PUBLIC HEALTH REPORTS

VOL. 46 **JULY 24, 1931** **NO. 30**

THE NEED FOR CONTINUED STUDY IN PUBLIC HEALTH WORK[1]

By W. S. LEATHERS, M. D., *Dean of the School of Medicine, Vanderbilt University, Nashville, Tenn.*

This is a rather academic subject, but it is one which is exceedingly important and, so far as I know, it is the first time that a topic of this kind has been presented to a conference of the personnel of State and local health departments. It is interesting that the State Commissioner of Public Health, Dr. E. L. Bishop, in his official capacity requested that this subject be placed on the program for this meeting. This title presupposes that one has had some opportunity to gain specific knowledge in the field of public health, either from a general point of view or in special fields. Having had such preparation prior to beginning practical public health work, it is desirable that a person develop for himself a program which will avoid the mistake of becoming a mere routine worker. Considering the many responsibilities which confront the busy all-time health officer and others engaged in practical public health work, it is a relatively easy matter to get into a rut. As a result, one's interest is often decreased, his perspective is circumscribed, and the vigor and efficiency with which he should carry on diminish. There is need for intellectual refreshment and a storing-up of mental reserve, so that the job can be done with a larger measure of success.

It is, therefore, pertinent that the question be asked, How may one who is engaged in what may be termed routine or practical public health work continue to study and keep informed concerning the advancements in preventive medicine and public health? There are a number of ways by which this may be accomplished; but unless one has the incentive to become more than a routine worker, it is probable that this principle will not be observed. Therefore, the first thing which I wish to stress is that a public health worker must have the

[1] Read before the annual conference of the personnel of Tennessee State and local Departments of Public Health, December, 1930. (From the Department of Preventive Medicine and Public Health of the School of Medicine of Vanderbilt University.)

incentive and, I may say, ambition to keep in the forefront in the field of public health. If we consider other professional groups, it is at once obvious that the practitioners of medicine who are most successful are those who read journals, who attend scientific meetings, and who otherwise avail themselves of opportunities for continued study. This is also true of engineers, successful teachers, or persons engaged in research. One who is engaged in investigative work must not only know what has been done in connection with a particular problem, but one must also project a plan of study which may ultimately lead to the solution of the question which one is endeavoring to answer. In the same manner it is important for public health workers to use every means possible to build up their professional status so that they will become stronger and more effective in their respective positions. A State health officer should be particularly interested in and contribute toward this outcome. This will be a means of maintaining a more enlightened and efficient State and local health personnel, and larger dividends will be declared in the expenditure of funds for the prevention and control of disease.

Speaking more specifically, what are some of the methods that may be used for continued study?

1. Every health worker should read and be informed on current literature bearing upon the particular field in which he is engaged. In order that this may be done, the health department, whether it be State or local, should provide three or more journals in which papers are published dealing with general or special phases of public health work. If a health officer is a member of the American Medical Association, which indeed he should be, he will receive regularly the weekly publication of that organization, the Journal of the American Medical Association. In this are published many papers of great value to public health officials. Then, there is the American Journal of Public Health, in which there is subject matter of interest and value not only to the health officer but also to the nurse, sanitary inspector, and others assuming administrative responsibilities in this field of medical service. The Journal of Preventive Medicine, which is the official publication of the John McCormick Institute of Infectious Diseases, also should be made available. This journal publishes papers on investigative work of definite value to the public health worker. Every health department should receive the publications of the United States Public Health Service, especially the PUBLIC HEALTH REPORTS, Public Health Bulletins, and the National Institute of Health Bulletins, which are free to health agencies. Certain journals dealing with special phases of clinical medicine and public health are indispensable, such as the American Journal of Hygiene, American Journal of Tropical Medicine, Bulletin of Hygiene, Journal of Industrial Hygiene, Public Health (official organ of the Society of Medical

Officers of Health of England), American Review of Tuberculosis, Tubercle, Journal of Social Hygiene, and the American Journal of Diseases of Children. The following journals would be valuable for the nursing personnel of a health department: The Public Health Nurse and the American Journal of Nursing. Lastly, the journal Municipal Sanitation will be useful in dealing with problems of sanitation, such as water supply, sewage disposal, refuse disposal, and similar matters. There is much material available; but unless there is a definite interest and effort made in its use, it will simply be put on the shelf. I make mention of these publications largely to emphasize the importance of reading one or more of them regularly.

2. A library should be provided with books on public health. The size of such a library will depend upon the extent of the organization. It is clear that the State health department should have a library not only providing opportunities for study of special topics but also for reference. Books and bound journals should be accumulated over a period of years so that in the course of time the State health department would have library facilities which could be used not only by members of its own staff but by others who may want to investigate special problems bearing upon preventive medicine and public health. A carefully selected list of books which a department of health will find most useful is given in the appendix.

Every local health department should provide some kind of a library for the use of its staff. If an interest is expressed in having a library and a plan is developed for acquiring books from time to time, I am confident that any local health department, even though it be a small one, can provide a number of books and current journals for its personnel which, if used in connection with their work, will be of immense value in a program of study. It seems to me that it would be legitimate to use the contingent fund of the budget within limitations for purchasing certain books or for subscribing to journals. These may be added to by special donations on the part of individuals in the community or local agencies such as federated and civic clubs and the local medical society.

There should be some method of encouraging systematic reading on the part of the health personnel. This depends a good deal on the health officer's interest and perspective in keeping his personnel interested and informed concerning modern public health. A program of reading could be adopted by the health officer, as well as by the nurse, the engineer, the inspector or other workers, and discussions could be stimulated bearing upon certain subjects in weekly or biweekly conferences. Such conferences would afford opportunity for the members of the health department to contribute to each others knowledge by interchange of ideas and by reporting new facts and methods in public health practice. This would be one way of avoiding the indictment of being a mere routine public health worker.

3. The personnel of State and local health departments should attend the annual conference of the State health department. Such conferences are now being held by all of the wide-awake State health organizations. They are proving of immense value in informing the different groups of health workers concerning the problems and difficulties encountered by one another. I have observed that following these meetings one frequently enters upon his task invigorated and with a new perspective, which indicates the unquestioned value of contacts of this kind.

4. It is also very desirable that health officers, engineers, nurses, inspectors, and others engaged in health work attend meetings from time to time which may be of national or sectional importance. For example, the health officer will profit greatly by attending as frequently as possible the annual meetings of the American Medical Association. Many papers are read in the section on preventive and industrial medicine and public health which are of much interest and practical importance in scientific public health. The meetings of the American Public Health Association afford splendid contacts, and the various sections provide opportunity for one to follow his interest in special phases of public health. This organization has sections on public health administration, engineering, child hygiene, statistics, and so forth. The large exhibit may also be observed and studied with profit. However, the greatest asset of these meetings is contact with other workers and, in conversation, finding out in a measure their problems and difficulties and the way in which they solve them. A large acquaintance in the field of public health is well worth while, and in attending such meetings one has the opportunity of knowing and cultivating others who are engaged in the same line of endeavor. This is stimulating and broadens one's educational and scientific horizon.

I should not forget to mention in this connection the meetings of the Southern Medical Association, which are particularly beneficial to those living in this part of the country. The section on hygiene and public health is always well attended. It provides an avenue for the reading and publication of papers on public health subjects with special reference to semitropical conditions. Being present at these meetings and hearing the discussions of such subjects creates a disposition to read the papers which are published monthly in the Journal of the Southern Medical Association. In affiliation with this meeting, there is the annual conference of the National Malaria Committee which provides a splendid program on malaria control. Papers which have been read at this meeting are published in the Southern Medical Journal, and anyone who is engaged in malaria work will find them most helpful in the control of malaria.

Of the greatest importance are the local medical society meetings and the annual meetings of the State medical association. Health officers should attend these meetings and become acquainted with physicians who occupy influential positions in the practice of medicine in their respective communities. All of this has a very definite bearing on the general promotion of public health. Such contacts are stimulating and afford opportunities for acquiring information in the different phases of medical service. I can scarcely see how any health officer can be as successful as he should be unless he keeps in close touch with the local and State medical societies. This is fundamental.

5. Every health worker should become interested in a special problem and should study it with a view to preparing a paper for some scientific meeting. The preparation of a paper necessitates working up the subject both from the standpoint of one's own experience and observations and the reading of literature which bears upon the problem. In this way one finds it necessary to read and study. This kind of effort tends to make a person more accurate, thoughtful, and conservative. It is an excellent way to build up knowledge of a subject. Moreover, there is much need for field studies in epidemiology, maternal mortality, and public-health administration.

6. One phase of public-health work to which I wish to refer is the making of talks or addresses at schools or before other public audiences. I am inclined to think that the average health officer does too much spontaneous talking, if I may use this term; that is, speaking to groups of people without any preparation or without giving much thought to what is to be said. It seems to me that this kind of educational work is not very productive. How much better it would be if one were to select a topic, read somewhat on the subject, and present in a concrete way certain items which are relevant and which will be productive of thought in the listeners.

7. One very important phase of study or reading is the history of preventive medicine and public health. Some years ago the American Public Health Association published a volume entitled "A Half Century of Public Health." This publication includes chapters on the history of different phases of public health service, such as bacteriology, the quarantine system in the United States, 50 years of water purification, milk and its relation to public health, food conservation, and child welfare work in the United States. This volume may be obtained from the American Public Health Association and is of much value for reference in any public health library. Then there is a volume recently published on Pioneers of Public Health, by Mrs. M. E. M. Walker, with a foreword by Sir Humphrey Rolleston, of Cambridge University. This is a most interesting volume and I think that any one will get inspiration and benefit from reading it. I may state that there is an interesting history in connection with the

writing of this book. The names of those who are discussed are on the façade of the London School of Hygiene and Tropical Medicine. Mrs. Walker, on observing these names on the façade of the building, became interested and decided to write a book on these distinguished physicians and scientists. She was encouraged to do so by Sir Andrew Balfour, who, after the manuscript had been finished, found it of such interest that it was decided to publish it in book form. I should also mention in this connection the book by Sir Arthur Newsholme on the Evolution of Preventive Medicine. Every public health worker should read this small volume. It adds greatly to the enthusiasm and inspirational qualities of a task if one has an appreciation and respect for the background of the field in which he is engaged. It seems to me that reading or study should be directed somewhat along the line of the background or the history of public health, so that one may gain new inspiration in meeting the difficult problems with which he is confronted. We should know something of the trials, sacrifices, and achievements of the pioneers of public health.

8. In conclusion, I wish to suggest that some plan should be worked out by each State so that the personnel of the local health departments can avail themselves of continued study in postgraduate courses in certain universities. Short intensive courses of this kind can be made most helpful and constructive in building up one's professional background. These courses are referred to in England as "refresher courses." Last year five health officers were brought in from as many counties in Tennessee and provision was made for them to take a two months' course provided by the department of preventive medicine and public health of Vanderbilt Medical School in cooperation with the Tennessee State Health Department. Substitutes were provided for these men so that their work continued under effective direction. It seems to me that this procedure is particularly desirable, and I know of no plan which would afford better opportunity for continued study on the part of health personnel than for a scheme to be worked out by the United States Public Health Service and State health departments in cooperation with educational institutions, possibly with the aid of philanthropic agencies, so that postgraduate instruction may be offered to health officers, nurses, and others who may be interested in gaining new knowledge and in keeping in the forefront of their profession.

APPENDIX

The accompanying list of books should be in the library of every State and local health department. It has been prepared with the assistance of Dr. Henry E. Meleney, associate professor, and Dr. A. E. Keller, assistant professor, in the department of preventive medicine and public health, Vanderbilt University School of Medicine.

GENERAL

Fitzgerald, J. G.: An Introduction to the Practice of Preventive Medicine. (2d edition.) 1926.
Hope, E. W., and Stallybrass, C. O.: Textbook of Public Health. (9th edition.) 1926.
Kenwood, H. R., and Kerr, H.: Hygiene and Public Health. (8th edition.) 1929.
Park, W. H.: Public Health and Hygiene. 1928.
Rosenau, M. J.: Preventive Medicine and Hygiene. (5th edition.) 1928.
Vaughan, V. C.: Epidemiology and Public Health. 2 vols. 1922.
Broadhurst, J.: Home and Community Hygiene. (4th edition.) 1929.
Dublin, L. I.: Health and Wealth. 1928.
Horwood, M. P.: Public Health Surveys. 1921.
Moore, H. H.: Public Health in the United States. 1923.
Smiley, D. F., and Gould, A. G.: Community Hygiene. 1929.
Cecil, R. L.: A Textbook of Medicine. 1927.
Osler, W., and McCrea, T.: The Principles and Practice of Medicine. (11th edition.) 1930.
Holt, L. E., and Howland, J.: Diseases of Infancy and Childhood. (9th edition.) 1926.
Stitt, E. R.: The Diagnostics and Treatment of Tropical Diseases. (5th edition.) 1929.
Williams, J. W.: Obstetrics. (6th edition.) 1930.

