbers in parentheses designate references.

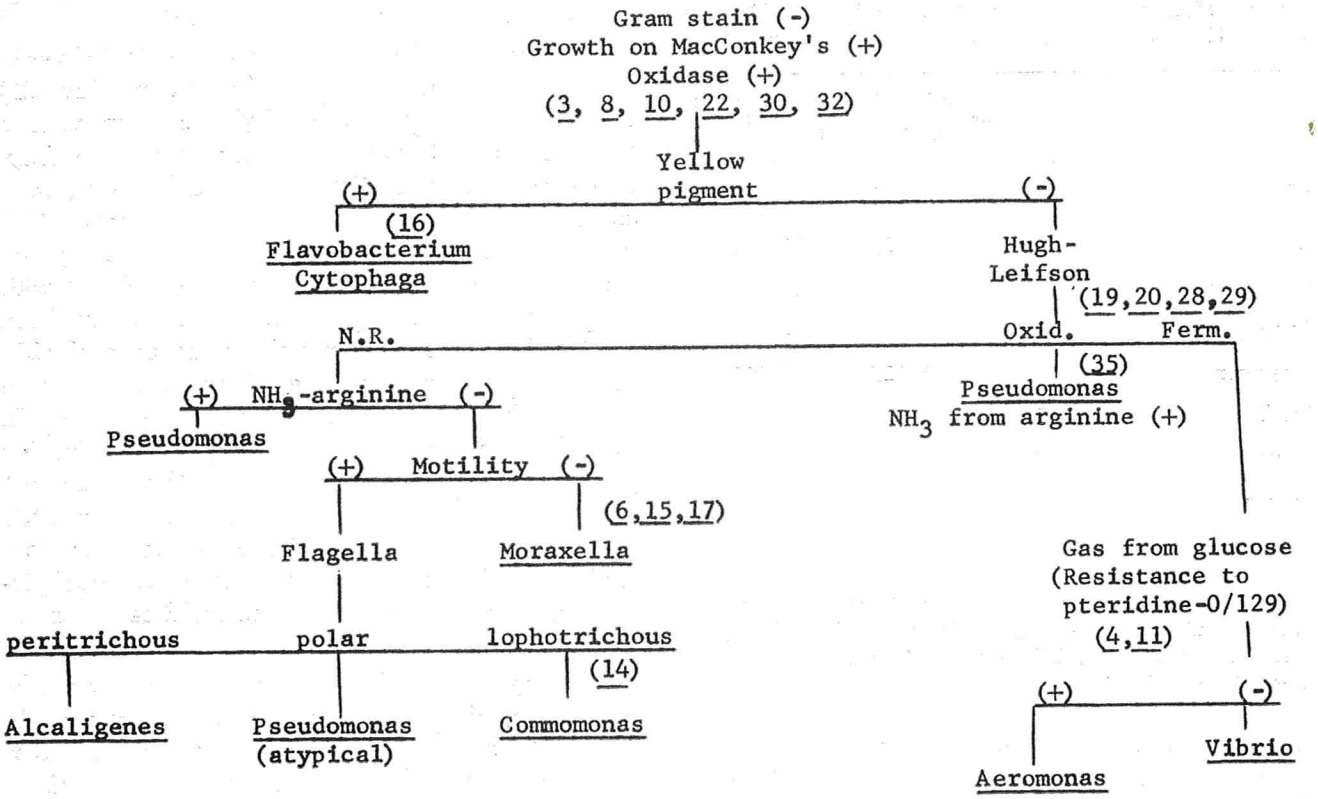

Figure 2. Scheme for identification of gram-negative oxidase-positive bacteria. Numbers in parentheses designate references.

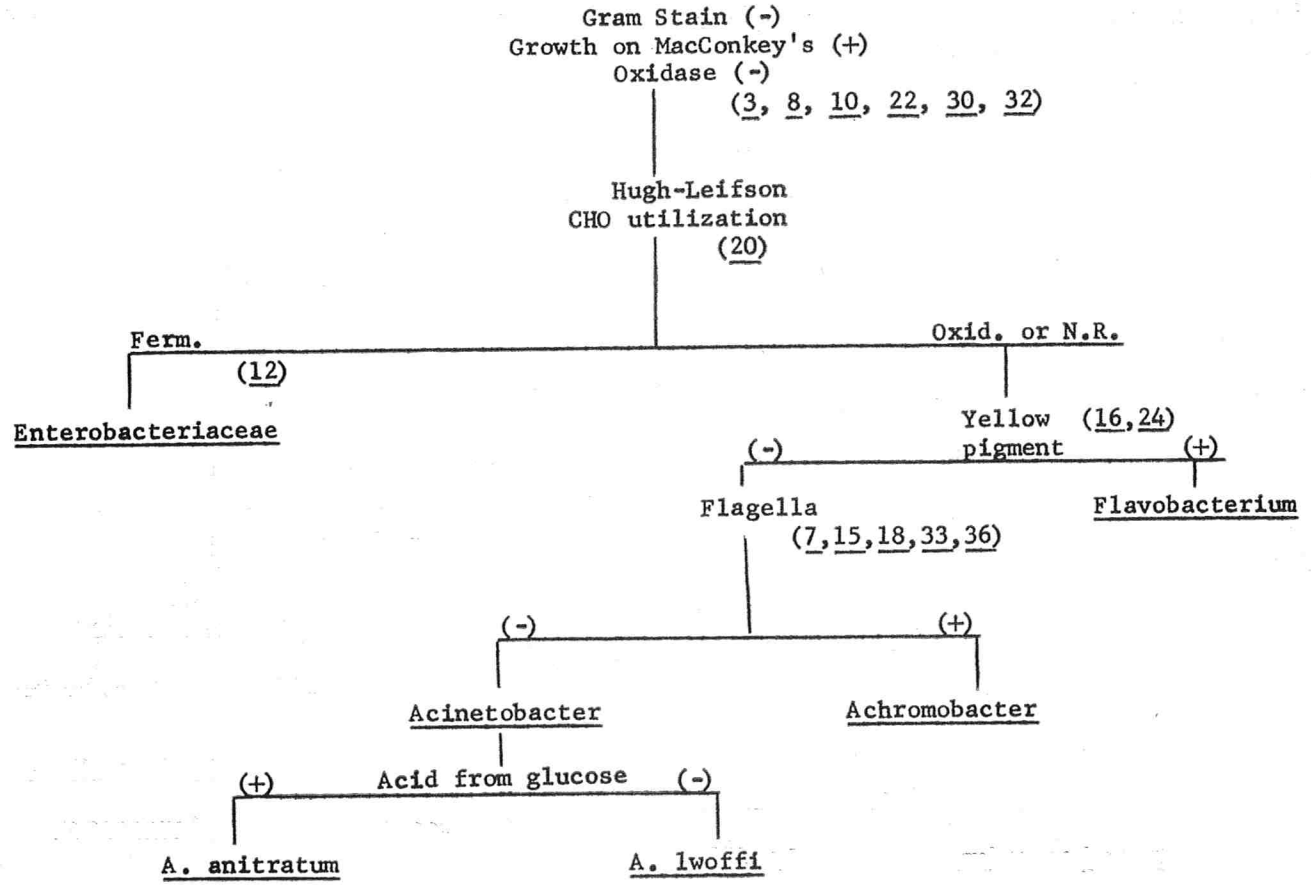

Figure 3. Scheme for identification of gram-negative oxidase-negative bacteria. Numbers in parentheses designate references.

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SHELF LIFE AND CULINARY PROPERTIES OF THAWED FROZEN PASTEURIZED WHOLE EGG

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Abstract

Commercially pasteurized whole egg had a shelf life (total viable count slightly in excess of 10^6 bacteria per gram) of approximately 15, 9, 2, and 1 days at 2, 7, 13, and 23 C, respectively. The thawed frozen pasteurized product has a maximum shelf life of 9 days at 2 C and 3 days at 13 C. The thawing temperature of the frozen product did not influence its shelf life to any great extent. Culinary properties of the fresh, pasteurized and thawed frozen pasteurized egg were very similar.

Whole liquid egg is used extensively in the food industry and usage has increased tremendously in recent years. A large percentage of processed eggs are sold in the frozen form—in 1960 the percentage was 60.8. Usage of frozen liquid egg will probably increase with the application of liquid egg at the consumer and institutional levels for preparation of scrambled eggs and omelets. A sizeable percentage of whole liquid eggs is being pasteurized and, from a public health standpoint, one can consider the pasteurized liquid egg as safe. However, the frozen pasteurized product on thawing, could be easily mishandled so that bacteria would multiply. This study was undertaken to determine: *(a)* the shelf life of thawed frozen egg and *(b)* the baking quality of such a product as reflected in cake volume and cake firmness.

Materials and Methods

Liquid egg magma. Liquid egg used in this study was produced under commercial conditions. Egg breaking was done mechanically and pasteurization was accomplished commercially by the triple tube method with a temperature of 61.1 C for 3 min. Pasteurized egg was packed in one-half gallon plastic coated cartons (9.5 x 19.5 cm) similar to milk cartons and was frozen at −35 C. Unfrozen pasteurized egg was produced under identical conditions. The unfrozen and frozen samples were brought to the laboratory and stored at 0 C and −15 C, respectively. All experiments were repeated and data are the average of two trials.

Thawing of frozen samples. Frozen samples were thawed at four different temperatures to obtain comparative data on the time required to thaw under different conditions. Cartons of frozen egg were stored at each of the following temperatures: 2, 7, 13, and 23 C. The average thawing time was determined by inserting thermocouples into the cartons and recording the temperature changes of the egg on a recording potentiometer. Samples were considered thawed when the temperature reached 0 C.

Shelf life studies. The thawed product was transferred to sterile 6 oz jars and incubated at 2, 4.5, 7, and 13 C. Shelf life studies at these temperatures were carried out for different incubation periods. Appropriate dilutions of the liquid egg were plated on standard plate count agar using *Standard Methods (1).* Plates were incubated at 32 C for 48 hr to determine the total number of viable bacteria. Sampling was continued until a population of 10^6 organisms per gram was achieved and the sample was arbitrarily considered spoiled.

In another experiment, the shelf life of an unfrozen pasteurized product was determined at 2, 7, 13, and 23 C.

Sponge cake determinations. The baking quality of fresh pasteurized unfrozen and thawed frozen pasteurized liquid egg was determined by measuring cake volume. Cakes prepared with pasteurized unfrozen and fresh eggs were also compared using Kramer Shear Press readings.

Results and Discussion

Table 1 gives the times required by the egg in cartons to thaw at temperatures indicated. The thawing time was the time required to reach a temperature of 0 C in the center of the carton. These values were an average of four determinations. The thawing temperature ranged from 40.4 hr at 2 C to 10.5 hr at 23 C. The thawing times at 7 and 13 C were similar.

Table 1. Time required to thaw the pasteurized frozen egg magma at various temperatures

Thaw temperature (C)	Thawing time (hr)
2.0	40.4
7.0	17.5
13.0	17.2
23.0	10.5

Bacteriological data on unfrozen pasteurized liquid egg are shown in Table 2. The spoilage time (time to reach a population of 10^6 viable organisms per gram) varied from 1 day at 23 C to 15 days at 2 C. Data in Tables 3, 4, 5, and 6 were obtained when frozen pasteurized eggs were thawed at 2.0, 4.5, 7.0, and 13.0 C and incubated at varying lengths of time at different temperatures. It appeared that the temperature of thawing had no great influence on the bacteriological quality of the final product but the incubation temperature influenced the numbers of

TABLE 2. BACTERIOLOGICAL COUNTS OF PASTEURIZED UNFROZEN WHOLE EGGS WHEN INCUBATED AT TEMPERATURES INDICATED

Days of incubation	Incubation temperatures (C) 2.0	7.0	13.0	23.0
	Number of bacteria per gram			
0	7,200	7,200	7,200	7,200
1	——[a]	——	——	5,000,000
2	4,500	95,000	4,700,000	——
7	3,700	——	——	——
9	——	3,170,000	——	——
11	15,000	——	——	——
13	84,000	——	——	——
15	2,300,000	——	——	——

[a]——No determinations.

TABLE 3. BACTERIOLOGICAL QUALITY OF PASTEURIZED FROZEN EGG MAGMA THAWED AT 2.0 C AND INCUBATED AT THE TEMPERATURE INDICATED

Days of incubation	Incubation temperature (C) 2.0	4.5	7.0	13.0
	Number of bacteria per gram			
1	4,100	2,800	3,100	3,600
3	3,300	3,400	3,800	30,000
5	2,500	3,400	143,000	2,900,000
7	10,000	36,000	644,000,000	——
9	174,000	1,950,000	——	——
10	1,200,000	——	——	——
13	——[a]	——	——	——

[a]——No determinations.

TABLE 4. BACTERIOLOGICAL QUALITY OF PASTEURIZED FROZEN EGG MAGMA THAWED AT 7.0 C AND INCUBATED AT THE TEMPERATURES INDICATED

Days of incubation	Incubation temperatures (C) 2.0	4.5	7.0	13.0
	Number of bacteria per gram			
0	3,100	4,000	3,620	3,700
1	2,950	3,100	3,000	3,210
3	3,950	6,100	1,850,000	>3,000,000
5	8,100	8,900	——	——
7	2,100,000	>3,000,000	——	——
9	>3,000,000	——[a]	——	——

[a]——No determinations.

bacteria present. The spoilage time for thawed frozen pasteurized egg at 2 C was lower (7-9 days as compared to 15 days) than for unfrozen pasteurized liquid eggs. At first this appeared very surprising since freezing is detrimental to bacteria and thus these samples should spoil slower than the unfrozen product. It appears, however, that "repair" of the injured cells takes place during the cooling and freezing period. Experiments were conducted in this laboratory by Steele *(4)* and indeed, it was found to be true. A similar phenomenon has been observed by Allen *(1)*, and Jackson and Woodbine *(3)* in other products. The low spoilage time of thawed frozen whole eggs could also result from breaking up of bacterial clumps. Data in Tables 2, 3, 4, 5, and 6 indicate that an initial decrease in the population took place before the number of viable cells increased on incubation. This was observed more often at lower temperatures of incubation and may result from metabolic adjustment of the heat treated organisms. Some of the initially viable cells were unable to multiply to produce colonies.

The baking quality of fresh and pasteurized egg

TABLE 5. BACTERIOLOGICAL QUALITY OF THE PASTEURIZED FROZEN EGG MAGMA THAWED AT 13 C AND INCUBATED AT TEMPERATURES INDICATED

Days of incubation	Incubation temperature (C) 2.0	4.5	7.0	13.0
	Number of bacteria per gram			
0	3,700	4,050	3,500	3,700
1	4,125	3,950	9,600	32,750
3	4,050	3,825	>3,000,000	>3,000,000
5	7,950	3,700	——	——
7	>3,000,000	8,925	——	——
9	——[a]	>3,000,000	——	——

[a]——No determinations.

TABLE 6. BACTERIOLOGICAL COUNT OF THE PASTEURIZED FROZEN EGG MAGMA THAWED AT ROOM TEMPERATURE (23 C) AND INCUBATED AS INDICATED

Days of incubation	Incubation temperature (C) 2.0	4.5	7.0	13.0
	Number of bacteria per gram			
0	3,000	2,950	3,375	3,100
1	2,450	2,700	1,150	2,875
3	6,900	9,800	>3,000,000	>3,000,000
5	10,200	18,600	——	——
7	22,400	>3,000,000	——	——
9	>3,000,000	——[a]	——	——

[a]——No determinations.

TABLE 7. KRAMER SHEAR READINGS ON SAMPLES OF CAKES BAKED WITH FRESH AND PASTEURIZED WHOLE EGGS

Type of liquid egg	Shear press readings (average) (lb)
Pasteurized	4.867
Fresh	5.206

TABLE 8. THE BAKING QUALITY OF FRESH PASTEURIZED AND PASTEURIZED FROZEN THAWED EGGS

Thawing temperature (C)	Type of liquid egg	Volume of cake in ml.
	Fresh	693
	Pasteurized	673
	Fresh	655
2.0	Thawed frozen pasteurized	622.5
	Fresh	714.5
7.0	Thawed frozen pasteurized	567.0
	Fresh	585.75
13.0	Thawed frozen pasteurized	528.75
	Fresh	685.75
23.0	Thawed frozen pasteurized	635.75
	Fresh	697.67
55.0	Thawed frozen pasteurized	609.0

as compared by Kramer Shear Press readings is shown in Table 7. No differences could be observed between cakes prepared from fresh or pasteurized product. Table 8 gives the data on cake volumes. Cakes were prepared from fresh unfrozen pasteurized and thawed frozen pasteurized eggs. Fresh eggs consistently produced cakes with a slightly larger volume—this may be caused by heat denaturation of egg albumen during the pasteurization process.

In conclusion, it appeared that the pasteurized unfrozen whole egg had a better shelf life than a similar frozen product. The lower thawing temperatures gave a better shelf life but the incubation (holding) temperature was found to be more important than the thawing temperature.

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FIRST ISOLATION OF A VIRUS FROM A WHALE

Scientists at the Naval Biological Laboratory, University of California, Berkeley, have reported the first isolation of a virus from a whale.

Last year the Marine Mammal Biological Laboratory, U. S. Bureau of Commercial Fisheries, Seattle, Washington, invited interested scientists to join their whale biologists in studying California Gray Whales which were to be landed in San Francisco Bay at the only shore-based whale factory still operating on the West Coast. Dr. H. M. S. Watkins and Mr. G. R. L. Worthington, virologists at the nearby Naval Biological Laboratory (NBL) accepted this rare opportunity to look for viruses in these giant mammals.

California Gray Whales migrate each year from the Bering Sea to Mexican lagoons, often within sight of coastal beaches, sometimes even entering shallow bays. Costal cities discard their wastes into the sea, often untreated. Public health officials and marine biologists are interested in determining to what extent marine life becomes contaminated or infected with human disease germs, since there is good chance that as men spend more and more time on the sea bottom, they will eventually encounter infections that are not found on land.

Eighty-five specimens, including tissues from different organs, were collected from 17 gray whales. Attempts were made to isolate viruses in five kinds of tissue cultures used to isolate human and animal viruses, and also in two cell lines developed at NBL from kidneys of a Pilot Whale and a Bottlenosed Dolphin. Only one virus was grown from a rectal swab inoculated onto the dolphin kidney cells.

The virus would also grow on whale kidney cells, but not on the human, monkey, rabbit and hamster cell lines that were tried. The original whale had a high concentration of antibodies to the virus in its serum. This is believed to mean that this whale had been infected. Fourteen other gray whales had lower antibody concentrations; sera from two gray whales, 5 sperm whales, 8 finback whales, and 46 adult humans (including two whale biologists) had no antibodies for this virus.

The virus has physical and biochemical characteristics similar to a group of human intestinal viruses called Echo viruses, but it does not react with antisera produced from human Echo or other intestinal viruse. Since nonhuman Echo-type viruses have also been found that are native to domestic animals and monkeys, it is believed that this is a new virus to the gray whale.

A COMPARISON OF SCREENING TESTS TO DETECT ABNORMAL MILK[1]

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ABSTRACT

The results of the Feulgen-DNA-color optical density and score, the California mastitis test (CMT) score, viscosity developed in milk samples by addition of equal volume of CMT reagent, the catalase test, the direct microscopic count of leucocytes, and the proportion of live leucocytes were compared using fresh, quarter, and bucket milk samples and 1 to 2 day old bulk milk samples. The Feulgen-DNA-color gave good correlations with all the tests in all types of samples, except with the CMT of bulk samples. The CMT score and viscosity gave good correlations with all the tests on fresh milk samples and insignificant correlation with stored milk samples. The catalase test gave good correlations with all other tests in fresh samples and low but significant correlations with stored samples. Quarter and bucket milk samples contained 71% and 74% live leucocytes and bulk milk samples contained 42% live leucocytes.

Holding of milk at 5 C for 5 days did not significantly change the Feulgen-DNA-color and catalase activity, slightly increased total leucocyte counts, but gradually decreased the CMT score, the viscosity, and the proportion of live leucocytes.

The Feulgen-DNA-color of milk samples containing few millions of leucocytes and the direct microscopic count of total leucocytes gave poor reproducibility.

Direct microscopic counts of leucocytes in stained milk smears are often used to detect milk from mastitic cows. Other less laborious methods of estimating numbers of leucocytes have been used for this purpose *(3, 5)*.

This study was made to compare the California mastitis test *(5)*, the Feulgen-DNA-color reaction test *(3)*, the catalase test *(2)*, and direct microscopic counts of leucocytes with each other. Samples tested were obtained from single cow quarters, buckets (pooled cow quarters), and bulk tanks (herd composite).

MATERIALS AND METHODS

Quarter samples from 14 cows (54 quarters) and bucket samples from 45 cows were obtained from randomly selected cows of the University of Wisconsin dairy herds. Bulk milk samples from 52 farm tanks were obtained with the assistance of the Madison Milk Producers Association. Bulk samples were from milk held 24 to 48 hr after milking and were taken by tank truck drivers. Tests with quarter and bucket samples were started within 2 hr after milking. Bulk samples were tested approximately 30 to 54 hr after milking.

Viscosity determination

Fifty milliliters of milk either cooled or warmed to 25 ± 2 C were mixed with 50 ml of California mastitis test (CMT) reagent[1] in the sample cup of a Fisher electroviscometer with a X-1 bobbin and tempered to 25 C in the water bath of the viscometer. Viscosity was noted 20 sec after starting the viscometer motor. The CMT score was determined according to the method of Schalm and Noorlander *(5)* and numerical values for statistical analysis were assigned as shown in Table 1.

Feulgen-DNA-color reaction

The DNA color was determined by the method of Paape et al. *(3)*, with the folowing modification. Milk samples treated with Schiff's reagent were centrifuged at 200 x g for 5 min and color of the packed sediment was scored with the aid of the color chart of Paape et al. Numerical values for statistical analysis were assigned as shown in Table 1. The optical density of the DNA color was determined by a Bausch & Lomb spectrophotometer with reflectance attachment at 560 mμ. A sample of the same milk without addition of Schiff's reagent, but heated with 1.0 N HCl, was used as the blank.

Catalase determination

Oxygen released by catalase was estimated by an inverted tube method at room temperature as described by Nageswararao et al. *(2)*.

Estimation of leucocytes

Leucocytes in the milk samples were determined by spreading 0.01 ml of milk with a 0.01 ml pipette on a glass slide over an area of 1 cm². The smears were air dried and stained by the Levowitz-Weber modification of the Newman-Lampert stain *(1)*. The leucocytes were counted in 20 successive fields in each of duplicate smears with a 95x oil immersion objective having 4 x 10^5 microscopic factor.

Trypan blue was used to examine the viability of leucocytes. To 1 ml of milk, an equal volume of 0.5% aqueous solution of trypan blue was added and mixed immediately. A small drop of the mixture was transferred to a glass slide, covered with a cover slip, and examined microscopically. The number of stained leucocytes out of 100 leucocytes in each sample was noted between 5 and 10 min after the addition of trypan blue. Dead leucocytes, because of an increase in the permeability of their cell walls, will be stained blue by trypan blue and live leucocytes appear as yellowish-white cells.

Reproducibility of methods

Estimates of the reproducibility of methods were made by replicate measurements on milk containing approximately

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[2]Present address—Endocrine Laboratories, Madison, Wis. 53701.

[1]"Mastest Solution," Norden Laboratories, Lincoln, Neb.