PUBLIC HEALTH ADMINISTRATION

American Child Health Association, Research Division: A Health Survey of Eighty-Six Cities. 1925.
American Public Health Association: Appraisal Forms, Rural and City.
Overton, F., and Denno, W. J.: The Health Officer. 1919.
Mustard, H. S.: A Cross Section of Rural Health. 1930.
McCombs, C. E.: City Health Administration. 1927.
Schmeckebier, L. F.: The Public Health Service, Its History, Activities, and Organization. Service Monograph of the United States Government, No. 10. Institute for Government Research. Johns Hopkins Press. 1923.
Leigh, R. D.: Federal Health Administration in the United States. 1927.

VITAL STATISTICS

Brinton, W. C.: Graphic Methods for Presenting Facts. 1923.
Chaddock, R. E.: Principles and Methods of Statistics. 1925.
Falk, I. S.: Principles of Vital Statistics. 1923.
Pearl, R.: Introduction to Medical Biometry and Statistics. (2d edition.) 1930.
Whipple, G. C.: Vital Statistics. 1922.
U. S. Census Bureau: Index to the International List of Causes of Death and Manual of Joint Causes of Death. (1930 revision.) 1931. Washington, D. C.: Government Printing Office.

EPIDEMIOLOGY

Bushnell, G. E.: The Epidemiology of Tuberculosis. 1920.
Hamer, W.: Epidemiology Old and New. 1929.
Stallybrass, C. O.: The Principles of Epidemiology and the Process of Infection. 1931.

COMMUNICABLE DISEASES

Bowers, A. G., and Pilant, E. B.: Communicable Diseases for Nurses and Mothers. 1929.
Chapin, C. V.: Sources and Modes of Infection. (2d edition.) 1912.
McLaughlin, A. G.: The Communicable Diseases. 1923.
Nichols, H. J.: Carriers in Infectious Diseases. 1922.
Rolleston, J. D.: Acute Infectious Diseases. (2d edition.) 1929.
Shamberg, J. F., and Kolmer, J. A.: Acute Infectious Diseases. 1928.
Stimson, P. M.: A Manual of the Common Contagious Diseases. 1931.
Medical Research Council, Bacteriological Committee: Diphtheria. 1923.
Gay, F. P.: Typhoid Fever. 1918.
Fishberg, M.: Tuberculosis. 1922.
Myers, J. A.: Modern Aspects of the Diagnosis, Classification, and Treatment of Tuberculosis. 1927.
Myers, J. A.: The Care of Tuberculosis. 1924.
Myers, J. A.: Tuberculosis Among Children. 1930.
Shamberg, J. F.: Diseases of the Skin and the Eruptive Fevers. 1921.
Stakle, J. H.: Dermatology and Syphilology for Nurses. 1930.
Stokes, J. H.: Modern Clinical Syphilology. 1928.
Sutton, R. L.: Diseases of Skin. 1928.

BACTERIOLOGY AND PARASITOLOGY

Jordon, E. C., and Falk, I. S.: The Newer Knowledge of Bacteriology and Immunology. 1928.
Park, W. H., and Williams, W. A.: Pathogenic Microorganisms. (9th edition.) 1929.
Zinsser, H.: A Textbook of Bacteriology. (6th edition.) 1928.
Stitt, E. R.: Practical Bacteriology, Blood Work and Animal Parasitology. (8th edition.) 1927.
Chandler, A. C.: Introduction to Human Parasitology. 1930.
Boyd, M. F.: An Introduction to Malariology. 1930.

NUTRITION AND FOOD

Blum, S.: Practical Dietetics for Adults and Children in Health and Disease. (3d edition.) 1928.
Eddy, W. H.: Nutrition. 1928.
Kelly, E., and Clements, C. E.: Market Milk. 1923.
Klein, L. A.: Principles and Practice of Milk Hygiene. 1917.
Lusk, G.: The Elements of the Science of Nutrition. (4th edition.) 1928.
McCollum, E. V., and Simonds, N.: The Newer Knowledge of Nutrition. (3d edition.) 1925.
McCollum, E. V., and Simonds, N.: Food, Nutrition, and Health. (2d edition.) 1929.
Parsons, T. R.: Fundamentals of Biochemistry in Relation to Human Physiology. (3d edition.) 1928.
Rose, M. S.: Feeding the Family. 1925.
Rose, M. S.: Foundations of Nutrition. 1929.
Sherman, H. C., and Smith, S. L.: The Vitamins. (2d edition.) 1931.
Stiles, P. G.: Nutritional Physiology. (5th edition.) 1924.
Thom, C., and Hunter A., C.: Hygienic Fundamentals of Food Handling. 1924.

MATERNAL, CHILD, AND SCHOOL HYGIENE

Van Blarcom, C.: Obstetrical Nursing. 1922.
Zabriskie, L.: Nurses' Handbook on Obstetrics. 1929.

Arlitt, A. H.: Psychology of Infancy and Early Childhood. 1928.
Baker, S. J.: Child Hygiene. 1925.
Brown, M. A.: Teaching Health in Fargo. 1929.
Clark, M. A.: Recording and Reporting For Child Guidance Clinics. 1930.
DeSchweinitz, P.: Growing Up. 1928.
Rand, W., Sweeny, M., and Vincent, E.: Growth and Development of the Young Child. 1930.
National Education Association and American Medical Association: Health Education—A Program for Public Schools and Teacher-Training Institutions. Report of the Joint Committee on Health Problems in Education. 1930.
Sellew, G.: Pediatric Nursing. 1926.
Terman, L. M., and Almack, J. C.: Hygiene of the School Child. 1929.
Thom, D. A.: Everyday Problems of the Everyday Child. 1927.
Wood, T. D., and Rowell, H. G.: Health Supervision and Medical Inspection of Schools. 1927.
Woodbury, R. M.: Infant Mortality and Its Causes. 1927.

INDUSTRIAL HYGIENE

Clark, W. I.: Health Service in Industry. 1922.
Hamilton, A.: Industrial Poisons in the United States. 1925.
Hope, E. W.: Industrial Hygiene and Medicine. 1923.
Kober, G. M., and Hayhurst, E. R.: Industrial Health. 1924.

MENTAL HYGIENE AND SOCIOLOGY

Burnham, W. H.: The Normal Mind. 1924.
Davies, S. P.: Social Control of the Mentally Defective. 1930.
Groves, E. R., and Blanchard, P.: Introduction to Mental Hygiene. 1930.
Porter, R. L., Kenworthy, M. E.: Mental Hygiene and Social Work. 1929.
Sayles, M. B.: The Problem Child at Home. 1928.
Tredgold, A. F.: Mental Deficiency. (4th edition.) 1922.
Wickman, E. K.: Children's Behavior and Teachers' Attitudes. 1928.
White, W. A.: An Introduction to the Study of the Mind. 1924.
Byington, M.: What Social Workers Should Know About Their Own Community. 1929.
Landis, B. V.: Handbook of Rural Social Resources. 1928.
Townsend, H.: Social Work, A Family Builder. 1926.

PUBLIC-HEALTH NURSING

Beard, M.: The Nurse in Public Health. 1929.
Brainard, A.: The Evolution of Public Health Nursing. 1922.
Brainard, A.: Organization of Public Health Nursing. 1919.
Burgess, M.: Nurses, Patients and Pocketbooks. 1928.
Dock, L., and Stewart, I.: Short History of Nursing. 1924.
Gardner, M. S.: Public Health Nursing. (2d edition.) 1927.
Hodgson, V.: Tuberculosis Nursing for Public Health Nurses. 1929.
National Organization Public Health Nursing: Manual of Public Health Nursing. 1928.
National Organization Public Health Nursing: Board Members Manual. 1930.
Pillsbury, E.: Nursing Care of Communicable Diseases. 1929.
Williams, J.: Personal Hygiene Applied. 1928.
Wright, F.: Industrial Nursing. 1928.

SANITARY ENGINEERING AND SANITATION

Ehlers, V. M., and Steel, E. W.: Municipal and Rural Sanitation. 1927.
Hardenbergh, W. A.: Home Sewage Disposal. 1924.

Kibbey, C. H.: The Principles of Sanitation. 1927.
Phelps, E. B.: The Principles of Public Health Engineering. 1925.
Winslow, C.-E. A.: Fresh Air and Ventilation. 1926.

LEGAL MEDICINE

Hemenway, H. B.: Legal Principles and Administration. 1914.
Tobey, J. A.: Public Health Law. 1926.
Peterson, F., Haines, W. S., and Webster, P. W.: Legal Medicine and Toxicology. 2 vols. (2d edition.) 1923.
Robertson, W. G. A.: Manual of Medical Jurisprudence and Toxicology. 1921.

HISTORICAL AND BIOGRAPHICAL

Gorgas, M. D., and Hendrick, B. J.: William Crawford Gorgas, His Life and Work. 1924.
Jordan, O. E., Whipple, G. C., and Winslow, C.-E. A.: Pioneer of Public Health—William Thompson Sedgwick. 1924.
Kelly, H. A.: Walter Reed and Yellow Fever. 1923.
Nash, R.: A Short Life of Florence Nightingale. 1925.
Newsholme, A.: The Evolution of Preventive Medicine. 1927.
Seelig, M. G.: Medicine—An Historical Outline. 1925.
Trudeau, E. L.: Autobiography. 1916.
Vallery-Radot, R.: Life of Pasteur. 1927.
Walker, M. E. M.: Pioneers of Public Health. 1930.
Winslow, C.-E. A.: The Life of Hermann M. Biggs, Physician and Statesman of Public Health. 1929.

MISCELLANEOUS

American Society for the Control of Cancer: Essential Facts About Cancer. 1924.
Barker, L. F., and Sprunt, T. P.: The Degenerative Diseases, Their Cause and Prevention. 1925.
Dorland, W. A. N.: The American Illustrated Medical Dictionary. (13th edition.) 1925.
Murrell, W.: What To Do in Cases of Poisoning. (13th edition.) 1926.
Pardee, H. E. B.: What You Should Know About Heart Disease. 1928.

THE CHEMISTRY OF CELL DIVISION

II. THE RELATION BETWEEN CELL GROWTH AND DIVISION IN AMOEBA PROTEUS

By H. W. Chalkley, *Physiologist, Division of Pharmacology, National Institute of Health, United States Public Health Service* [1]

INTRODUCTION

In the first of this series of papers, Voegtlin and Chalkley (1930) reported results obtained in respect to the action of glutathione on division in *Amoeba*. During the course of the investigation it became evident that more complete information upon the relations between cell growth, division, and polynucleation was desirable in order to

[1] The writer wishes to express his thanks to Dr. H. Kohler, biophysicist, National Institute of Health, for helpful suggestions and criticism of the mathematical treatment of the results.

provide a basis for the evaluation of further data that it is hoped may be secured in respect to the chemistry of cell division. This paper represents the results of an attempt to secure additional information on these matters. The investigation was based on the following considerations:

The individual organisms in a culture of *Amoeba proteus* vary widely in volume. They also vary as to the number of nuclei they contain. Stolc (1906) and Levy (1924) observed as many as six nuclei in a single cell. The latter observer asserts that cells with more than one nucleus are generally somewhat larger than those with single nuclei, and he maintains that these polynucleates result from failure of nuclear and cytoplasmic division to coincide. If Levy's findings are true, a close correlation should exist in *Amoeba* between the volume of the cell and the number of nuclei contained therein.

Voegtlin and Chalkley (loc. cit.) found that the percentage of cell division occurring in a given time in a group of mononucleate *Amoebae* is dependent, if the range of volume is narrow, upon the average volume for the group. This is also true for the number of polynucleate *Amoebae* found in the group at the end of a given period, indicating that nuclear division is also a function of volume. It was assumed that differences in volume in *Amoeba* are primarily growth differences, and that growth is an increasing function of time. If this be true, any cellular characteristic that changes with volume, *under the normal conditions of culture*, is likewise a function of time, and it should be a simple matter to ascertain the course of such changes with age by a statistical study of their relations to volume.

In view of these considerations, it appeared that if the relation between time and volume—i. e., the course of growth of *Amoeba*—was ascertained, it might be possible from a statistical study of *Amoebae* of different volumes to ascertain the relation of division of nucleus and of cytoplasm and the rate of growth to age and their relation to each other. This should furnish valuable information as to the normal intracellular conditions associated with cell division in this organism, which should assist in the planning of further experimental research on division and in providing criteria for the selection of more uniform material for any physiological and pharmacological experimentation on *Amoeba proteus*.

A statistical study on *Amoeba proteus* as cultured in this laboratory was therefore instituted to ascertain the relation of the volume of the cell to (*a*) time, (*b*) the nucleo-cytoplasmic ratio, (*c*) the number of nuclei in the cell, and (*d*) the distribution of individuals of different volumes and types of nucleation in a culture.

MATERIAL AND METHODS

Amoeba proteus (Sch., 1916) from a strain which was obtained originally from the Johns Hopkins University, and which has been continuously cultured by a single procedure (Chalkley, 1930) for the past two years, was used throughout.

While some variation existed from culture to culture, it does not appear that it was sufficient to constitute a serious source of error,

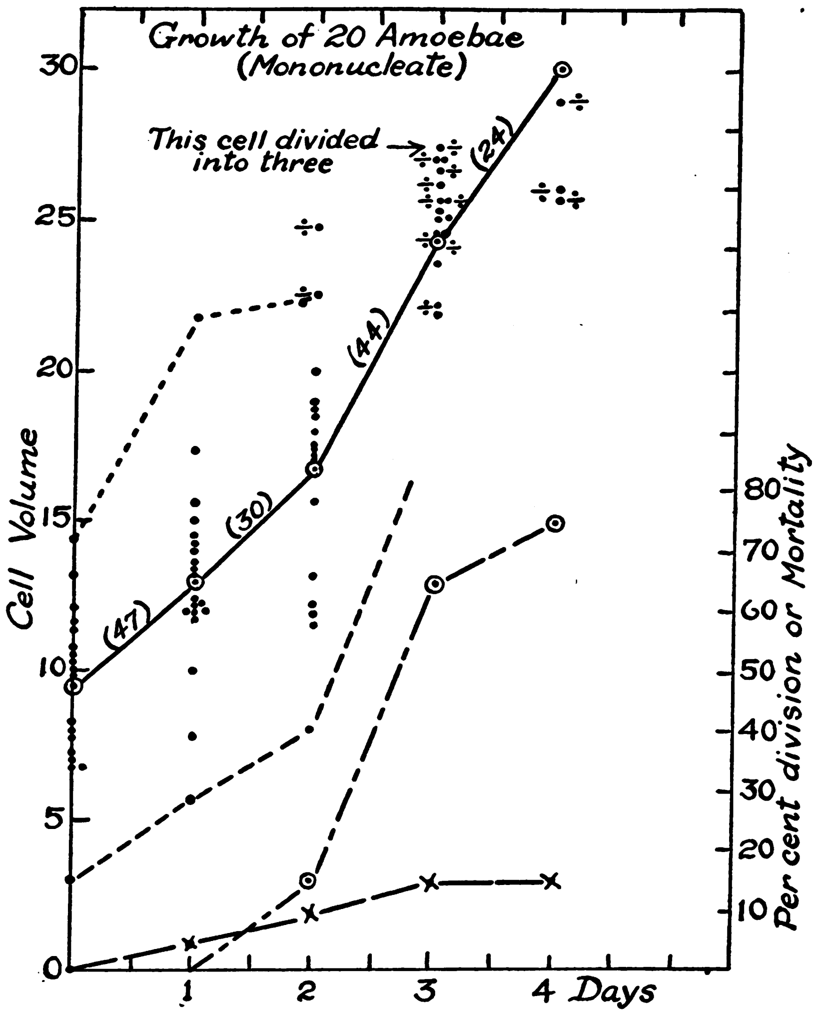

FIGURE 1.—Daily growth of 20 mononucleate *Amoebae*. Solid line represents average growth (increase in volume); fine broken lines, growth of largest and smallest *Amoebae*, heavy broken line, percentage mortality; dotted and dashed line, percentage division. Division signs opposite points indicate division of cells. Figures in parentheses give percentage growth rate on successive days

and in some sets of measurements, as will be pointed out later, this was tested.

The measurements of cell and nuclear volumes were made by means of a compound microscope, with an eyepiece micrometer, using a 20-X ocular and 16-mm. apochromatic objective when measuring the cell, and a 20-X ocular and 4-mm. apochromatic objective when measuring the nucleus. In measuring cell volumes the *Amoebae* were repeatedly drawn into and ejected from a capillary pipette and thus stimulated until they assumed a spherical shape. Then their

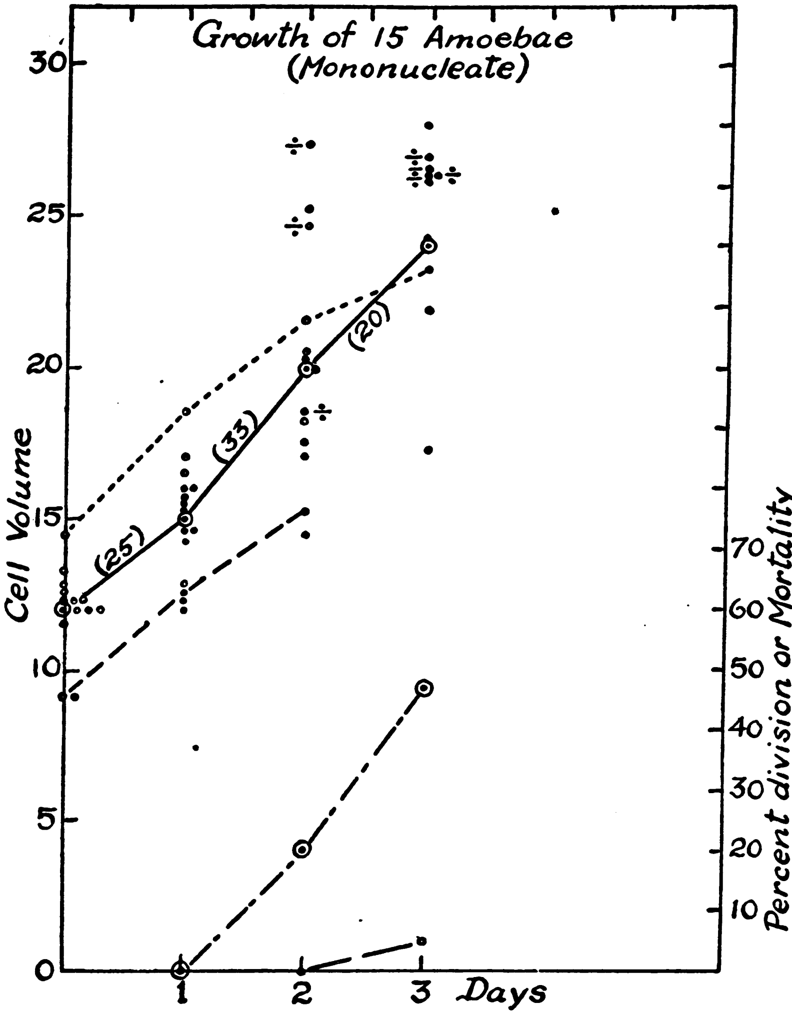

FIGURE 2.—Daily growth of 15 mononucleate *Amoebae* (daughter cells of those dividing in Figure 1). Solid line represents average growth (increase in volume); fine broken lines, growth of largest and smallest *Amoebae;* heavy broken line, percentage mortality; dotted and dashed line, percentage of division. Division signs opposite points indicate division of cells. Figures in parentheses give percentage growth rate on successive days

diameters were ascertained and their volumes calculated. The measurements thus secured proved sufficiently accurate, and it was fortunately not necessary to use the more precise but more time-consuming methods available (Chalkley, 1929).

In measuring nuclear volumes each nucleus was kept under observation until several measurements of its three dimensions had been secured. The shape of the nucleus varies from ellipsoid in most very small cells to discoid in the larger cells. Neglect of this change of

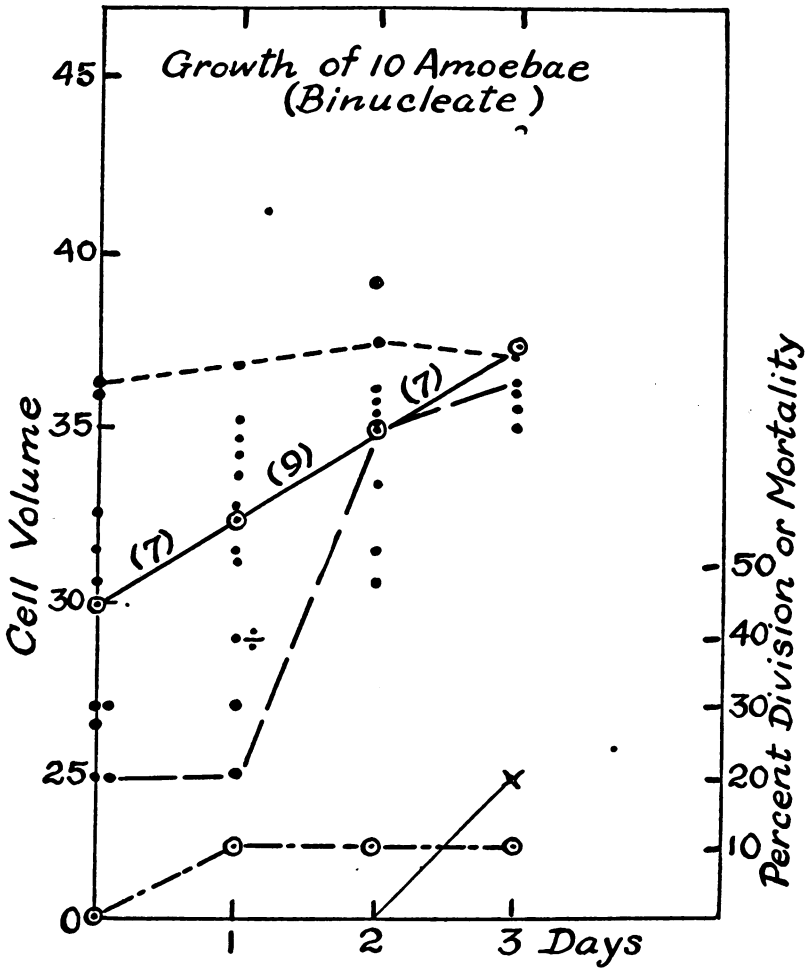

FIGURE 3.—Daily growth of 10 binucleate *Amoebae.* Solid line represents average growth (increase in volume); fine broken lines, growth of largest and smallest *Amoebae;* heavy broken lines, percentage mortality; dotted and dashed line, percentage division. Division signs opposite points indicate division of cells. Figures in parentheses give percentage growth rate on successive days

shape, however, appeared to constitute a negligible error in comparison with the error inherent in the technique of measurement of the dimensions, and so an approximation was made by considering it an ellipsoid and calculating the volume on that basis.

In this paper all measurements given in the text and figures are in arbitrary units. They can be converted to absolute volumes in cubic millimeters by multiplying cytoplasmic or cell volumes by 0.000098 and nuclear volumes by 0.00000078.

CELL GROWTH IN AMOEBA

To obtain a representative growth curve for the cell, 20 small mononucleate *Amoebae* and 10 large binucleate *Amoebae* were selected. Their volumes were measured and then each was put into a 25-c.c. pyrex glass beaker containing 2 to 3 cubic centimeters of fluid from the culture from which the *Amoebae* were taken. Care was exercised to ensure an ample supply of food organisms in each beaker. Then the volume of each *Amoeba* was measured daily for three successive days. Divisions occurred in the group of 20 originally small *Amoebae* during the second, third, and fourth days of the experiment. The daughter cells as formed were also isolated and their volumes measured over a period of three days. Divisions occurred in this group on the second and third days. Only one division, and that on the *first* day, occurred in the group of 10 binucleate *Amoebae*. The original group of 20 small *Amoebae*, the group composed of their daughter cells, and the group of large binucleate *Amoebae* are hereafter referred to as Groups 1, 2, and 3, respectively. The measurements, including the sums of the volumes of the pairs of daughter cells the first day found were averaged each day for each group, and these averages were plotted as a function of time. The resulting curves, showing the average growth (increase in volume with time) in each of the three groups, are presented in Figures 1, 2, and 3. In these figures the daily measurements of each individual are plotted, as well as the averages, to enable the reader to form an idea of the variation encountered. This for the individual cells was of considerable magnitude. In addition, the individual growth curves of the smallest and largest cell in each group are indicated, as is also the percentage of division and mortality, and the average daily percentage rate of growth.