TABLE 1. ORIGINAL CALIFORNIA MASTITIS TEST SCORES AND FEULGEN-DNA-COLOR SCORES COMPARED WITH THE EXPANDED SCORES USED IN THIS STUDY AND NUMERICAL VALUES ASSIGNED FOR STATISTICAL ANALYSES

Original CMT score	Expanded score	Assigned numerical values	Original Feulgen-DNA-Color score	Expanded score	Assigned numerical values
—	—	0	—	—	0
T[a]	T[a]	1		1	1
	1	2	1		
1				1+	2
	1+	3		2	3
	2	4	2		
2				2+	4
	2+	5		3	5
	3	6	3		
3				3+	6
	3+	7		4	7
			4		
				4+	8

[a]Trace

TABLE 2. REPRODUCIBILITY OF SOME SCREENING TESTS TO DETECT ABNORMAL MILK

Method		Mean	Coefficient of variability (%)
Viscosity (Relative units)		21.1	6.3
Feulgen-DNA-color optical density	Low	0.127	13
	High	0.245	5.4
Total leucocyte count $\log_{10}$ transformation		6.626	0.6
No transformation		4.12×10^6	9.8
Live leucocytes (%)		75	5

4 x 10^6 leucocytes/ml. A separate sample of milk was used for each series of replicates. Twenty replicates were used to estimate reproducibility of viscosity, 20 replicates for estimation of live leucocytes, 20 replicates for total leucocyte count, and 25 replicates for optical density measurement of the Feulgen-DNA-color. An additional 25 replicate tests of Feulgen-DNA-color optical density were made with a milk sample containing approximately 9 x 10^6 leucocytes/ml. Standard deviation of the replicate determinations is expressed as coefficient of variability *(6)*.

Effect of age of samples

Bucket milk samples from 8 different cows were tested for viscosity, CMT score, Feulgen-DNA-color optical density and score, live leucocytes and total leucocytes, and catalase activity within 2 hr after milking. The samples were then held at 5 C for 5 days and tested daily at approximately the same time of day by each of the above methods.

RESULTS AND DISCUSSION

Reproducibility of methods

The results are presented in Table 2. Feulgen-DNA-color optical density gave poor reproducibility at low optical density, indicating that this method may not give satisfactory results with milk samples containing less than 4 million leucocytes/ml. Total leucocyte counts also gave poor reproducibility, but log transformation of total leucocyte counts decreased the variability. Viscosity determination and estimation of live leucocytes in milk samples containing 4 x 10^6 leucocytes/ml, and Feulgen-DNA-color optical density in milk sample containing 9 x 10^6 leucocytes/ml gave good reproducibility.

Effect of age of sample

The results are summarized in Table 3. Oxygen released by the catalase remained unchanged with slight fluctuations during the 5-day period. The total leucocyte count increased by the second day and then decreased gradually. The increase may be explained on the basis that most of the milk leucocytes are polymorphonuclear leucocytes with multilobed nuclei. The multilobed nuclei of dead and disintegrated leucocytes may be counted as more than one leucocyte in stained smears. Feulgen-DNA-color score and optical density remained constant with fluctuations within the limits of experimental error. This result is in agreement with the findings of Tucker and Paape *(7)*.

The proportion of live leucocytes gradually decreased day by day from 75% soon after milking to 21% by the fifth day. The viscosity and CMT score also decreased gradually, similar to that of live leucocytes. This indicates that the viscosity of the CMT reaction is caused by live leucocytes. This conclusion is in agreement with the results of Rao *(4)* that native DNA-protein complex of the leucocyte nuclei is necessary for the formation of gel in the CMT reaction. Death of leucocytes on holding of milk exposes the nuclei of dead cells to deoxyribonucleases and proteases which are either normally present in milk or released from dead cells and cause breakdown of the DNA-protein complexes and eliminate their gel forming property in the CMT reaction.

Comparison of tests

Feulgen-DNA-color reaction with other methods. The correlation coefficient between Feulgen-DNA-color scores and optical density was 0.76 and 0.80 with quarter and bucket milk samples but only 0.65 with bulk samples. Repeating the above comparison with samples that gave some numerical value by scoring (22 quarter, 20 bucket, and 48 bulk samples) did not appreciably increase the correlation coefficient of bucket and bulk samples, but increased the correlation coefficient of quarter samples to 0.83. Optical density of DNA-color with log of total leucocyte counts gave low but significant correlations with all samples (Table 4). Correlation of optical density of Feulgen-DNA-color with catalase activity

Table 3. Effect of holding milk at 5 C on the results of various tests (mean of 8 samples)

Test	Number of days at 5 C					
	0	1	2	3	4	5
Feulgen-DNA-color score	1.92	1.75	1.75	1.88	1.85	1.88
Optical density x 10^{-2}	8.0	6.9	8.5	7.4	8.1	7.8
Viscosity (relative units)	15.7	13.4	12.5	10.6	9.6	9.0
CMT score	2.0	1.6	0.9	0.75	0.75	0.6
Live leucocytes (%)	75	64	45	30	27	21
Total leucocytes x 10^4	115	146	157	138	130	112
Catalase activity as % 0_2	44.4	44.4	43.8	41.9	45.5	44.7

Table 4. Comparisons between different pairs of screening tests expressed as correlation coefficients

Test	Source of samples	Number of samples	Log of leucocyte counts	Feulgen-DNA color score	Viscosity	CMT score	Catalase activity as % 0_2
Optical density of Feulgen-DNA-color	Quarter	54	0.534	0.761	0.670	0.708	0.549
	Bucket	45	0.711	0.798	0.719	0.745	0.669
	Bulk	51	0.557	0.650	0.257	0.226	0.572
Viscosity	Quarter	54	0.608	0.680	1.00	0.872	0.711
	Bucket	43	0.648	0.614	1.00	0.849	0.729
	Bulk	52	0.269	0.105	1.00	0.475	0.363
Catalase activity as % 0_2	Quarter	54	0.634	0.779	0.711	0.783	1.00
	Bucket	45	0.660	0.674	0.729	0.704	1.00
	Bulk	52	0.409	0.480	0.363	0.396	1.00

was low but significant with all samples (Table 4). Comparison of optical density of DNA-color with viscosity gave highly significant correlation coefficients with quarter and bucket milk samples and insignificant correlation with bulk samples. Similar results were obtained by comparing optical density of Feulgen-DNA-color with CMT score, as shown in Table 4.

Thus the Feulgen-DNA-color optical density and score gave fairly good correlation with all other tests compared in this study in all types of milk samples with the exception of the CMT of the bulk samples.

Viscosity with other methods. The results are summarized in Table 4. Viscosity and CMT score gave fairly good correlations with quarter and bucket milk samples and low but significant correlation with bulk samples. Viscosity and catalase activity gave correlation coefficients of 0.71 and 0.73 with quarter and bucket samples and 0.36 with bulk samples. Similar results were obtained by comparing CMT score and catalase activity. Log of total leucocyte counts and viscosity gave correlation coefficients of 0.61 and 0.65 with quarter and bucket milk samples and insignificant correlation with bulk samples. Substituting the log of total live leucocytes in the above comparison did not increase the correlation coefficient of quarter samples, but increased that of bucket samples to 0.81 and of bulk samples to 0.38.

The viscosity and CMT reactions gave good correlations with all other tests compared in this study in fresh (quarter and bucket) samples but poor correlation with stored (bulk) samples, indicating that this test is a good method to detect abnormal milk if samples are fresh but not useful for examination of samples stored for one or more days.

Catalase activity with other tests. The results are presented in Table 4. Catalase activity gave good correlations with all other tests compared in this study in quarter and bucket milk samples and low but significant correlations in bulk milk samples. Thus catalase test is a better method than the viscosity and CMT reactions for detection of abnormal milk in stored milk samples.

The proportion of live leucocytes of samples exam-

ined for this study ranged from 40 to 95% (mean 71%) in quarter samples, from 35 to 92% (mean 74%) in bucket samples and from 12 to 69% (mean 42%) in bulk samples.

Even though the correlation coefficients of Feulgen-DNA-color test with other reactions are better than viscosity tests with other reactions the following disadvantages make the Feulgen-DNA-color tests less suitable for routine field use. The reproducibility of of Feulgen-DNA-color is low in milk samples containing less than 4 million leucocytes. Samples of suspicious or weakly positive mastitic milk usually contain less than 2 million leucocytes/ml. The Schiff's reagent used for DNA-color development is highly sensitive to light and moisture and must be prepared every few days. The Schiff's reagent is difficult to handle, because of its acid fumes and because all extraneous organic material with which it comes in contact is stained pink.

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METHOD FOR DIAGNOSING THE SANDFLY FEVER DISEASE

Two Gulf South Research Institute scientists have discovered a simple, fast and effective method for diagnosing the Sandfly Fever disease—an illness which has caused serious problems in the past for the United States military overseas.

The new technique for typing and identifying the various strains of viruses causing the disease was disclosed recently by Dr. A. N. Ibrahim and Dr. Benjamin H. Sweet.

The Sandfly illness, often called Phlebotomus Fever, is characterized by an acute benign fever usually lasting from seven to 14 days. It is accompanied by headache, pains in the eyes and a general feeling of discomfort.

Until 1959, only two viruses causing this disease were known and were limited to the Middle East and Mediterranean areas.

"During the last decade at least 10 more viruses were isolated from man, rodents, and sandflies in widespread geographical areas including Asia, Africa, and South and Central America," said Dr. Ibrahim.

The arbovirologist, working at GSRI's Lake Pontchartrain Laboratories in New Orleans, said there is no evidence that the species of sandflies existing in the United States can transmit the disease.

Sandfly Fever became a major problem for the military during World War II when thousands of Allied troops were stricken. "The vectors can now be controlled by DDT but there is always a possibility of a general resurgence of the disease," said Dr. Ibrahim.

"These viruses are now being found increasingly in many countries of the world and the potential for further spread is made greater by rapid transportation, the tourist boom and frequent shifting of military personnel."

In their efforts to diagnose the disease and identify the viruses rapidly, Dr. Ibrahim and Dr. Sweet coated glass slides with a layer of gel. A central hole, surrounded by six to eight other holes, was made in the gel.

Into the central hole was placed a sample of the patient's blood. The surrounding wells were each filled with one of the viruses. When the blood sample reacts with one of these viruses the scientists are able to conclude that this is the virus that causes the disease.

The reaction appears within 18-24 hr in the form of a white line between the two holes. The line is easy to see with the naked eye.

Dr. Ibhahim and Dr. Sweet said the reverse procedure can be used to identify a suspected new virus. The virus thought to be new is placed into a central well and the surrounding wells are filled with antibodies prepared against the known viruses.

If the virus in the centrol hole reacts with one of the antibodies it can be presumed that the central virus is related to a known virus. If there is no reaction the scientists may conclude that a new virus has been isolated.

HOLDERS OF 3-A SYMBOL COUNCIL AUTHORIZATIONS ON AUGUST 20, 1969

"Questions or statements concerning any of the holders of authorizations listed below, or the equipment fabricated, should be addressed to C. A. Abele, Secretary-Treasurer, 2617 Hartzell St., Evanston, Ill. 60201."