From these figures it is seen that the volume of the cell is in fact an increasing function of time, so that cell characteristics which are functions of the volume may properly be compared as functions of age, provided, of course, that *averages* and not *individuals* are dealt with.

Attention is drawn to the close grouping both as to volume and age of the cells in Groups 1 and 2 that divided. The average volume at which division occurred in Group 1 is 25.0. The modal[2] volume is between 25 and 30, and the range 18.6 to 29.0 with an average deviation of 1.8.

---

[2] The mode is, of course, the *most frequent* in a series of measurements. The modal class (in this case the class of volumes between 25 and 30) is the class in which the greatest number of observations fall.

In Group 2 the average volume is 25.3, the mode is between 25 and 30, the range from 18.5 to 27.4, and the average deviation 2.1.

If we consider, as seems most reasonable in view of the range of original volumes in Group 2 in which all cells were known to be less than 24 hours old, that the cells in Group 1 were of similar age when selected, it appears that of the 22 cells that divided (Groups 1 and 2) 5, or 23 per cent, with an average volume of 23.5, divided on the second day; 14, or 64 per cent, with an average volume of 25.4 on the third day, and 3, or 23 per cent, with an average volume of 26.9 on the fourth day. This gives an average period from division to division of 2.9 days. From Figure 3 it will be noted that in the group of large binucleates, whose average volume at the beginning of the experiment was 29.9 (just the average reached by Group 1 at the end of the experiment), there was only one cell division, and this on the first day. This may indicate that with increase in cell volume above the mode of 25–30 found for Groups 1 and 2, and the occurrence of nuclear division, the tendency toward cytoplasmic division is decreased even though the presence of two nuclei within the cell might *a priori* be expected to increase rather than decrease such a tendency. In addition it is noticeable that the mortality tends to increase with age and volume. This is shown by comparison of the mortality in Group 3 with that in Groups 1 and 2. This confirms the conclusion of Levy (loc. cit.). These figures as a whole show very definitely that in *Amoeba* the volume of the cell is normally (i. e., under cultural conditions) an increasing function of time. So, using the term *age* in a general sense as referring to the state of development of the cell within the growth cycle from cell division to cell division, it may be said that cells in the average grow steadily larger with age. If the polynucleates measured are typical of the very large cells, they suggest that the rate of cell growth may be a decreasing function of time and volume.

There are other facts, however, of considerable interest. It will be noted that one cell in Group 1 (see fig. 1) divided into three. While it must be admitted that this division was not actually observed, it appears, in view of other data given later, more probable that this cell divided thus directly than that the three small cells found were the result of two rapidly succeeding divisions. The cells, however, were of such a size (8.5, 8.4, and 10.4 in volume, respectively) that this might have been the mechanism of production. In either event such a division indicates the method of production of the very small cells (having volumes as low as 2.0) that occasionally appear in the cultures.

It was very noticeable that *Amoebae* undergo a striking change in appearance with division. Just prior to division the cytoplasm is quite granular and frequently has a slight dusky yellowish tinge in the nongranular portions. The streaming of the cytoplasm appears somewhat sluggish. The nucleus differs strongly from the cytoplasm in refractive index, and the chromatin blocks at its periphery are easily distinguished. The nuclear surface appears coarsely granular. The periphery of the nucleus is often slightly irregular and its shape is discoid (occasionally bent, irregular). Just after division the cytoplasm is more hyaline, less granular, and the streaming active. The cell reacts very promptly to mechanical stimuli and adheres very strongly to the substrate. The nucleus apparently differs little from the cytoplasm in refractive index and is often hard to find. The chromatin blocks are usually invisible and the nuclear surface shows none or extremely fine granulation. The periphery of the nucleus is smooth and its shape usually ovoid, occasionally slightly discoid. The picture presented in this change is one of rejuvenation accompanied by an increased dispersal of the cell colloids.

Figure 4 shows the growth curve of a hexanucleate *Amoeba*. It is interesting to note that the greatest growth increment per 24 hours observed in this cell was only slightly in excess of the average growth increment in Group 1 and much less than the increment of the smallest cell in that group during the third day. The percentage rate of growth was very much less in this large cell than in the mononucleates. It would have been desirable to secure more of these giant cells, but none were available.

THE RELATION BETWEEN CELL VOLUME AND THE RATE OF GROWTH

In the preceding section it is noted that the rate of growth of the cell is apparently a function of time. Since, on an average, volume is a function of time, the plotting of the rate of cell growth as a function of volume should bring this out clearly.

From the preceding data it is a simple matter to ascertain the average per cent increase in volume per 24 hours as a function of volume. To do this all measurements of cell volume, together with their corresponding measurements after 24 hours, were recorded in order of magnitude of the initial measurement. A frequency table was then constructed for the initial measurements with an interval of 5, and the difference between the averages of the two sets of measurements for each interval, expressed as a percentage of the average of the initial measurements, was calculated. The mean deviation of the percentage rates of growth at all intervals of volume, except those which contained only one *Amoeba* (see fig. 5), was less than 10 per cent. These values were then plotted as a function of volume, taking each to correspond with the mean of the corresponding frequency interval. The curve obtained is presented in Figure 5. From this it will be seen that *the percentage rate of growth is a decreasing function of the cell volume* and tends to become constant at about a volume of 35–40. Considering this in terms of age, it indicates that *the rate of cell growth is greatest just after division and progressively lessens as the cell ages* until the time when cell division usually occurs. In cells that live longer the rate becomes approximately constant.

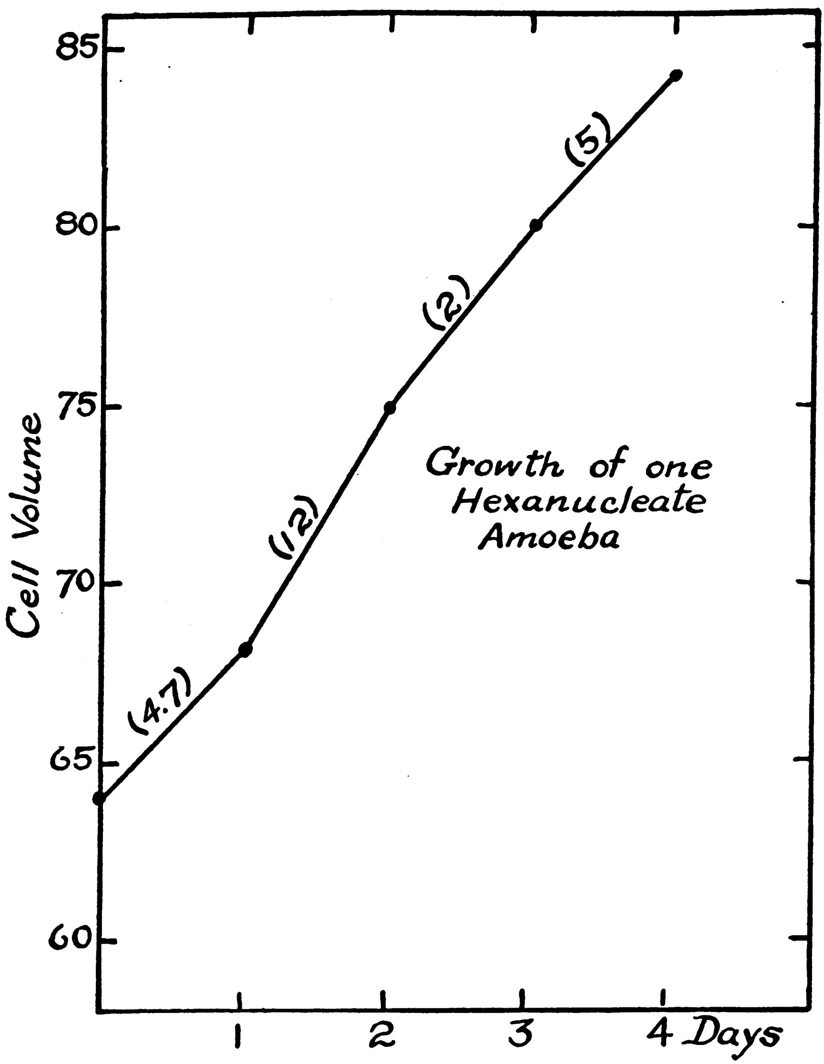

FIGURE 4.—Daily growth (increase in volume) of one hexanucleate *Amoeba*. Figures in parentheses represent growth on successive days

THE RELATION BETWEEN CELL VOLUME AND THE NUCLEO-CYTOPLASMIC RATIO

The volumetric ratio of cytoplasm to nucleus has long been known to change during the cycle from division to division in many cells, and this change has been linked with cell division. (Hertwig, 1903; Minot, 1895.) While many of the contentions of these investigators undoubtedly can not be sustained, the changes in this ratio are of interest in that they are measurable intracellular growth changes, and it is only by the correlation of such changes with environmental changes that the problems of cell division and cell growth can be attacked. Further, all such changes that can be quantitatively correlated with volume may serve as criteria in the selection of material. It was therefore decided to make a study of this ratio.

To ascertain this, 80 *Amoebae* were selected and the volumes of nuclei and cells measured. Care was taken to get an even distribution over a wide range of cell volumes. Sixty of the *Amoebae* were taken from one culture and the other 20 from three other cultures. Measurements obtained from these conformed to those obtained from the

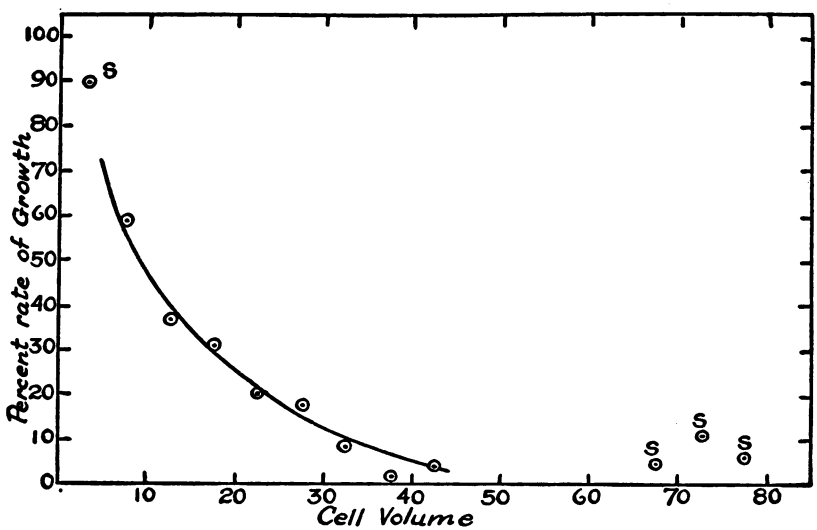

FIGURE 5.—Mean percentage rate of cell growth (increase in volume) for *Amoebae* of different cell volumes, based on 333 measurements on 46 *Amoebae*. Points marked "S" were obtained from measurements on only one *Amoeba*

single culture, indicating that the cultural variation encountered does not constitute a serious source of error in these measurements. From these measurements the volumetric ratio of cytoplasm to nucleus was calculated for each *Amoeba* and plotted as a function of cell volume. The resulting curve, smoothed by fives, is presented in Figure 6.

From the figure it is apparent that *with increasing volume the ratio of cytoplasm to nucleus increases;* i. e., it is an increasing function of volume, and therefore of the age (in a general sense) of the cell. Further, the flattening of the curve as the cell volume increases appears to indicate that the ratio tends to become constant in cells with a volume of over 50.

The curve obtained appeared so nearly inverse to that obtained for the rate of growth as a function of volume that it appeared of interest to plot the rate of growth as a function of the nucleo-cytoplasmic ratio by interpolation of values for volume in Figures 5 and 6. The resulting curve is shown in Figure 7. This curve indicates very clearly that *the rate of growth is nearly inversely proportional to the nucleo-cytoplasmic ratio over a very wide range of volume.* It is interesting to

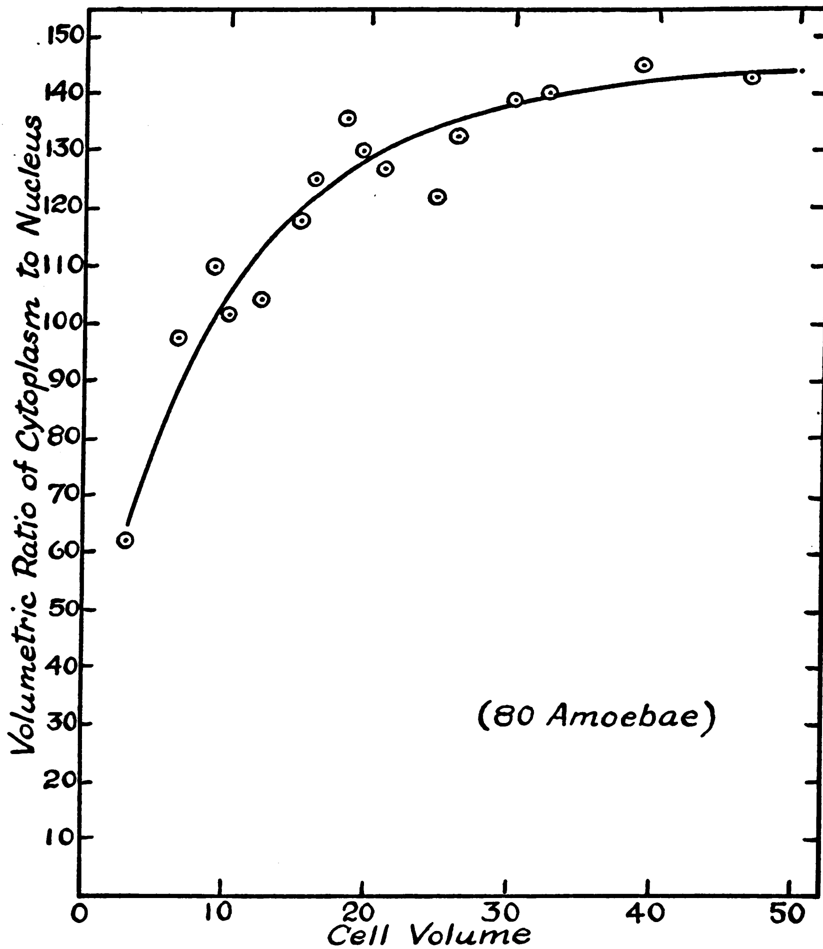

FIGURE 6.—Relation between cell volume and the volumetric ratio of cytoplasm to nucleus, based on measurements of cytoplasm and nuclei of 80 *Amoebae* of different volumes. Each point is an average of the measurements on five *Amoebae*

note that the departure from this relation first becomes marked at the point where the ratio of cytoplasm to nucleus reaches a value of 125–130 to one and the growth rate has decreased to about 30 to 25 per cent per 24 hours. This, it will be noted, occurs when the volume has increased to about 20, which is approximately the average volume attained by the *Amoebae* in Groups 1 and 2 (figs. 1 and 2) on the second day, at which time division first occurred.

THE RELATION BETWEEN CELL VOLUME AND THE NUMBER OF NUCLEI

In the section on cell growth it is suggested that there is a tendency toward suppression of cytoplasmic division in cells that attain a volume in excess of the apparent mode for cell division (25–30); i. e., that such cells tend to become polynucleate. By the time that the data on the nucleo-cytoplasmic ratio had been gathered it had become evident that cells in excess of this volume were nearly all polynucleate. Therefore the attempt was made to define the relationship more precisely. To do this the volumes of 284 *Amoebae* (from several

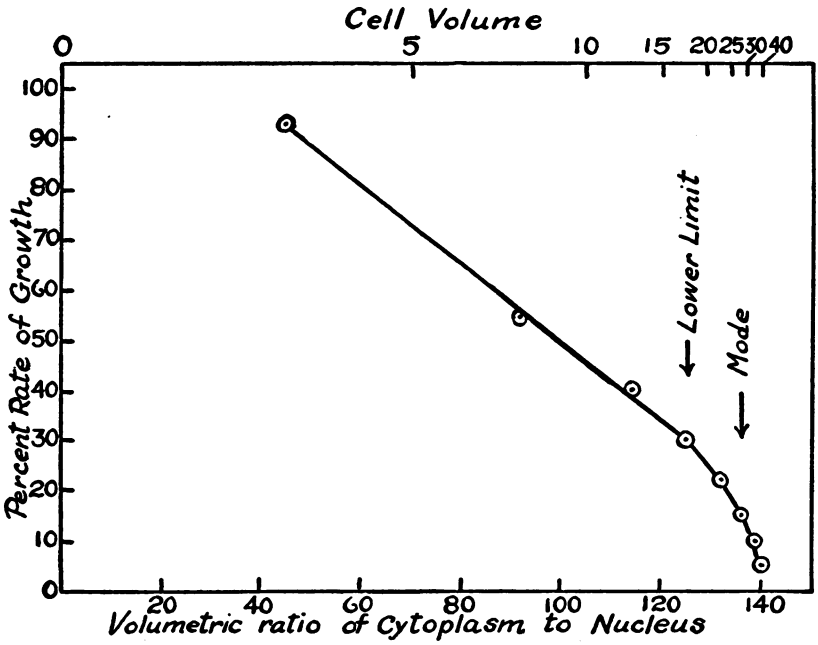

FIGURE 7.—Relation between percentage rate of cell growth and ratio of cytoplasm to nucleus, based on data given in Figures 5 and 6. The arrows indicate the approximate mode and lower limit, respectively, for cell division in the originally mononucleate cell

cultures) were measured and the number of nuclei in each cell was counted. The measurements of volume were then grouped in a frequency table using an interval of 5, and the percentage of each type of nucleation (i. e., mono, bi, tri nucleate, etc.) found in each interval was calculated. These percentages for each type were plotted as a function of cell volume. The resulting curves are presented in Figure 8.

From the figure it will be seen that the *different types of nucleation appear in regular order as the volume of the cells examined is increased,* and that each type successively increases in percentage frequency until it reaches or approaches a maximum, with the exception of the mononucleates, which, of course, are originally at their maximum.

The volume classes of the maximal percentages of the types are of considerable interest. If a glance is given to Figures 1 and 2 it will be noted that the modal volume found for division lies between 25 and 30. The maximum for the percentage of binucleates also is at this point, which must be the case if Levy's contention is true that the formation of polynucleates is due to failure of the cytoplasm to divide.

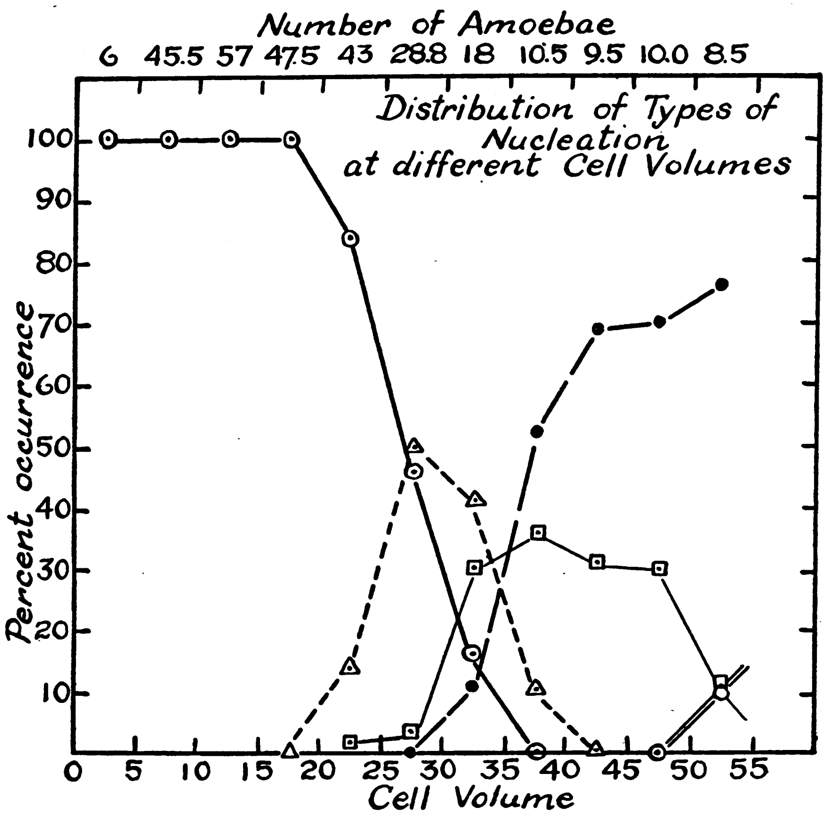

FIGURE 8.—Percentage distribution of *Amoebae* of different types of nucleation at different cell volumes. Heavy continuous line represents mononucleates; fine broken line, binucleates; fine continuous line, trinucleates; heavy broken line, quadrinucleates; double fine line, pentanucleates

Now, one-half of the modal volume at which cell division is most frequent is necessarily approximately the modal volume of the mononucleate cell just after division and (see fig. 9) very close to the modal volume for the mononucleate cell. Further, it will be noted that at the volume where the binucleates reach their maximum the percentage of tri and quadri nucleates begins to rise rapidly. Hence, if this is evidence of a systematic change, it is to be expected that the incidence of the pentanucleates at a volume of 50–55 is indicative that at about this volume the percentage of quadrinucleates will be maximal. Taking, then, the mean (52.5) of the class 50–55 as the probable value for the modal volume of the quadrinucleates, and the modal volumes for the bi and tri nucleates as indicated on the curves,

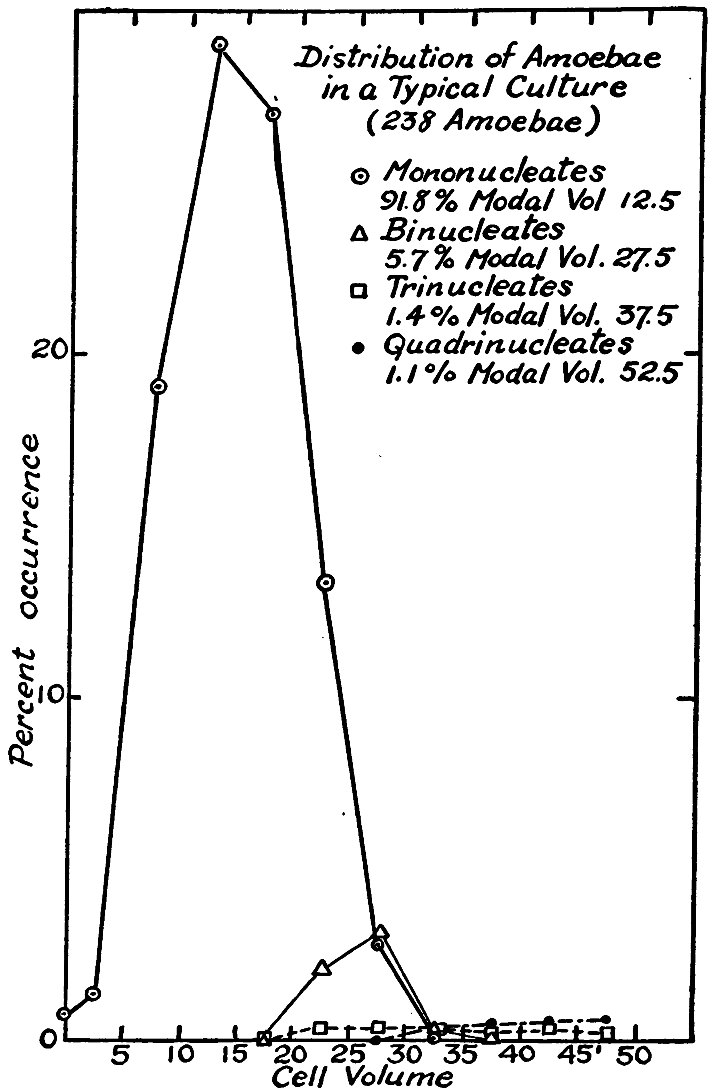

FIGURE 9.—Percentage distribution of *Amoebae* in a typical culture, with respect to volume and nucleation. The area under each curve is proportional to frequency of occurrence of the nuclear type in the culture. The individual curves show the percentage distribution of volume in respect to the entire culture for each type of nucleation up to the quadrinucleate

it will be seen that they are very nearly multiples of the modal volume of the mononucleate, as represented by one-half the modal volume at cell division; that is, *the modal volume for each type of polynucleate is* *very nearly the modal volume of the mononucleate multiplied by the number of nuclei.* This is shown by the following table:

	Calculated modal volume	Observed modal volume
Binucleates	27.5	27.5
Trinucleates	41.2	37.5
Quadrinucleates	55.0	52.5

Thus it appears that the relations between the volumes at which the maximal occurrences of the several types of polynucleates are found may indicate that all types of nucleation in *Amoeba* are most stable when each nucleus has associated with it a definite volume of cytoplasm. The total volume of the nuclei in these large cells is so insignificant in respect to the cell as a whole that the cell volume may be taken instead of the cytoplasmic volume without introducing an error greater than errors of the modes.