0102 Storage Tanks for Milk and Milk Products, as Amended

116 Jacob Brenner Company, Inc. (10/ 8/59)
450 Arlington, Fond du Lac, Wisconsin 54935

28 Cherry-Burrell Corporation (10/ 3/56)
575 E. Mill St., Little Falls, N. Y. 13365

102 Chester-Jensen Company, Inc. (6/ 6/58)
5th & Tilgham Streets, Chester, Pennsylvania 19013

1 Chicago Stainless Equipment Corp. (5/ 1/56)
5001 No. Elston Avenue, Chicago, Illinois 60630

2 CP Division, St. Regis (5/ 1/56)
1243 W. Washington Blvd., Chicago, Illinois 60607

117 Dairy Craft, Inc. (10/28/59)
St. Cloud Industrial Park
St. Cloud, Minn. 56301

76 Damrow Brothers Company (10/31/57)
196 Western Avenue, Fond du Lac, Wisconsin 54935

115 DeLaval Company, Ltd. (9/28/59)
113 Park Street, So., Peterborough, Ont., Canada

207 The DeLaval Separator Co. (7/23/69)
Duchess Turnpike, Poughkeepsie, N. Y. 12602

109 Girton Manufacturing Company (9/30/58)
Millville, Pennsylvania 17846

21 The J. A. Gosselin Co., Ltd. (9/20/56)
P. O. Box 280, Drummondville, Quebec, Canada

114 C. E. Howard Corporation (9/21/59)
9001 Rayo Avenue, South Gate, California 90280

127 Paul Mueller Company (6/29/60)
1616 W. Phelps Street, Springfield, Missouri 65801

197 Paul Mueller (Canada), Ltd. (9/ 9/67)
84 Wellington St., South, St. Marys, Ont.

143 Portersville Stainless Equipment Div. (5/16/63)
Gibson Industries, Inc.
Portersville (Butler County), Pennsylvania 16051

31 Walker Stainless Equipment Co. (10/ 4/56)
Elroy, Wisconsin 53929

0204 Pumps for Milk and Milk Products Revised, as Amended

29R Cherry-Burrell Corporation (10/ 3/56)
105 W. Adams St., Chicago, Ill. 60603

63R CP Division, St. Regis (4/29/57)
1243 W. Washington Blvd., Chicago, Illinois 60607

205R Dairy Equipment Co. (5/22/69)
1919 So. Stoughton Road, Madison, Wisc. 53716

180R The DeLaval Separater Co. (5/ 5/66)
Poughkeepsie, N. Y. 12602

65R G & H Products Corporation (5/22/57)
5718 52nd Street, Kenosha, Wisconsin 53140

145R ITT Jabsco, Incorporated (11/20/63)
1485 Dale Way, Costa Mesa, Calif. 92626

26R Ladish Co., Tri-Clover Division (9/29/56)
2809 60th Street, Kenosha, Wisconsin 53140

148R Robbins & Myers, Inc. (4/22/64)
Moyno Pump Division
1345 Lagonda Ave., Springfield, Ohio 45501

163R Sta-Rite Products, Inc. (5/ 5/65)
343 Wright Street, Delavan, Wisconsin 53115

72R L. C. Thomsen & Sons, Inc. (8/15/57)
1303 53rd Street, Kenosha, Wisconsin 53140

175R Universal Milking Machine Div., (10/26/65)
National Cooperatives, Inc.
First Avenue at College, Albert Lea, Minn. 56007

52R Viking Pump Div.—
Houdaille Industries, Inc. (12/31/56)
406 State Street, Cedar Falls, Iowa 50613

5R Waukesha Foundry Company (7/ 6/56)
Waukesha, Wisconsin 53186

0402 Homogenizers and High Pressure Pumps of the Plunger Type, As Amended

87 Cherry-Burrell Corporation (12/20/57)
2400 Sixth Street, S. W., Cedar Rapids, Iowa 52404

37 CP Division, St. Regis (10/19/56)
1243 W. Washington Blvd., Chicago, Illinois 60607

75 Manton-Gaulin Mfg. Co., Inc. (9/26/57)
44 Garden Street, Everett, Massachusetts 02149

0506 Stainless Steel Automotive Milk Transportation Tanks for Bulk Delivery and/or Farm Pick-up Service, As Amended

131 Almont Welding Works, Inc. (9/ 3/60)
4091 Van Dyke Road, Almont, Michigan 48003

98 Beseler Steel Products, Inc. (3/24/58)
417 East 29th, Marshfield, Wisconsin 54449

70 Jacob Brenner Company (8/ 5/57)
450 Arlington, Fond du Lac, Wisconsin 54935

40 Butler Manufacturing Co. (10/20/56)
1000 Berry Avenue, St. Paul, Minnesota 55114

118 Dairy Craft, Inc. (10/28/59)
St. Cloud Industrial Park
St. Cloud, Minn. 56301

66 Dairy Equipment Company (5/29/57)
1818 So. Stoughton Road, Madison, Wisconsin 53716

123 DeLaval Company, Ltd. (12/31/59)
113 Park Street, South Peterborough, Ont., Canada

190 Eastern Industries, Limited (11/18/66)
830 Blvd., Lemire, Drummondville, Quebec, Canada

121 The J. A. Gosselin Co., Ltd. (12/ 9/59)
P. O. Box 280, Drummondville, Quebec, Canada

45 The Heil Company (10/26/56)
3000 W. Montana Street, Milwaukee, Wisconsin 53235

201 Paul Krohnert Mfg., Ltd. (4/ 1/68)
West Hill, Ontario, Canada

80 Paul Mueller (Canada), Ltd. (11/24/57)
84 Wellington Street, So., St. Marys, Ont., Canada

93 Pennsylvania Furnace & Iron Co. (2/ 6/58)
316 Pine Street, Warren, Pennsylvania 16365

85 Polar Manufacturing Company (12/20/57)
Holdingford, Minn. 56340

144 Portersville Stainless Equipment Div., (5/16/63)
Gibson Industries, Inc.
Portersville (Butler County), Pennsylvania 16051

71 Progress Industries, Inc. (8/ 8/57)
400 E. Progress Street, Arthur, Illinois 61911

47 Trailmobile Div. of Pullman, Inc. (11/ 2/56)
16th & Howell Streets, North Kansas City, Mo. 64116

189 A. & L. Tougas, Ltée (10/ 3/66)
1 Tougas St., Iberville, Quebec, Canada
25 Walker Stainless Equipment Co. (9/28/56)
New Lisbon, Wisconsin 53950

0808 Fittings Used on Milk and Milk Products Equipment, and Used on Sanitary Lines Conducting Milk and Milk Products and Supplements 2, 3, 4, 5, and 6 As Amended

79 Alloy Products Corporation (11/23/57)
1045 Perkins Avenue, Waukesha, Wisconsin 53186
138 A.P.V. (Canada) Equipment, Ltd. (12/17/62)
103 Rivalda Rd., Weston, Ont., Canada
82 Cherry-Burrell Corporation (12/11/57)
105 W. Adams St., Chicago, Ill. 60603
124 DeLaval Company, Ltd. (2/18/60)
113 Park Street, South, Peterborough, Ont., Canada
184 The DeLaval Separator Co. (8/ 9/66)
Poughkeepsie, New York 12602
67 G & H Products Corporation (6/10/57)
5718 52nd Street, Kenosha, Wisconsin 53140
199 Gray Company, Inc. (12/ 8/67)
60 Eleventh Ave., N.E., Minneapolis, Minn. 55413
203 Grinnell Company (11/27/68)
260 W. Exchange St., Providence, R. I. 02901
204 Hills McCanna Company (2/10/69)
400 Maple Ave., Carpentersville, Ill. 60110
34 Ladish Co., Tri-Clover Division (10/15/56)
2809 60th St., Kenosha, Wisconsin 53140
200 Paul Mueller Co. (3/ 5/68)
1616 Phelps St., Springfield, Mo. 65601
149 Q Controls (5/18/64)
Occidental, California 95465
89 Sta-Rite Industries, Inc. (12/23/68)
343 Wright Street, Delavan, Wis. 53115
73 L. C. Thomsen & Sons, Inc. (8/31/57)
1303 43rd Street, Kenosha, Wisconsin 53140
191 Tri-Canada Fittings & Equipment Ltd. (11/23/66)
21 Newbridge Road, Toronto 18, Ontario
151 Tubular Components, Inc. (11/18/64)
Butternut Drive, East Syracuse, New York 13057
86 Waukesha Specialty Company (12/20/57)
Walworth, Wisconsin 53184

0902 Thermometer Fittings and Connections Used on Milk and Milk Products Equipment and Supplement 1, As Amended

32 Taylor Instrument Companies (10/ 4/56)
95 Ames Street, Rochester, New York 14611
206 The Foxboro Company (8/11/69)
Neponset Ave., Foxboro, Mass. 02035

1002 Milk and Milk Products Filters Using Disposable Filter Media, As Amended

35 Ladish Co., Tri-Clover Division (10/15/56)
2809 60th Street, Kenosha, Wisconsin 53140

1102 Plate-Type Heat Exchangers for Milk and Milk Products, As Amended

20 A.P.V. Company, Inc. (9/ 4/56)
137 Arthur Street, Buffalo, New York 14207
30 Cherry-Burrell Corporation (10/ 1/56)
2400 Sixth Street, S.W., Cedar Rapids, Iowa 52404
14 Chester-Jensen Co., Inc. (8/15/56)
5th & Tilgham Streets, Chester, Pennsylvania 19013
38 CP Division, St. Regis (10/19/56)
1243 W. Washington Blvd., Chicago, Illinois 60607
120 DeLaval Company, Ltd. (12/ 3/59)
113 Park Street, South, Peterborough, Ont., Can.
17 The DeLaval Separator Company (8/30/56)
Poughkeepsie, New York 12602
15 Kusel Dairy Equipment Company (8/15/56)
100 W. Milwaukee Street, Watertown, Wisconsin 53094

1202 Internal Return Tubular Heat Exchangers, for Milk and Milk Products, As Amended

103 Chester-Jensen Company, Inc. (6/ 6/58)
5th & Tilgham Street, Chester, Pennsylvania 19013
96 C. E. Rogers Company (3/31/64)
8731 Witt Street, Detroit, Michigan 48209
152 Sanitary Processing Equipment Corp. (11/18/64)
Butternut Drive, East Syracuse, New York 13057

1303 Farm Milk Cooling and Holding Tanks — Revised, As Amended

11R CP Division, St. Regis (7/25/56)
1243 W. Washington Street, Chicago, Illinois 60607
119R Dairy Craft, Inc. (10/28/59)
St. Cloud Industrial Park, St. Cloud, Minn. 56301
4R Dairy Equipment Company (6/15/56)
1919 S. Stoughton Road, Madison, Wisconsin 53716
92R DeLaval Company, Ltd. (12/27/57)
113 Park Street, South, Peterborough, Ontario, Canada
49R The DeLaval Separator Company (12/ 5/56)
Poughkeepsie, New York 12602
10R Girton Manufacturing Company (7/25/56)
Millville, Pennsylvania 17846
95R Globe Fabricators, Inc. (3/14/58)
7744 Madison Street, Paramont, California 90723
179R Heavy Duty Products (Preston), Ltd. (3/ 8/66)
635 Laurel St., Preston, Ont., Canada
12R Paul Mueller Company (7/31/56)
1616 W. Phelps Street, Springfield, Missouri 65801
58R Schweitzer's Metal Fabricators, Inc. (2/25/57)
806 No. Todd Avenue, Azusa, California 91702
50R Emil Steinhorst & Sons, Inc. (12/20/56)
612-616 South Street, Utica, New York 13503
134R Universal Milking Machine Division (5/19/61)
National Co-operatives, Inc.
First Avenue at College, Albert Lea, Minn. 56007
42R VanVetter, Inc. (10/22/56)
2130 Harbor Avenue S.W., Seattle, Washington 98126
18R Whirlpool Corporation, St. Paul Division (9/20/56)
850 Arcade Street, St. Paul, Minnesota 55106
55R John Wood Company (1/23/57)
Superior Metalware Division
509 Front Avenue, St. Paul, Minnesota 55117
170R The W. C. Wood Co., Ltd. (8/ 9/65)
5 Arthur Street, South, Guelph, Ont., Canada
16R Zero Manufacturing Company (8/27/56)
Washington, Missouri 63090

1400 Inlet and Outlet Leak Protector Plug Valves for Batch Pasteurizers

122 Cherry-Burrell Corporation (12/11/59)
105 W. Adams St., Chicago, Ill. 60603
69 G & H Products Corporation (6/10/57)
5718 52nd Street, Kenosha, Wisconsin 53140

27 Ladish Co. - Tri-Clover Division (9/29/56)
2809 60th Street, Kenosha, Wisconsin 53140
78 L. C. Thomson & Sons, Inc. (11/20/57)
1303 43rd Street, Kenosha, Wisconsin 53140

1603 Evaporators and Vacuum Pans for Milk and Milk Products, As Amended

132 A.P.V. Company, Inc. (10/26/60)
137 Arthur Street, Buffalo, New York 14207
111 Blaw-Knox Company, (2/12/59)
Dairy Equipment Division
750 E. Perry, Buffalo, N. Y. 14210
110 Arthur Harris & Company (11/10/58)
210-218 North Aberdeen Street, Chicago, Illinois 60607
164 Mora Industries, Inc. (4/25/65)
112 South Park Street, Mora, Minnesota 55051
107 C. E. Rogers Company (8/ 1/58)
8731 Witt Street, Detroit, Michigan 48209
186 Marriott Walker Corporation (9/ 6/66)
925 East Maple Road, Birmingham, Mich. 48008