This close relation certainly appears to indicate that the *division of the nucleus is a function of the total volume of the cytoplasm.* In no other way does it appear possible to account for the fact that increase in the number of nuclei in the cell is accompanied, on an average, by a directly proportional increase in cytoplasmic volume. This is particularly evident when due weight is given to the fact that when the number of nuclei is odd their volumes are so related that it is evident that the sum of the volumes of two of them is approximately equal to the volume of any one of the other nuclei in the cell. This condition could scarcely obtain if the polynucleates were formed to any extent by fusion of cells.

It is concluded, therefore, that Levy's contention as to the formation of the polynucleates is confirmed, and, further, that the division of the nucleus tends to be repeated as successive unit increments of cytoplasm are added. It would seem that this again indicates a tendency toward suppression of cytoplasmic division in very large cells.

THE FREQUENCY OF OCCURRENCE IN A CULTURE OF AMOEBAE OF DIFFERENT VOLUMES AND TYPES OF NUCLEATION

From data presented in the preceding section it is concluded that the binucleate *Amoebae* arise as individuals in which for some reason the cytoplasmic division that *usually occurs very soon after nuclear division,* at the time when the cell has attained a volume between 25–30, is suppressed and that continued suppression results in the formation of tri, quadri, etc., nucleated cells. Further, there are, as before noted, indications that a tendency to this suppression may be accentuated with continued nuclear division and increase in cell volume. It seems probable, therefore, that if the percentage distribution of *Amoebae* in a culture as a function of volume is ascertained, it might be possible, by noting the relation of the percentages of cells which are (on the basis of the data in the preceding section) to be considered as mononucleate, binucleate, etc., to adduce further evidence as to whether cytoplasmic division did in fact, under the cultural conditions obtaining, tend to be suppressed as the number of nuclei within the cell increased.

To ascertain the distribution of the *Amoebae* of different volumes and types of nucleation in culture, some 200 *Amoebae* were taken at random from a culture and their volumes measured. A frequency table for volumes was then constructed as before, and the number in each interval as a percentage of the total number plotted as a function of volume. Then, using the data given in Figure 8, the percentage of each type of polynucleate in each interval was calculated and indicated in Figure 9. From this it will be seen that as the sum of the areas under the curves represents the total culture, approximately 91.8 per cent of *Amoebae* in the culture are mononucleate, 5.7 per cent are binucleate, 1.4 per cent trinucleate, and 1. 1 per cent quadrinucleate or more. At first glance the numerical relations would seem to constitute almost conclusive proof that with progressive increase in volume and nucleation the tendency toward cytoplasmic division declines, if it is granted, which to the writer appears most certain, that the polynucleates arise by repeated division of the nucleus. It must be considered, however, that, owing to their slower rate of growth, these polynucleated cells remain in each stage of nucleation longer than in the preceding one, at least to the trinucleate condition, and allowance must be made for this.

On an average, the cell persists as a mononucleate for approximately three days, as noted in the section on cell growth. Now, from the data for the rate of growth given in Figure 5, and the data for the occurrence of polynucleates in Figure 8, it is possible to calculate, approximately, the average length of time that the cell will persist on the average in the bi and tri nucleate condition. It will be noted from Figure 8 that the maximal number of cells are binucleate at a volume of about 27.5 and trinucleate at 37.5, quadrinucleate at 52.5. If we assume that the average cell just after division is half the volume of the cell at division (i. e., approximately 13.7), it is possible to calculate by the use of Figure 5 the time necessary for such a cell to grow to these sizes. If this is done, it appears that the average cell lives as a mononucleate 3 days, as a binucleate 3.5 days, and as a trinucleate 9 days. The mortality of cells in these conditions tends, as shown by the data in this paper and the work of Levy (loc. cit.), to increase with increase in nuclear number; hence this would tend, if anything, to offset the effect of the longer periods of persistence with increasing nucleation. This, however, is neglected in what follows, as the data of Levy are not precise enough, and those here are insufficient to allow of quantitative expression.

If the tendency toward cytoplasmic division were constant in all types, it would be expected that the ratio of occurrence of the trinucleates at any one time, such as that depicted in the curve presented in Figure 9, would be the same in respect to the binucleates as is that of the binucleates to the mononucleates multiplied by the ratios of the times of persistence. This would mean that it would be expected that for each 100 mononucleates, 6.2 binucleates and 0.95 trinucleates would be found, whereas it appears that for each 100 mononucleates there are 6.2 binucleates and 1.5 trinucleates, or 57 per cent more trinucleates than the expected number. Neglecting the indicated increase in mortality in the polynucleate forms, which Levy's figures would indicate is of considerable importance, it would seem, then, that there is an indication that the tendency toward cytoplasmic division may be inhibited. Further research will be necessary however, to disprove or confirm this, especially as the possible methods of division of the polynucleates are diverse. This possibility is illustrated by the *Amoeba* (see fig. 1) which divided directly into three mononucleates without giving rise to a long-lived binucleate. That such divisions are of some frequency is probably indicated by the occurrence (see fig. 8) of a low percentage of trinucleate individuals with volumes approximating those of the average binucleate.

DISCUSSION

The results obtained must, of course, be understood merely as indicative of the most usual course of events in the growth of the cell in *Amoeba* under the cultural conditions used. This understood, they indicate strongly that the following is true: The average cell just after division has a volume of 10 to 15 and a ratio of cytoplasm to nucleus of approximately 125 to 1; its cytoplasm is hyaline with few granules; its nucleus is either ovoid or slightly discoid, with a refractive index very close to that of the cytoplasm, and is smooth and even of surface. Cell growth progresses at first at a relatively high rate, and as it proceeds the ratio of cytoplasm to nucleus increases. The rate of both growth and the relative volumetric increase of cytoplasm to nucleus diminishes as the cell volume increases with growth and the percentage rate of increase in volume is very nearly directly proportional to the decrease in the ratio of cytoplasm to nucleus until a volume of about 20 is attained.

This volume, 18 to 20, appears to be the usual lower limit for cell division. The majority of cells, however, divide when the volume

is between 25 and 30. In the *Amoebae* examined, the average time taken to attain this volume and divide was three days.

As the cell grows the cytoplasm apparently becomes more granular and its streaming more sluggish, and the nucleus becomes more granular, definitely discoid, usually biconcave, and of a higher refractive index and loses its smoothness of outline. In nuclei of cells judged to be near division there are often seen clefts or deep indentations. In certain cells (apparently these form some 8 per cent of the cells in the cultures in this laboratory) nuclear division takes place without the usual accompanying cytoplasmic division, with the result that the cell becomes binucleate. This occurs most frequently at the time the average cell has attained a volume between 25 and 30. Some cells of this type divide, but some continue to grow without dividing, some die and disintegrate, those that do neither become in a similar way trinucleate, and if again neither cytoplasmic division nor death occurs, may become quadrinucleate, pentanucleate, etc. This group of cells, the polynucleates, have, on the average, certain characteristics in common. The volumetric ratio of cytoplasm to nucleus is nearly constant, with a value of approximately 140 to 1. The number of nuclei tends to be directly proportional to the volume of the cytoplasm, the unit volume per nucleus being usually very close to the modal cytoplasmic volume of the mononucleate cell. The percentage rate of cell growth is low and approximately constant. The mortality rate tends to increase, probably rapidly, with the degree of polynucleation. However, these cells are, as individuals, extremely long lived. In comparison with the three days that the average mononucleate persists as an individual cell, the average quadrinucleate has lived and grown for approximately nine days before attaining the quadrinucleate condition.

It appears that these results indicate with regard to cell growth and division that the rate of growth is a very close correlate of the volumetric ratio of cytoplasm to nucleus, as is shown in Figure 7, and that, normally, *division of the nucleus is dependent upon the volume of the cytoplasm*, as is seen in Figure 8.

As to the *division of the cytoplasm* it seems to the writer that the results indicate that this *probably depends upon the volumetric ratio between cytoplasm and nucleus*. As mentioned previously, it normally occurs when the relation between the rate of growth and this ratio ceases to be direct, and there are indications that as this ratio and the rate of growth tend toward constant values the chances for cytoplasmic division become less. Certainly these results point to a marked independence between the mechanisms of nuclear and cytoplasmic division.

As regards the furnishing of criteria for the selection of material it appears that cells selected with regard to volume, nuclear number, and the nucleo-cytoplasmic ratio together should, if the cells are taken from similar cultures, constitute very uniform material for research. Of the three criteria, volume would appear to be the most reliable single index.

SUMMARY

1. Measurements were made of the growth of single cells of *Amoeba proteus*. Measurements were also made on cells of *Amoeba proteus* over a wide range of cell volume, of the rate of growth, volumetric ratio of cytoplasm and nucleus, and the number of nuclei.

2. Under the cultural conditions used—

(*a*) The volume of *Amoeba* is an increasing function of time.

(*b*) The percentage rate of growth is a decreasing function of time.

(*c*) The volumetric ratio of cytoplasm to nucleus is an increasing function of cell volume.

(*d*) The rate of cell growth is inversely proportional to the volumetric ratio between cytoplasm and nucleus until a cell volume of approximately 0.0025 to 0.0030 cubic millimeter is attained. With greater increase in volume the ratio and rate of growth tend to become constant.

(*e*) The number of nuclei in the average cell is a function of the cell volume. The modal volume of polynucleates with a given number of nuclei is approximately equal to the modal volume of the mononucleates multiplied by the number of nuclei.

(*f*) Cytoplasmic division probably depends upon the volumetric ratio between cytoplasm and nucleus.

(*g*) Nuclear division probably depends upon the volume of the cell.

3. In *Amoebae* used for experimental material, consideration should be given not only to cultural conditions but also to the volume, nucleo-cytoplasmic ratio, and nucleation of the individuals, in order to secure greater uniformity of results.

REFERENCES

Chalkley, H. W.: Physiological Zoöl. (1929), **2**, 535.

———— Science (1930), **71**, 441.

Hertwig, R.: Biol. Centralbl. (1903), **23**, 49 and 108.

Levy, Joseph: Genetics (1924), **9**, 124.

Minot, C. S.: Biol. Centralbl. (1895), **15**, 161.

Stolc, Antonin: Arch. f. ent. Mech. der Organ (1906), **21**, 111.

Voegtlin, Carl, and Chalkley, H. W.: Pub. Health Rep. (1930), **45**, 3041.

THE AIR JET HYDROCYANIC ACID SPRAYER

By C. L. Williams, *Surgeon, United States Public Health Service*

The past 20 years has seen both a tremendous increase in the use of fumigation for the destruction of vermin on ships and great improvements in fumigation methods. In both cases the advances are due to the introduction of hydrocyanic acid as a fumigant.

Leaving the cumbersome, laborious, and time-consuming sulphur fumigation, we have passed through the method of generating HCN, with its still cumbersome apparatus and paraphernalia, through the period of liquid HCN, complicated by the difficulty of transporting so dangerous a material, and have arrived at the exceedingly simple procedure of knocking a hole in a can of Zyklon, pouring the contents down the hold, and throwing the can overboard.

Unfortunately the search for simplification has turned our attention away from the main purpose of fumigation, the destruction of vermin. This has been a rather natural deviation. The reputation established for HCN as a fumigant has been so great that one is naturally inclined to believe that the mere introduction of it into a closed compartment is quite sufficient to insure the death of all animal life therein. It is only after several years of study that we have been reluctantly forced to conclude that the mere liberation of the gas is not always enough, that to secure results we must take positive steps to assure penetration into the deeper recesses wherein the vermin which we seek to destroy take refuge.

It was reluctantly, and only after considerable experimentation, that the writer turned from Zyklon back to liquid HCN for the fumigation of vessels which are either loaded with cargo or have protected rat harborages which are heavily infested. The greater flexibility of the liquid form has permitted its adaptation to use with special apparatus far more effectively than has, as yet, been accomplished with Zyklon. It is usually considered an apparent reactionary move to retreat from the simple to the more complicated; but the method herein described effects such a superior fumigation that the greater difficulty attendant upon its use is more than justified under these conditions. It is not intended to discard the use of Zyklon, but to confine its use to the routine fumigation of the average ship which does not require special apparatus for effective fumigation and to smaller quarantine stations which could not use this more or less elaborate apparatus requiring compressed air and personnel experienced in the use of such apparatus.