1702 Fillers and Sealers of Single Service Containers, For Milk and Milk Products, As Amended

192 Cherry-Burrell Corporation (1/ 3/67)
2400 Sixth St., S. W., Cedar Rapids, Iowa 52404
139 Exact Weight Sale Company (4/15/68)
538 East Town Street, Columbus, Ohio 43215
137 Ex-Cell-O Corporation (10/17/62)
P. O. Box 386, Detroit, Michigan 48232
140 General Films, Inc. (4/23/63)
Covington, Ohio 55318
142 Polygal Company (4/15/63)
Div. of Inland Container Corp.
P. O. Box 68074, Indianapolis, Indiana 46268

1901 Batch and Continuous Freezers, For Ice Cream, Ices and Similarly Frozen Dairy Foods, As Amended

141 CP Division, St. Regis (4/15/63)
1243 W. Washington Blvd., Chicago, Illinois 60607
146 Cherry-Burrell Corporation (12/10/63)
2400 Sixth Street, S. W., Cedar Rapids, Iowa 52404

2201 Silo-Type Storage Tanks for Milk and Milk Products

168 Cherry-Burrell Corporation (6/16/65)
575 E. Mill St., Little Falls, N. Y. 13365
154 CP Division, St. Regis (2/10/65)
1243 W. Washington Blvd., Chicago, Illinois 60607
160 Dairy Craft, Inc. (4/ 5/65)
St. Cloud Industrial Park
St. Cloud, Minn. 56301
181 Damrow Brothers Company (5/18/66)
196 Western Ave., Fond du Lac, Wisconsin 54935
156 C. E. Howard Corporation (3/ 9/65)
9001 Rayo Avenue, South Gate, California 90280
155 Paul Mueller Co. (2/10/65)
1616 W. Phelps Street, Springfield, Missouri 65801
195 Paul Mueller (Canada) Ltd. (7/ 6/67)
84 Wellington St., So., St. Marys, Ont., Canada
165 Walker Stainless Equipment Co. (4/26/65)
Elroy, Wisconsin 53929

2300 Equipment for Packaging Frozen Desserts, Cottage Cheese and Milk Products Similar to Cottage Cheese in Single Service Containers

174 Anderson Bros. Mfg. Co. (9/28/65)
1303 Samuelson Road, Rockford, Illinois 61109
209 Doughboy Industries, Inc., (7/23/69)
Machine Division
869 So. Main Ave., New Richmond, Wisc. 54017
193 Triangle Package Machinery Co. (1/31/67)
6655 West Diversey Ave., Chicago, Illinois 60635

2400 Non-Coil Type Batch Pasteurizers

161 Cherry-Burrell Corporation (4/ 5/65)
575 E. Mill St., Little Falls, N. Y. 13365
158 CP Division, St. Regis (3/24/65)
1243 W. Washington Blvd., Chicago, Illinois 60607
187 Dairy Craft, Inc. (9/26/66)
St. Cloud Industrial Park
St. Cloud, Minn. 56301
208 The DeLaval Separator Co., (7/23/69)
Duchess Turnpike, Poughkeepsie, N. Y. 12602
177 Girton Manufacturing Co. (2/18/66)
Millville, Pennsylvania 17846
166 Paul Mueller Co. (4/26/65)
1616 W. Phelps Street, Springfield, Missouri 65802
198 Paul Mueller (Canada), Ltd. (9/ 9/67)
84 Wellington St., So., St. Marys, Ont., Canada

2500 Non-Coil Type Batch Processors for Milk and Milk Products

162 Cherry-Burrell Corporation (4/ 5/65)
575 E. Mill St., Little Falls, N. Y. 13365
159 CP Division, St. Regis (3/24/65)
1243 W. Washington Blvd., Chicago, Illinois 60607
188 Dairy Craft, Inc. (9/26/66)
St. Cloud Industrial Park
St. Cloud, Minn. 56301
167 Paul Mueller Co. (4/26/65)
1616 W. Phelps Street, Springfield, Missouri 64801
196 Paul Mueller (Canada), Ltd. (7/ 6/67)
84 Wellington St., So., St. Marys, Ont., Canada
202 Walker Stainless Equipment Co. (9/24/68)
New Lisbon, Wis. 53950

2600 Sifters for Dry Milk and Dry Milk Products

171 Entoleter, Inc. (9/ 1/65)
Subsidiary of American Mfg. Co.
1187 Dixwell Avenue, Hamden, Connecticut 06514
173 Food & Chemical Equipment Div., (9/20/65)
Blaw-Knox Company
1325 S. Cicero Avenue, Chicago, Illinois 60650
185 The Orville-Simpson Co. (8/10/66)
1230 Knowlton St., Cincinnati, Ohio 45223
172 Sweco, Inc. (9/ 1/65)
6111 E. Bandini Blvd., Los Angeles, California 90022
176 Sprout, Waldron & Co., Inc. (1/ 4/66)
Munsy, Pennsylvania 17756

MICROBIOLOGY OF SOME FROZEN AND DRIED FEEDSTUFFS[1]

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Abstract

Frozen meat by-products, liver, and fish used as components in the diets of mink and a dry cereal-type feedstuff were examined for their microbiological condition initially and after 12 and 24 hr of storage at 30 C. The dry product was moistened before incubation.

Initially, frozen meat by-products and frozen liver had a similar microbiological profile. Both contained an average per gram of approximately 5.5 million total bacteria, 175 thousand enterococci, 10 to 30 thousand coliforms, and 400 yeasts and molds. Salmonellae and coagulase-positive staphylococci were recovered from 40% of the samples of both products. Salmonellae associated with these products included: *Salmonella saint paul, Salmonella typhimurium, Salmonella infantis, Salmonella derby* and *Salmonella anatum*. The frozen fish product contained, on the average, less than 10% of the number of microorganisms found in the other two products and test samples were free from coagulase-positive staphylococci. Salmonellae found in this product included: *S. saint paul, S. derby,* and *S. infantis*. Examination of the dried cereal-type mink feed revealed low numbers of microorganisms and an absence of salmonellae and coagulase-positive staphylococci.

Incubation of all feedstuffs tested was accompanied by rapid growth of bacteria during the first 12 hr period and continued but slower growth during the second 12 hr period. Multiplication of yeasts and molds was minimal in the frozen feeds but was rapid in the moistened cereal product during the second 12 hr period of incubation. Coagulase-positive staphylococci grew well in the frozen feeds but multiplication of suspected salmonellae was minimal in these products.

Relationships between the microbiological condition of foods and their safety and keeping quality have been well established. Numerous experiments also have been conducted on the occurrence and fate of microorganisms in frozen foods *(4, 5, 6)*. Certain food processing operations produce frozen by-products which are used as animal feeds. Of particular interest are frozen meat by-products, feed-grade frozen liver, and feed-grade frozen fish which are frequently included in the diets of mink.

Wisconsin produces approximately one-third of the domestic mink which, not too many years ago, obtained much of their animal protein from the carcasses of over-aged draft horses. Since draft horses have virtually disappeared from the scene and thus no longer serve as a source of protein for mink, operators of mink ranches have elected to utilize fresh frozen liver, fish, and meat by-products as feedstuffs.

Although some information is available on the microbiology of certain feed products *(2, 3)*, no data exist on the microbiological condition of frozen feedstuffs. When these feedstuffs are fed to mink it is not uncommon for some of the feed to remain uneaten for periods of 12 hr or more. Extended incubation of the feeds may lead to substantial changes in the microflora. This report summarizes information on: *(a)* the initial microbiological condition of three different frozen feeds and of one dried product and *(b)* changes in the microflora of these feeds when they were held at 30 C for up to 24 hr.

Materials and Methods

Sampling of products

Samples were taken aseptically from commercial frozen feed products or dried mink feed and were placed in sterile containers. They were immediately transported to the laboratory where the frozen feed products were maintained in that condition until the time of testing.

Bacteriological analyses

Essentially those techniques outlined by the American Public Health Association *(1)* were followed in the analysis of samples. A 1:10 dilution of the sample was achieved by blending 11 g of the thawed product (held in a water bath at 30 C for approximately 10 min to thaw) with 99 ml of sterile buffered distilled water in a Waring Blendor.

Plates for total count determination were poured with Plate Count agar (Difco) and incubated for 48 hr at 30 C. The number of molds and yeasts was determined with the aid of potato dextrose agar (Difco) acidified to pH 3.5 with sterile tartaric acid. These plates were incubated at 30 C for 4 to 5 days.

Enterococci were enumerated using the citrate azide medium of Reinbold et al. *(7)* as modified by Saraswat et al. *(8)*. Plates were incubated at 37 C for 48 hr.

Coliform bacteria were detected and enumerated with the aid of violet red bile agar (Difco) and an incubation of 18 to 24 hr at 37 C. Typical colonies were confirmed as coliforms by means of the Gram stain and growth in brilliant green bile broth (Difco).

Mannitol salt agar (Difco) and the spread-plate technique were used for detection of staphylococci. After an incubation of 2 days at 37 C, 10 to 15 typical colonies were picked and tested for their ability to produce coagulase.

To detect salmonellae, 10 g of sample was thawed as de-

[1]Published with the approval of the Director of the Wisconsin Agricultural Experiment Station.

TABLE 1. MICROBIOLOGICAL CONDITION OF FRESH FROZEN MEAT BY-PRODUCTS[a, b]

No. per gram	Total count		Yeasts and molds		Coliforms		Enterococci	
	No. of samples	Per cent	No. of samples	Per cent	No. of samples	Per cent	No. of samples	Per cent
0 - 100	0	–	4	26.7	0	–	0	–
110 - 1,000	0	–	10	66.7	3	20.0	0	–
1,100 - 10,000	0	–	1	6.7	5	33.3	1	6.7
11,000 - 100,000	0	–	0	–	6	40.0	9	60.0
110,000 - 1,000,000	4	26.7	0	–	1	6.7	5	33.3
1,100,000 - 10,000,000	8	53.3	0	–	0	–	0	–
11,000,000 - 100,000,000	3	20.0	0	–	0	–	0	–
Average, No./g	5,700,000		420		31,000		180,000	
Median, No./g	1,900,000		280		7,200		88,000	

[a]Six of 15 samples tested contained 11,000 to 1,000,000 coagulase-positive staphylococci per gram.
[b]Suspected salmonellae were recovered from 9 of 15 samples. Serological typing of isolates showed that 4 samples contained *Salmonella saint paul*, 1 sample contained S. *saint paul* plus *Salmonella typhimurium*, 2 samples contained *Arizona* sp., and suspected cultures from 2 samples were neither *Arizona* nor *Salmonella*.

scribed above, blended with 90 ml of nutrient broth and incubated at 37 C for 24 hr. This preenrichment culture was subcultured by inoculating tetrathionate or selenite broth (Difco) which was incubated for 24 hr at 37 C. A loopful of material from the enrichment culture was streaked on both brilliant green and SS agars (Difco). After incubation at 37 C for 18 to 24 hr, typical colonies were picked and inoculated into triple sugar iron (TSI) agar (Difco) and urea broth (Pennsylvania Biological Laboratories, Inc., Philadelphia, Pa.). Cultures with reactions typical of salmonellae were retained and submitted to the State (of Wisconsin) Laboratory of Hygiene for serological typing.

Incubation of feeds

When feed products of the types tested in these experiments are fed to mink, frequently they are not immediately eaten by the animals. Instead they may be held for 12 hr or longer before the feeds are consumed. Although microbiological changes during this holding period may be minimal during the colder winter months, appreciable growth of microorganisms can take place during the warmer spring, summer, and autumn months. To determine the microbiological changes which take place in the feeds during such holding periods in warm weather, the following experiment was conducted.

Samples obtained from different batches of each feed product being studied were placed in sterile containers. The feeds were tested initially (6 samples of each product), after 12 hr (3 samples of each product) and after 24 hr (6 samples of each product). Microbiological analyses as previously described were conducted on each sample. Numbers of suspected salmonellae were determined by the Most Probable Number procedure. The dried mink feed product was mixed with an equal amount of water (as might be done when it is used to feed mink) before it was incubated.

RESULTS

Initial microbiological condition of feeds

Frozen meat by-products. Results of tests conducted on frozen meat by-products are summarized in Table 1. The initial microbial content of this product was rather great as reflected in the total count results. Approximately 73% of the samples tested contained more than one million organisms per gram. The number of coliforms varied considerably and ranged from more than 100 to less than one million per gram with an average of 31,000 per gram.

Approximately 93% of the samples tested contained between 11,000 and one million enterococci per gram. Enterococci, here and in the later discussion, are defined as those organisms able to grow on the citrate azide medium used to enumerate these bacteria. Additionally, 40% of the samples tested yielded coagulase-positive staphylococci and organisms positively identified as salmonellae were recovered from approximately 33% of the test samples. *Salmonella saint paul* was recovered from all samples shown to contain salmonellae. In addition, one sample yielded *Salmonella typhimurium.*

The number of yeasts and molds in this feedstuff were quite low with approximately 93% of the samples containing less than 1,000 per gram.

Frozen liver. Data in Table 2 indicate that the microbiological condition of frozen liver was similar to that of the frozen meat by-products. Perhaps this is to be expected since both are by-products of the meat packing industry. Values obtained with the total count, coliform, enterococcus, and yeast and mold tests virtually duplicated those reported for the frozen meat by-products. The picture with regard to coagulase-positive staphylococci also was similar. Ac-

cording to data in Table 2, the incidence of salmonellae in this product may have been somewhat higher than was previously encountered. Seven of the 15 samples examined yielded the following salmonellae: S. *saint paul*, *Salmonella infantis*, *Salmonella derby*, and *Salmonella anatum*.

Frozen fish. Table 3 presents data obtained from the examination of frozen feed-grade fish. A comparison between the average number of organisms found in this product and those associated with the two frozen feeds just discussed suggests that the frozen fish is superior from a microbiological viewpoint. Although 73% of the samples tested contained from 110,000 to one million total bacteria per gram, the average value was only 270,000 per gram and the median was approximately 80,000 lower in number. Numbers of coliforms and enterococci present were quite low and coagulase-positive staphylococci were not recovered from any of the test samples.

The incidence of salmonellae in this feed approximated that observed in the meat by-products. Salmonellae identified as present include: S. *saint paul*, S. *derby*, and S. *infantis*.

Dried mink feed. For comparative purposes studies were conducted on a dried cereal-type feed product which is customarily included in the diet of mink. Results from tests on this product are presented in Table 4. An inspection of the data reveals that, from a microbiological viewpoint, this was the most satisfactory of the four feeds which were examined in this study. The average total count was an insignificant 38,000 per gram. Numbers of coliforms and enterococci also were very low and neither coagulase-positive staphylococci nor suspected salmonellae were recovered from the product. Contamination with yeasts and molds was somewhat greater (average of 1,100 per gram) than was observed in the frozen products (average of 230 to 450 per gram).

Microbiological condition of feeds after incubation

Frozen meat by-products. According to data in Fig. 1, the most rapid increase in total count, coliforms, enterococci, and yeasts and molds occurred during the first 12 hr of incubation. Calculations based on the data show that a 750-, 205-, 414-, and 25-fold increase in total count, coliforms, enterococci, and yeasts and molds, respectively occurred during the first 12 hr of storage. During the second 12 hr period the increase was only 2.3-, 10-, 4.1-, and 4.6-fold for the same groups of organisms. After completion of incubation the numbers per gram of total bacteria, coliforms, enterococci, and yeasts and molds exceeded 10^9, 10^7, 10^8, and 10^4, respectively. Growth of yeasts and molds was minimal during the first 12 hr of incubation when compared to that of the other organisms.

The behavior of coagulase-positive staphylococci during incubation is demonstrated by data in Table 5. It is evident that these bacteria grow well under the conditions provided and can attain numbers in excess of one million per gram during a 24 hr incubation at 30 C.

TABLE 2. MICROBIOLOGICAL CONDITION OF FRESH FROZEN FEED-GRADE LIVER[a b]

No. per gram	Total count		Yeasts and molds		Coliforms		Enterococci	
	No. of samples	Per cent	No. of samples	Per cent	No. of samples	Per cent	No. of samples	Per cent
0 - 100	0	—	4	26.7	1	6.7	1	6.7
110 - 1,000	0	—	9	60.0	3	20.0	1	6.7
1,100 - 10,000	0	—	2	13.3	6	40.0	1	6.7
11,000 - 100,000	0	—	0	—	5	33.3	4	26.7
110,000 - 1,000,000	4	26.7	0	—	0	—	8	53.3
1,100,000 - 10,000,000	7	46.7	0	—	0	—	0	—
11,000,000 - 100,000,000	4	26.7	0	—	0	—	0	—
Average, No./g	5,100,000		450		9,500		170,000	
Median, No./g	3,700,000		280		5,900		120,000	

[a]Six of 15 samples tested contained 11,000 to 1,000,000 coagulase-positive staphylococci per gram.

[b]Suspected salmonellae were recovered from 10 to 15 samples. Serological typing of isolates from 9 samples showed that 1 sample contained *Salmonella saint paul*, 1 sample contained *Salmonella infantis* plus *Arizona* sp., 1 sample contained *Salmonella derby* plus *Arizona* sp., 3 samples contained S. *saint paul* plus S. *derby*, 1 sample contained S. *derby* and *Salmonella anatum*, and cultures from 2 samples were neither *Salmonella* nor *Arizona*.

TABLE 3. MICROBIOLOGICAL CONDITION OF FRESH FROZEN FEED-GRADE FISH[a, b]

No. per gram	Total count		Yeasts and molds		Coliforms		Enterococci	
	No. of samples	Per cent	No. of samples	Per cent	No. of samples	Per cent	No. of samples	Per cent
0 - 100	0	—	7	46.7	8	53.3	8	53.3
110 - 1,000	0	—	8	53.3	7	46.7	2	13.3
1,100 - 10,000	1	6.7	0	—	0	—	5	33.3
11,000 - 100,000	3	20.0	0	—	0	—	0	—
110,000 - 1,000,000	11	73.3	0	—	0	—	0	—
Average, No./g	270,000		230		83		1,600	
Median, No./g	190,000		160		90		950	

[a]No coagulase-positive staphylococci were recovered from 15 samples.

[b]Suspected salmonellae were recovered from 7 of 15 samples. Serological typing of isolates showed that 2 samples contained *Salmonella saint paul,* 1 sample contained *Salmonella derby,* 1 sample contained *S. derby* plus *Salmonella infantis,* 1 sample contained *Arizona* sp., and suspected cultures from 2 samples were neither *Salmonella* nor *Arizona.*

TABLE 4. MICROBIOLOGICAL CONDITION OF DRIED MINK FEED[a]

No. per gram	Total count		Yeasts and molds		Coliforms		Enterococci	
	No. of samples	Per cent	No. of samples	Per cent	No. of samples	Per cent	No. of samples	Per cent
0 - 100	0	—	5	33.3	13	86.7	8	53.3
110 - 1,000	0	—	8	53.3	2	13.3	6	40.0
1,100 - 10,000	3	20.0	2	13.3	0	—	1	6.7
11,000 - 100,000	12	80.0	0	—	0	—	0	—
Average, No./g	38,000		1,100		65		270	
Median, No./g	31,000		180		30		50	

[a]No coagulase-positive staphylococci or suspected salmonellae were recovered from 15 samples.

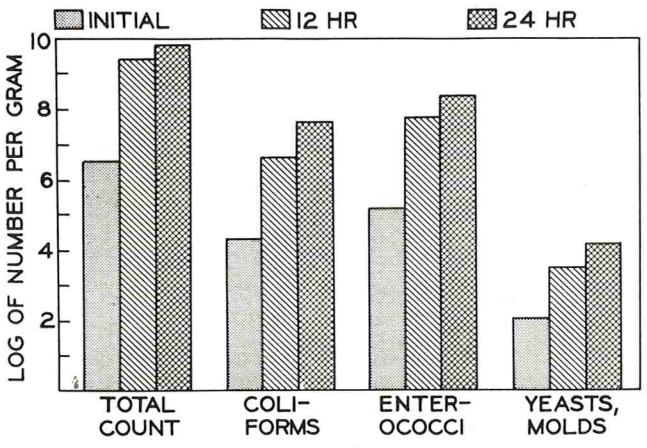

Figure 1. Changes in numbers of microorganisms in frozen meat by-products during incubation at 30 C.

In contrast to this, according to results in Table 6, suspected salmonellae failed to develop appreciable numbers after 12 or 24 hr of incubation.

Frozen liver. Data obtained from studies on this product are shown in Fig. 2. Calculations show that a 24-, 253-, 381-, and 22-fold increase in total count, coliforms, enterococci, and yeasts and molds, respectively, occurred during the first 12 hr of incubation. During the second 12 hr period the increases were 3.2-, 5.1-, 1.6-, and 13-fold for the same groups of organisms. In general, coliforms, enterococci, and yeasts and molds in this product proliferated in a manner similar to that observed in the frozen meat by-products. The increase in total count was less dramatic than that noted in the meat by-products. This may be attributed, in part, to a higher initial number (8.0×10^7 per gram) in the liver than in the meat by-

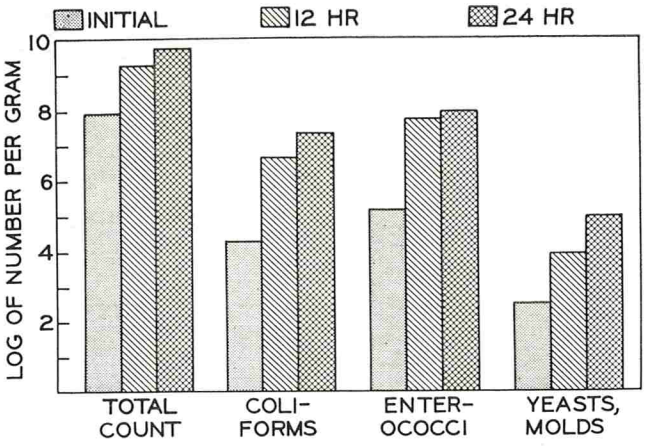

Figure 2. Changes in numbers of microorganisms in frozen feed-grade liver during incubation at 30 C.

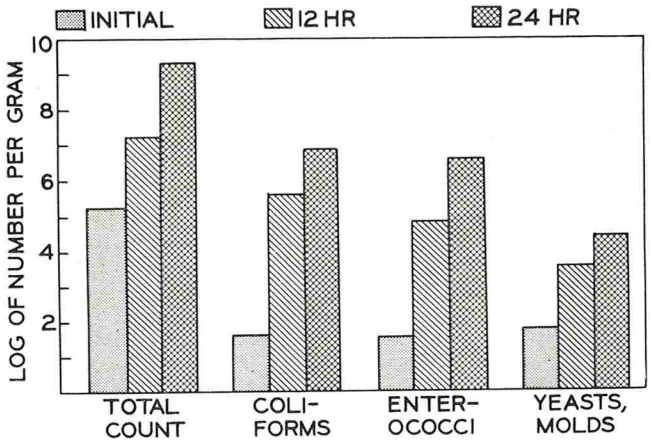

Figure 3. Changes in numbers of microorganisms in frozen feed-grade fish durin gincubation at 30 C.