PENETRATION

Those who have studied records of ship fumigation have been struck by the persistent recurrence of rats on some ships, sometimes over periods of years, despite the facts that many ships are free from rats and that the great majority of vessels at least have intervals of freedom from these animals. Such a condition must have but one meaning—that is, that on the persistently infested vessels fumigation is relatively ineffective, some rats always escaping. The writer, after extensive observation, is able to assign but one cause to this condition—the failure of the fumigating gases to penetrate into the deeper rat harborages.

Penetration of fumigating gases into rat harborages is, to a considerable extent, dependent upon the concentration of the fumigant outside the harborages. Since rat harborages are almost always around the walls of infested inclosures, it is the concentration at the wall that is most important.

When the holds of a ship are fumigated with Zyklon or other fumigant introduced in solid form from which the HCN evaporates, it will generally be found that the highest concentration occurs in the hatchway, near the bottom of the hold. Unless the Zyklon has been scattered on the "'tween decks," the concentration in the far corners of all levels is likely to be considerably less than that in the hatchway. Furthermore, with Zyklon and similar materials the evaporation of the gas requires time, so that maximum concentration is not secured until some time after introduction of the fumigant. If there is any material loss of gas during the fumigation, the calculated concentration will never be reached.

By taking samples of air at various locations in ships' holds during fumigation and testing these for HCN concentration it has been shown at the New York quarantine station that the conditions mentioned above are those that actually occur during the usual fumigation of ships with Zyklon or HCN discoids. It is true that such conditions can be, to a large extent, overcome by scattering the fumigant in all directions on all decks; but this means that fumigators must go down into the holds to do the scattering, a procedure that they are not at all prone to carry out.

Liquid HCN delivered through the usual type of spray nozzle is spread to a greater extent than is the gas evaporating from Zyklon, yet this diffusion is not nearly so rapid or complete as with the apparatus described herein.

THE AIR JET HCN SPRAYER

The air jet sprayer for liquid HCN is an adaptation of the ordinary oxyacetylene blowpipe, the HCN being connected with the acetylene side and compressed air to the oxygen side. The apparatus works well over a considerable range of pressures, but is most effective when the HCN is supplied under a pressure of 75 to 100 pounds and the air from 100 to 200 pounds.

The method of use is not complicated. To the sprayer are attached two 50-foot lengths of rubber pressure tubing, one for air and one for HCN. The HCN tube is connected to a cylinder, called an applicator, containing liquid HCN under 75 to 100 pounds pressure. The air line is connected to an applicator filled with air at a pressure of 200 pounds. The air line is connected to the air side of its applicator; if connected to the gas side, condensed water in the bottom of the applicator will be taken up and will freeze in the nozzle of the sprayer, blocking it.

The sprayer is lowered into the hold below the lowest "'tween deck" and the air valve is opened. As soon as the noise of escaping air is heard, the gas valve is opened. When the liquid HCN reaches the nozzle, it is shot out in a fine white cloud to a visible distance of about 8 feet. Since the nozzle of the sprayer is at right angles to the hose line, the spray is projected toward the side of the hold. The recoil of escaping air causes the nozzle to fly about in various directions which can be controlled, to some extent, by twisting the supply lines, so that the spray is directed to all sides.

When the proper amount of gas for the lower portion of the hold has been delivered, the spray nozzle is drawn up to the level of each "'tween deck" in turn, where the amount of gas indicated for each level is delivered. When the full dose has been discharged, the gas valve is closed and the air permitted to run until the spray is no longer visible, when the air is cut off and the apparatus is drawn up and carried to the next hold. When all compartments have been fumigated the gas line is cleared by blowing air through it. Proper dosage is measured by keeping the gas applicator on a platform spring scale and noting the progressive loss of weight.

If a 30-pound applicator is used for the air tank, it will, starting at 200 pounds pressure and permitting it to drop to 75 pounds, spray approximately 3 pounds of liquid, when it must be refilled with air. Its operation, however, can be made continuous by connecting the line from the main air supply to the gas connection of the air tank and manipulating valves so as to maintain a pressure between 100 and 200 pounds. An air tank may be dispensed with entirely by placing a reducing valve in the main air line and connecting it directly to the air line of the sprayer.

The mistlike spray delivered by this apparatus is partly HCN in gaseous form, partly very fine droplets of liquid HCN which evaporate in the air of the hold immediately, and partly very fine particles of frozen HCN. These latter are so fine that apparently they are melted and evaporated before they settle to the bottom.

With this apparatus so little of the gas escapes up the hatchway that it is quite rare for fumigators handling the supply lines to require the protection of gas masks. As a rule, the tarpaulin over the hatch may be rolled back for 2 or 3 feet, in order to give a clear view, without danger of losing any material amount of gas. Undoubtedly the reason for this is that most of the gas is projected to the sides of the holds under the decks. It will be noted that the entire operation is carried out from the deck.

DIFFUSION

The diffusion of the gas is immediate and remarkably uniform. Maximum concentration is attained at once and attained where it is needed, that is, around the walls of the inclosure. Samples taken from the far recesses under the decks, at various levels, and at

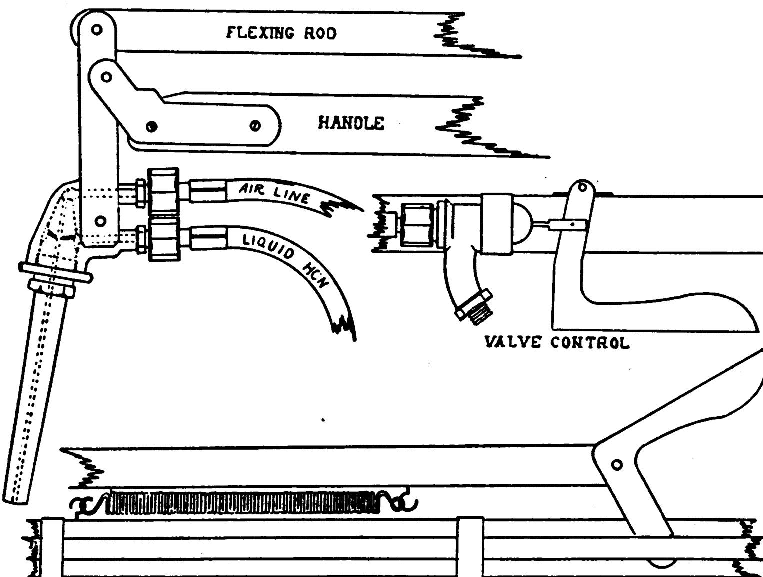

FIGURE 1.—Details of air-jet sprayer (air-jet gun)

various levels in the hatchway, show practically the same concentration at all times during the fumigation, except that it is usually somewhat less at the top of the hatch, probably due to loss of gas through the tarpaulin.

The initial concentration found is usually the calculated concentration, that is 60 grams (2 ounces) per thousand cubic feet. The final concentration at the end of two hours varies, largely in proportion to the amount of wind. When the wind is high, losses through tarpaulins are greater than when there is little breeze. On quiet days the final concentration is frequently still between 45 and 60 grams per thousand cubic feet. Samples taken from the ordinary types of harborage—that is, pipe casings and other similar inclosed spaces—generally show lethal concentration for rats within half an hour.

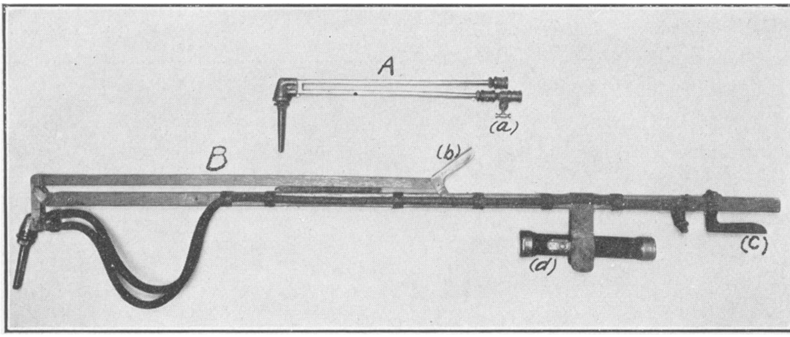

FIGURE 2.—A, Small air jet sprayer; B, large air jet sprayer (air jet gun), with overall length of 30 inches. (*a*), Control valve; (*b*), flexion control; (*c*), valve control; (*d*), electric flash light

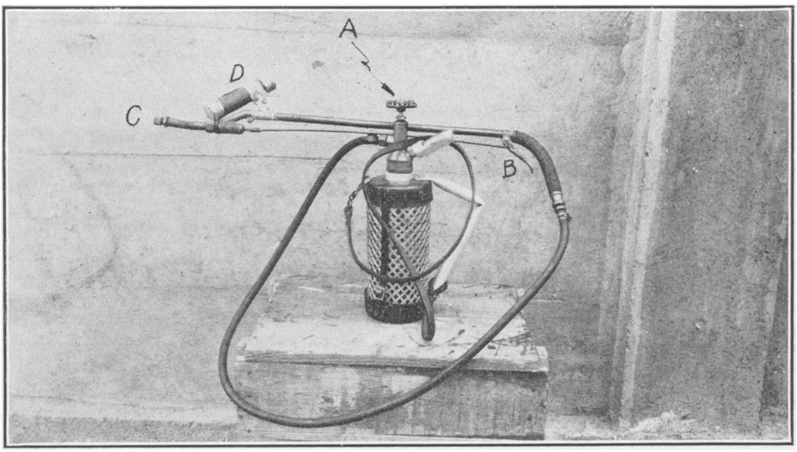

FIGURE 3.—Pressure bottle and sprayer, for use in isolated places difficult of access. Bottle is inclosed in woven steel netting. A, Main stop valve; B, valve control; C, spray head; D, hand flash light

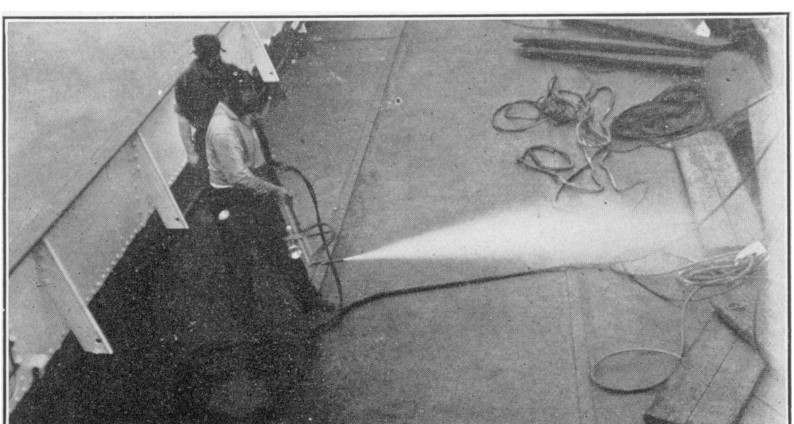

FIGURE 4.—Spray from air jet gun. A fine, mist-like spray, visible for eight feet or more, is projected

FIGURE 5.—Air jet sprayer in use on a loaded ship. The air line from the fumigating boat is connected with the air tank

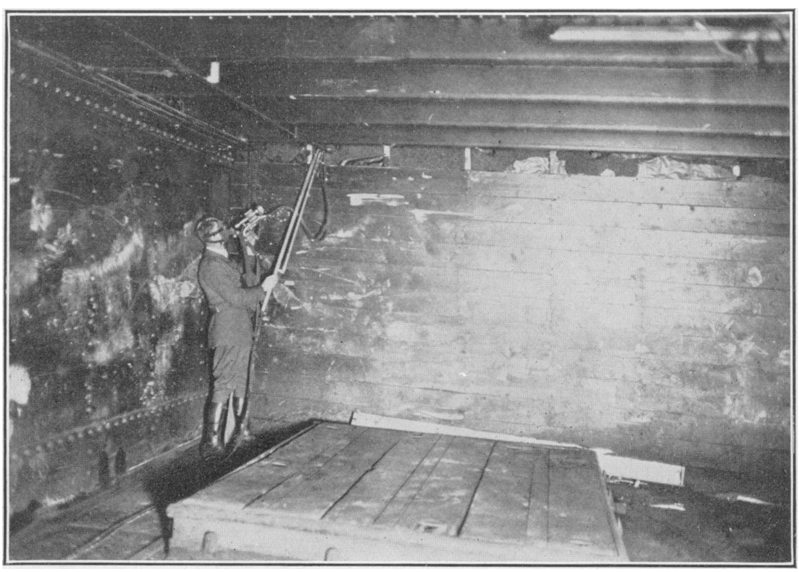

FIGURE 6.—Projecting HCN spray directly into rat-infested insulation of a cold-storage room. The apparatus shown is the first one used, in which the handle and valve were assembled separately. A strip of casing has been removed to permit direct application of fumigant to insulated space

FUMIGATING LOADED SHIPS

In fumigating loaded ships we have two main problems—one is to introduce gas in proper amounts in the various levels of the holds; the other is to secure diffusion over, around, and through the cargo. It must be obvious to any experienced fumigator that the apparatus described lends itself to the accomplishment of these purposes better than any fumigating apparatus at present in general use.