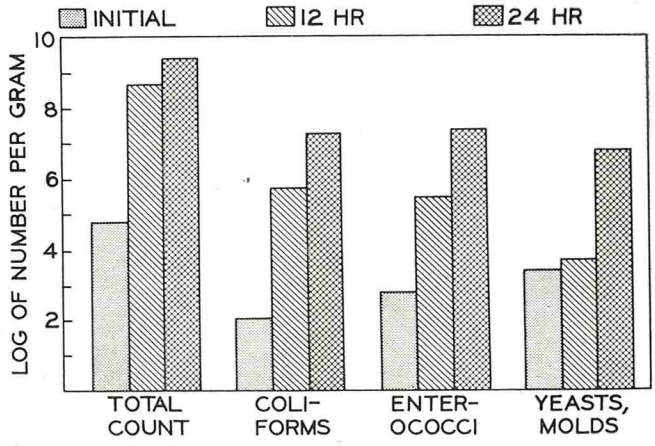

Figure 4. Changes in numbers of microorganisms in dried mink feed during incubation at 30 C. Feed mixed with water before incubation.

products (3.2 x 10^6 per gram). The total count of the two products after incubation was remarkably similar (5.4 x 10^9 and 6.0 x 10^9 per gram). Differences were also minimal in the numbers of the other groups of organisms present in the two products after incubation.

This feed product permitted the growth of coagulase-positive staphylococci (see Table 5), although overwhelming numbers were not attained in several samples after 24 hr of incubation. Limited data in Table 6 suggest that suspected salmonellae grew poorly in liver during the incubation period used in these studies.

Frozen fish. Figure 3 presents results obtained from studies on frozen fish. Calculations reveal that a 112-, 10,950-, 2,060-, and 60-fold increase in total count, coliforms, enterococci, and yeasts and molds, respectively, occurred during the first 12 hr of storage. The increases during the second 12 hr period were 126-, 17-, 64-, and 8.3-fold for the same groups of organisms. In contrast to the other products both the coliforms and enterococci in frozen fish increased markedly in numbers during the initial holding period. At the conclusion of the incubation the population of different microbial groups again was quite similar to that observed earlier for the other two frozen products.

Since coagulase-positive staphylococci were not encountered in samples of frozen fish, tests were not made on their growth during incubation. A single test on a sample of frozen fish contaminated with suspected salmonellae indicated that only limited growth of these organisms occurred during the storage period (Table 6).

Dried mink feed. Data obtained from tests on dried mink feed (cereal-type) which was moistened and incubated are given in Fig. 4. Calculations reveal that a 7,333-, 4,750-, 500-, and 1.9-fold increase in total count, coliforms, enterococci, and yeasts and

TABLE 5. CHANGES IN NUMBERS OF COAGULASE-POSITIVE STAPHYLOCOCCI IN SAMPLES OF TWO FROZEN FEEDS DURING INCUBATION AT 30 C

Feed product	Sample	No. per gram		
		Initial	After 12 hr	After 24 hr
Frozen meat by-product[a]	A	<10	—[b]	1,700,000
	B	<10	—[b]	90,000
	C	20,000	330,000	2,500,000
Frozen liver[a]	A	16,000	—[b]	240,000
	B	16,000	450,000	700,000
	C	29,000	400,000	2,100,000

[a]Six samples tested; 3 were free of coagulase-positive staphylococci.

[b]Analysis not performed.

TABLE 6. CHANGES IN NUMBERS OF SUSPECTED SALMONELLAE IN SAMPLES OF THREE FROZEN FEEDS DURING INCUBATION AT 30 C

Feed product[a]	Sample	No. per gram		
		Initial	After 12 hr	After 24 hr
Frozen meat by-product	A	0.91	—[b]	210
	B	1.40	9.30	210
	C	0.29	2.40	1100
Frozen liver	A	0.73	4.4	43
	B	2	11	160
Frozen fish	A	0.073	0.93	21

[a]Six samples of each feed were tested. Suspected salmonellae were recovered from 3, 2, and 1 samples of meat by-products, liver, and fish, respectively.

[b]Analysis was not performed.

molds, respectively, occurred during the initial 12 hr period of incubation. The increases during the next 12 hr period were 5.7-, 35-, 86-, and 1500-fold for the same groups of organisms. Growth patterns in this product were markedly different from those observed in the frozen feeds. Explosive growth of coliforms, enterococci, and total bacteria occurred during the initial 12 hr holding period so that populations of these organisms approximated those noted in the other feeds even though the initial level of contamination in the dried feed was substantially lower. At the end of 24 hr of incubation, the total number of bacteria and numbers of coliforms and enterococci approximated those observed in the frozen feeds when handled in a similar manner.

The change in yeast and mold population in this feed during the second one-half of the incubation period is particularly noteworthy. Very rapid growth was observed here in contrast to rather limited multiplication in the other feeds. Since coagulase-positive staphylococci and suspected salmonellae were not recovered from this product, no attmepts were made to follow their growth during the incubation period.

DISCUSSION

The frozen feeds examined in this study contained high numbers of microorganisms. Perhaps this is to be expected because as by-products the feedstuffs probably receive a minimum of care during their production. Additionally, some of the components of the products may be very heavily contaminated which would be reflected in a high population in the finished product.

Two of the frozen products (meat by-products and liver) frequently contained salmonellae and coagulase-positive staphylococci, both of which are human pathogens. In addition, frozen fish often contained salmonellae. Even though consumption of these products by humans in unlikely, they are nevertheless handled by caretakers working at the mink ranches and hence a potential hazard to humans exists. It is unknown at this point whether staphylococci, salmonellae, or any of the other bacteria present in the feeds are detrimental (or beneficial) to the mink. Studies to obtain this information are being planned.

Incubation of the feedstuffs in a manner similar to that which might be encountered on a mink ranch during a warm summer day was accompanied by a substantial increase in the microbial population of all feeds tested. The increase was most dramatic in frozen fish and in the dried feed which was moistened, probably because both feeds contained the lower initial levels of contamination.

Although coagulase-positive staphylococci grew reasonably well in the incubated frozen feeds, salmonellae apparently were unable to proliferate readily in these products. Perhaps rapid growth of other bacteria resulted in development of environmental conditions which retarded multiplication of the salmonellae.

ACKNOWLEDGMENT

The authors thank Dr. R. M. Shackelford, Department of Meat and Animal Science, University of Wisconsin, for providing the test samples used in these studies. Appreciation is also expressed to Dr. F. P. Pauls, State of Wisconsin Laboratory of Hygiene, for arranging the serotyping of salmonellae isolated from the feedstuffs and to Mrs. Eleanor Christensen for doing the serotyping. This study was supported, in part, by a grant from the Mink Farmers' Research Foundation.

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NEWS AND EVENTS

WADE F. ALEXANDER

Wade F. Alexander died recently. He was Senior Milk Sanitarian of the Saranac Lake District, N. Y. S. Dept. of Health, honored with the Emmet R. Gauhn Memorial Award for outstanding service and leadership in behalf of the Assoc. in 1964. He was a past president, having served in 1961-62. He was chairman of the Farm Practices Committee in 1957 and chairman of the Dairy Industry Equipment Committee for many years.

HOWARD B. MARLETT

Howard B. Marlett, 64, owner and director of the Orange County Dairy Laboratory in Middletown, died in Honesdale, Pa., July 10 after suffering a heart attack.

He was active in the New York State Association of Milk and Food Sanitarians Laboratory Practices Committee, serving a three-year term as chairman of the laboratory practices committee and was *candidate for president-elect this year* as well as founder and past president of the Orange County Milk Sanitarians Association.

FACULTY DISTINGUISHED ACHIEVEMENT AWARD TO DR. C. VANDERZANT

At the 1969 Faculty Assembly at Texas A&M University, May 20, Dr. Carl Vanderzant, Professor of Animal Science, was awarded a Distinguished Achievement Award in Teaching. The award made possible by the Association of Former Students consists of a certificate describing the contributions to teaching, a gold watch and $1000. The award honors Dr. Vanderzant for his outstanding lectures and laboratories in food microbiology. He received his M.S. and Ph.D degrees from Iowa State University. In 1953 he was appointed to the faculty at Texas A&M University with the rank of assistant professor. In addition to teaching, he has an active research program in food microbiology with emphasis on dairy and meat products. Dr. Vanderzant is a member of the American Society for Microbiology, the Society for Applied Bacteriology, the American Dairy Science Association, the Institute of Food Technologists, and the International Association of Milk, Food and Environmental Sanitarians.

DR. IVAN A. WOLFF TO HEAD UTILIZATION RESEARCH AT USDA'S EASTERN DIVISION

Dr. Ivan A. Wolff, a U. S. Department of Agriculture scientist noted for his research in the development of new agricultural crops for industrial purposes, has been named director of the Eastern Utilization Research and Development Division of the Agricultural Research Service in Philadelphia.

For the past 28 years, Dr. Wolff has been conducting chemical research at the Northern Utilization Research and Development Division in Peoria, Ill.

Dr. Wolff replaces Dr. P. A. Wells, who retired recently after spending 30 years as the head of the Philadelphia laboratory. The Eastern and Northern Utilization Research and Development Divisions are two of five centers where an active program of study is carried on to find new and improved uses for agricultural products. The others are the Southern and Western Utilization Research and Development Divisions in New Orleans, La., and Albany, Calif., and the new Southeastern Agricultural Research Laboratory in Athens, Ga.

Dr. Wolff is a native of Louisville, Ky., and is a graduate of the University of Louisville. He took his postgraduate work at the University of Wisconsin, earning the M.A. degree in 1938 and the Ph.D. in organic chemistry in 1940. In 1941, after some postdoctoral research in the Biochemistry Department at the University of Wisconsin, he joined the staff of the new Northern utilization laboratory in Peoria.

THE CHARACTERISTICS OF SOME ANAEROBIC BACTERIA FROM DIGESTING SLUDGE[1]

Carol H. Sussman

Natural anaerobic environments are found in the bottoms of rivers and lakes, in the soil, and in the rumen and intestinal contents of many animals. In all of these habitats, the bacterial population serves the important function of converting complex organic molecules to end-products which serve different functions from one habitat to another. In the sludge digestion treatment of municipal and industrial wastes, a similar anaerobic environment exists in which microorganisms degrade complex organic compounds and reduce the quantity of waste to be disposed. Often the digested sludge is used as a soil conditioner and because of this usage may serve to return nutrients to the biosphere.

In all of these ecosystems, the anaerobic decomposition of complex organic molecules basically involves two sequential processes. In the first, organic compounds such as carbohydrates, lipids, and proteins are dissimilated to end-products such as CO_2, fatty acids, and alcohols. This step is carried out by a large and varied physiological group of anaerobic and facultative bacteria often called the "acid-formers." The second group of strictly anaerobic bacteria are the methane formers which convert CO_2, short-chain fatty acids, and alcohols to methane and CO_2.

The study of anaerobic bacteria has been restricted by the lack of adequate culture techniques. However, investigations on rumen bacteria have led to the development of techniques which can be used in studying fastidious anaerobes from any ecosystem.

Studies on the numbers of nonmethanogenic bacteria occurring in anaerobic sludge digestion were summarized by Mah and Sussman (1). Such investigations were often made under aerobic conditions and consequently were much lower than numbers of methanogenic bacteria (1). Toerien and Siebert (2) reported counts of 3×10^7 bacteria/ml after 8 days of incubation at 30 C using methods similar to those employed in the present study. These counts were obtained from bench scale anaerobic digesters receiving raw sewage sludge. Toerien et al. (3) found that 3×10^7 anaerobic acid-forming bacteria/ml while aerobic and euryoxic counts were 1.6×10^6 bacteria/ml in a laboratory digester; the authors suggested that the anaerobes were important in anaerobic sludge digestion since they were about 20 times more numerous. Using a habitat-simulating medium, Mah and Sussman (1) reported *ca.* 1 to 2 $\times 10^8$ bacteria/ml under anaerobic conditions and *ca.* 1.2 to 38 $\times 10^5$ bacteria/ml under anaerobic conditions. These counts were obtained from a laboratory digester fed raw sewage sludge and were incubated about one week at 35 C. Anaerobic counts increased about ten-fold after 4 to 5 weeks of incubation. Random isolates from higher dilutions were acid-forming bacteria. It is interesting that results from Africa (2, 3) and the United States (1) are in general agreement as to approximate number of bacteria and to the much greater numbers of bacteria cultured under anaerobic vs. aerobic conditions even though different conditions were employed in each investigation. All results indicated that the anaerobic viable count is many times greater than the aerobic.

Non-methanogenic, anaerobic bacteria present in high numbers in digester sludge were selected for study because their very abundance indicates an important niche in this environment. For an organism to exist and maintain itself in high numbers, it must be well adapted to the conditions in the environment. In an anaerobic digester, an organism which is non-methanogenic would occupy an important ecological niche if it utilized complex organics present in raw sewage sludge (the feed of anaerobic digesters) and produced volatile acids and/or alcohols since this is the "first step" in anaerobic decomposition. Organisms with wider substrate preferences would have greater importance since raw sludge is so heterogeneous in composition.

Three strains of anaerobic bacteria were isolated from digesting sludge diluted to 10^{-7}; the total viable count for this dilution series was 1.2 to 3.0 $\times 10^8$ bacteria/ml. All were identified as *Bacteroides ruminicola* subsp. *brevis* or a closely related species. They were highly saccharolytic and produced succinic, acetic, and some formic acid from glucose. The three strains were somewhat proteolytic. Preliminary nutritional studies indicated an unknown factor (s) was required for good growth. *Bacteroides spp.* were not previously reported in such high numbers in digesting sludge.

Reprinted from ESE Notes

USDA ISSUES PUBLICATION ON DAIRY INSPECTION AND GRADING SERVICES

Butter, cheese, instant nonfat dry milk—dairy products such as these are inspected and graded for quality under a voluntary program described in a new pamphlet just issued by the U. S. Department of Agriculture.

"Dairy Inspection and Grading Services" gives information about the inspection and grading services offered the dairy industry on a fee-for-service basis by the Dairy Division of USDA's Consumer and Marketing Service. And it gives details about the

four major types of service offered—plant surveys, inspection and grading, laboratory tests, and in-plant resident grading.

Single copies of the publication are available free on request from the Office of Information, U. S. Department of Agriculture, Washington, D. C. 20250. Ask for Marketing Bulletin 48 (MB-48), "Dairy Inspection and Grading Services." And don't forget to include your ZIP code with your name and address.

MINUTES OF MEETING BOARD OF DIRECTORS—NATIONAL MASTITIS COUNCIL, INC. BROWN HOTEL—LOUISVILLE, KENTUCKY 19 AUGUST 1969

The following directors and alternates were in attendance: C. L. Anderson, W. L. Arledge, C. G. Ashe, K. B. Barber, W. I. Carr, R. C. Dawson (for Parnell J. Skulborstad), S. E. Ferrell, J. C. Flake, Bill Griffith, C. J. Haller, R. M. Hoyt, C. K. Johns (for H. G. Ellsworth), E. E. Kihlstrum, J. J. Mettler, Jr. (for H. G. Hodges), Hugh Munns, C. D. Olsen (for H. E. Thompson, Jr.), J. C. Olson, Jr., A. E. Parker, R. M. Parry, R. F. Rintelmann, P. W. Scherschel, Al Schumacher (for G. H. Meuwissen), J. B. Smathers, G. A. Smith, J. W. Smith, J. D. Tanner, J. F. Tufts, D. B. Whitehead, Harvey Wilhelm, R. T. Winbigler. Also in attendance: A. C. Holliday, Earl Manning, F. H. Meinershagen, E. E. Towne. President James B. Smathers presided.

Minutes of Last Meeting—The minutes of the meeting of January 29, 1969, were approved as mailed.

Membership Brochure—Copies of the new NMC membership brochure were distributed. President Smathers commended R. F. Rintelmann, J. R. Welch, and Klenzade Products Division of Economics Laboratory, Inc. for their excellent work in preparation of the brochure. The Directors were urged to use the brochure to increase membership in the Council. Copies are available from the NMC office.

NMC Plaque—President Smathers announced that an NMC plaque had been presented to Dr. C. J. Haller in appreciation of his service as President of the Council. Appreciation was expressed for the generous contribution of Babson Brothers Company in preparing the plaque.

World Association for Buiatrics—It was reported that no new information is available on this meeting since the January 29, 1969, meeting of the NMC Board of Directors.

Location of NMC Annual Meetings—After considerable discussion, it was agreed that the Council should continue to hold annual meetings in Chicago. It was announced that NMC annual meetings are scheduled at the Sherman House, Chicago, Illinois on February 23-25, 1970, and January 25-27, 1971.

Education Committee—Fred H. Meinershagen gave a brief report on the work of the Education Committee.

Membership and Finance Committee—R. F. Rintelmann reported that a large mailing to potential members of the Council in the past year resulted in few new members. He suggested that more direct communication will be required to obtain new state and national members for the Council.

Annual Meeting Program Committee—Dr. James W. Smith reported on the tentative program for the annual meeting of NMC on February 23-25, 1970. The program will concentrate on the problem of mastitis as a disease of the dairy cow, rather than on enforcement of abnormal milk control programs. The program should be of particular interest to veterinarians and dairymen.

Programs and Procedures Committee—Elmer E. Towne reported that the Programs and Procedures Committee met on August 18 in Louisville. The Committee agreed to recommend that the NMC Directors approve the program on abnormal milk control as published on pages 102-103 of the Proceedings of the 1969 Annual Meeting of the Council. This recommendation of the Committee was approved by the Directors.

State Mastitis Council Coordination Committee—Elmer E. Kihlstrum reported that he plans to mail the abnormal milk control program, approved by the NMC Directors on August 19, to all State mastitis councils.

NCIMS Abnormal Milk Program—J. C. Flake gave a brief report on the abnormal milk control program adopted by the National Conference on Interstate Milk Shipments on May 29, 1969, at Denver, Colorado.

Glossary Subcommittee—Dr. R. M. Parry reported that definitions of words used in relation to mastitis and abnormal milk have been compiled. This glossary has been referred to the Programs and Procedures Committee for review.

Research Committee—Dr. James W. Smith stated that the Subcommittee on Screening Tests is making a comparative study of five screening tests for abnormal milk. A. E. Parker recommended that attention be given to the problem of sampling of milk in farm bulk tanks for accuracy in the direct microscopic somatic cell count.

It was reported that the NMC manual on Microbiological Procedures for the Diagnosis of Bovine Mastitis should be available for distribution in October or November 1969. The Directors approved the following price schedule for this manual: Single copy—$2.00 if payment is included with order; $3.00 if payment is not included with order. Ten or more

copies in one order—10 percent discount.

Subcommittee on Hygiene and Dry Cow Therapy—There was considerable discussion of the need for research on this subject and the need for support of a project that has been outlined by this Subcommittee. Dr. R. M. Parry reported that he discussed the research project at the July 29-31, 1969, meeting of the Dairy Division of National Association of State Departments of Agriculture at Jackson, Wyoming. This project was well received by the Dairy Division of NASDA, and it is to be presented at the NASDA meeting in Syracuse, New York in October.

Cooperation with AVMA and USAHA—There was brief discussion of the joint meeting of the Mastitis Committee of American Veterinary Medical Association, the Mastitis Committee of U. S. Animal Health Association and representatives of NMC on January 26, 1969. It was agreed that a similar meeting should be held in conjunction with the 1970 NMC annual meeting in Chicago. President Smathers is to proceed with plans for this conference.

International Association of Milk, Food, and Environmental Sanitarians—A. E. Parker presented the following statement from the IAMFES Executive Board:

> A prime objective of the IAMFES representative to NMC is to enlist cooperative efforts of all representative groups in the National Mastitis Council toward an effective program to ensure the production of quality milk.

This statement was accepted by the NMC Directors.

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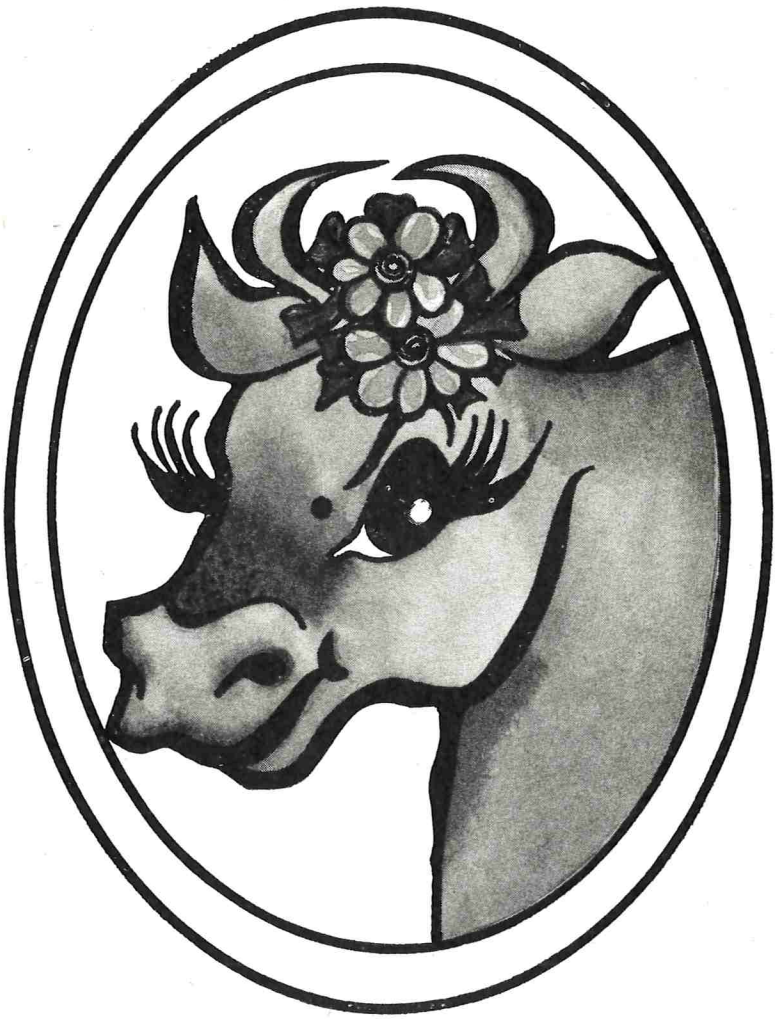

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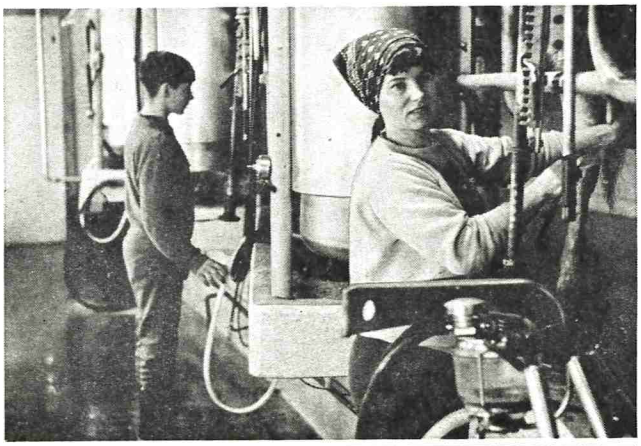

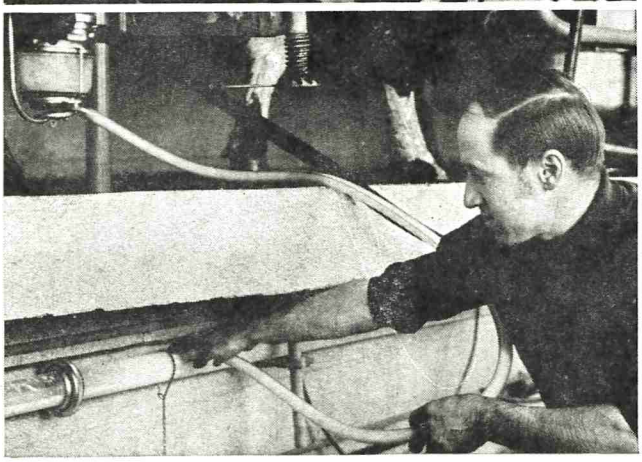

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