When Zyklon is poured down the ventilator into loaded holds, accurate doses in the various levels can not be obtained, since the amount of Zyklon diverted through the ventilator openings at the different levels can not be controlled. Furthermore, Zyklon, poured down the ventilators falls on the cargo directly under the ventilator openings, from which point the evaporating HCN must pass through the hold by slow diffusion. While it is true that this diffusion may be promoted by turning the ventilator cowl to the wind, such a method is not highly accurate. When a cowl is left inadvertently turned away from the wind, the HCN evaporating from Zyklon is largely drawn up the ventilator and lost.

The air jet sprayer, however, can be lowered through the ventilator openings to each level in turn, delivering measured doses to each, while the spray, projected forcibly over the top of the cargo, diffuses the gas widely in all directions.

FUMIGATING SUPERSTRUCTURES

The small air jet sprayer, used in the holds, is not well adapted for fumigating superstructures. For this purpose the large air jet sprayer (air jet gun) may be used, or, more conveniently, the pressure bottle, both of which are shown in the accompanying illustrations.

THE LARGE AIR JET GUN

The large air jet gun is an adaptation of the sprayer for use in projecting the fumigant directly into rat harborages. Where there exist rat harborages, into which it is unlikely that the gas will itself penetrate in lethal concentration, the nozzle of the gun may be passed through small openings and the spray projected directly into them, securing a penetration far deeper than could be expected by any other means now in use.

In order to control the spray, the gun has a double valve set on the handle. This valve, when its handle is pressed, opens both the air and gas line, closing both when the handle is released. It has been found by test that the amount of gas delivered can be figured approximately at 15 grams per second. In usual practice, it is rare that more than this amount is required for any one section of harborage.

It hardly seems necessary to add that fumigators handling this gun wear gas masks and that usually two men are needed, one to handle the gun and the other to keep the supply lines clear.

Reference to the accompanying drawing and photographs will show that the air jet gun consists essentially of an air jet sprayer attached to a handle by a hinge and controlled, as to direction, by a push rod and lever, which is also hinged to the handle and kept extended by a spring. The sprayer is flexed by pressing the lever up against the handle. A spring clip on the underside of the handle holds a flash light directed toward the nozzle. The short inlet pipes of the sprayer are joined to the double valve, set on the handle, by short lengths of pressure rubber tubing. In use the fumigator controls the direction of the nozzle with one hand and the valves with the other.

PRESSURE BOTTLE

The pressure bottle has been devised at the New York quarantine station for convenience in fumigating small spaces with liquid HCN. It consists of a very heavy glass bottle protected on the outside by a metal wire mesh and two leather caps, a short length of pressure tubing, and a trigger valve sprayer. The delivery tube opens at the bottom of the bottle, the liquid HCN being forced out by pressure, applied by screwing a steel capsule of compressed carbon dioxide down upon the hollow pointed needle valve, set in one side of the bottle cap. The flow through the delivery tube is controlled by two valves, one a needle valve set in the cap, and the other a trigger controlled spring valve just back of the spray nozzle. While the bottle is being carried around the needle valve is closed; the fumigator opens it just before use. The cap is screwed on to the top of the bottle, tight closure being secured by a rubber gasket. This cap is removed in filling the bottle with HCN, which is generally accomplished through a short length of tubing from an HCN applicator. The bottle holds a little over 480 grams of HCN.

With this apparatus slung from the shoulder the fumigator passes from compartment to compartment of the superstructure, introduces the sprayer into each and sprays in the amount of gas required. Approximately 15 grams per second is delivered, but dosage may be more accurately controlled, if desired, by means of a scale set on the outside of the bottle against which the level of the liquid within may be read.

DISADVANTAGES

The new apparatus has one major disadvantage—it requires the use of compressed air. For this reason it is probable that it can not be adopted at quarantine stations where the volume of fumigation is small. At the larger stations, however, there appears to be no specific bar to the installation of air-compression apparatus.

Another disadvantage in the use of liquid HCN is the danger of transportation over land. The containers at present approved by the Interstate Commerce Commission are too heavy to be handled readily on shipboard. The lighter containers for use on ships can be transported only by the quarantine boat. When a fumigating boat is available, the air compression apparatus may be installed as a part of its machinery.

COMMENT

The New York quarantine station maintains a card-index record of all ships fumigated at New York. Among the ships that regularly visit the port, and of which there are fumigation records over several years, there are a number that have been persistently rat-infested, every fumigation, with few exceptions, yielding rats. Many of these ships have been very heavily rat infested. During the past two years the apparatus described in this paper, and other projection apparatus tested in developing it, has been utilized in an intensive campaign to eradicate the rat colonies on these vessels. Success has not always been attained, but it is believed that the results set forth in Table 1 demonstrate its possibilities.

TABLE 1.—*Record of fumigations at New York with air-jet sprayer*

Ship No.	Previous record				Intensive fumigations, number of rats			Subsequent fumigations, number of rats		
	Period of record (years)	Number of fumigations	Average rats per fumigation	Maximum rats for any one fumigation	First	Second	Third	First	Second	Third
1	6	11	30	54	35			5	34	
2	4	8	25	79	23	33		0	14	19
3					130	0				
4	4	1	42	42	67	36		1		
5	3	3	69	206	84	29	4	3	7	
6	2	2	88	143	42	2				
7	5	8	43	127	70	1	0			
8	7	4	42	63	120	51	2			
9	4	3	2	6	15	0				
10	6	9	22	71	23	5				
11	4	2	35	39	135			22		
12					112	1				
13	2	3	21	26	17			1		
14	6	7	46	108	129			7		
15	2	4	42	70	52			2		
16	6	4	31	54	36			1	0	
17	4	8	35	72	30			0		
18	5	5	42	8	31	6		0	5	
19	3	3	71	134	91	17	21	1		
20	8	11	55	106	139	115				
21	4	5	195	352	115	68				

DEATH RATES IN A GROUP OF INSURED PERSONS

Rates for Principal Causes of Death for May, 1931

The accompanying table, taken from the Statistical Bulletin for June, 1931, issued by the Metropolitan Life Insurance Co., presents the mortality record of the industrial insurance department of the company for May, 1931, as compared with that for the preceding month and for the corresponding month of last year. It also gives the cumulative rates for the period January–May for the years 1930 and 1931. The rates are based on a strength of approximately 19,000,000 insured persons in the United States and Canada. In recent years the general death rate in this more or less selected group of persons has averaged about 72 per cent of the rate for the registration area of the United States.

With regard to health conditions in this group for May, 1931, as indicated by mortality, the Bulletin states:

Health conditions in May, 1931, were better than have ever been observed during the month of May in any previous year. This is indicated by the remarkably low death rate of 8.4 per 1,000 among the industrial policyholders of the company. The nearest approach to the above figure is 8.8, as recorded in the same month of both 1921 and 1930.

Since the influenza outbreak of last winter, health conditons have shown such marked improvement that the year-to-date death rate at the end of May was only 1.8 per cent in excess of the lowest figure for the like part of any previous year. Among Canadian policyholders and those in the Pacific Coast and Mountain States, the cumulative death rate has been lower this year than ever before registered for the January-May period. In Canada, the decline, as compared with 1930, is 8.4 per cent.

Diphtheria and tuberculosis continue to be the most noteworthy items on the favorable side of the year's health record. The cumulative death rate for the former (4.9 per 100,000) marks a decline of more than 37 per cent from the figure for the corresponding five months' period in 1930, and a drop of 52 per cent since 1929. The drop for tuberculosis in a single year has been 5.4 per cent and in two years 14.8 per cent. It is now almost a certainty that the year 1931 will register a new low point in the death rate from tuberculous disease. As for diphtheria, it would require an outbreak, such as has not occurred in many years, to preclude the attainment of a new low death rate this year. Puerperal conditions, also, are causing fewer deaths than ever before, and lower cumulative mortality rates, as compared with the like part of 1930, are in evidence for whooping cough, diarrheal diseases, and accidents.

One decidedly disturbing item in the mortality statistics of this year is an unusually large rise in the cancer death rate. While the general trend of the mortality from cancer has been upward for many years, there has been little change from year to year. Thus far in 1931, however, the rate has increased more than 8 per cent as compared with the corresponding period of 1930. Every month has shown a considerably higher cancer death rate than that for the corresponding month of last year.

Other causes of death to register higher mortality rates for the first five months of 1931 than in the like part of 1930 are measles and scarlet fever (both by small margins); influenza (by 64 per cent); diabetes (by 13 per cent); and pneumonia, suicides, and homicides (all by small margins).

Death rates (annual basis) per 100,000 for principal causes of death

[Industrial department, Metropolitan Life Insurance Co.]

Cause of death	Death rate per 100,000 lives exposed [1]				
	May, 1931	April, 1931	May, 1930	Cumulative, January to May	
				1931	1930
Total, all causes	841.8	975.1	884.5	971.1	953.5
Typhoid fever	1.6	.9	1.2	1.2	1.2
Measles	5.9	5.9	6.1	4.6	4.5
Scarlet fever	3.9	4.2	2.6	4.0	3.6
Whooping cough	3.4	2.8	4.5	3.7	4.7
Diphtheria	4.2	3.0	5.8	4.9	7.8
Influenza	16.9	33.0	14.1	38.5	23.5
Tuberculosis (all forms)	79.5	80.5	85.9	81.7	86.4
Tuberculosis of respiratory system	70.0	70.0	74.7	72.5	75.1
Cancer	77.4	82.8	74.2	82.6	76.4
Diabetes mellitus	18.9	22.9	18.6	23.0	20.4
Cerebral hemorrhage	60.4	68.8	60.5	66.5	63.8
Organic diseases of heart	145.3	168.4	145.8	166.2	161.9
Pneumonia (all forms)	71.8	111.0	90.6	114.8	111.8
Other respiratory diseases	10.2	13.3	12.2	13.1	13.2
Diarrhea and enteritis	8.8	9.4	11.5	9.9	11.7
Bright's disease (chronic nephritis)	64.4	73.7	68.6	72.5	72.4
Puerperal state	10.4	13.3	11.6	11.8	12.8
Suicides	9.5	11.2	10.2	9.6	9.5
Homicides	7.3	6.0	6.0	6.6	6.5
Other external causes (excluding suicides and homicides)	51.8	53.4	57.2	52.5	56.7
Traumatism by automobiles	18.1	18.5	19.3	18.3	18.0
All other causes	190.2	210.7	197.1	203.4	204.7

[1] All figures in this table include insured infants under 1 year of age. The rates for 1931 are subject to slight correction, since they are based on provisional estimates of lives exposed to risk.

COURT DECISION RELATING TO PUBLIC HEALTH

State of New Jersey held entitled to injunction restraining city of New York from dumping garbage at sea.—(United States Supreme Court; State of New Jersey *v.* City of New York, 51 S. Ct. 519; decided May 18, 1931.) The State of New Jersey brought an original suit in the Supreme Court of the United States against the city of New York, it being alleged that the city for many years had dumped and still was dumping noxious, offensive, and injurious materials—called garbage for brevity—into the ocean, and that great quantities of the same moving on or near the water's surface frequently had been and were being cast upon the beaches belonging to the State, its municipalities, and its citizens, thereby creating a public nuisance and causing great and irreparable injury. The State prayed for an injunction restraining the city from dumping garbage into the ocean or waters of the United States off the coast of New Jersey and from otherwise polluting its waters and beaches. The court appointed a special master to take the evidence and to report the same, together with his findings of fact, conclusions of law, and recommendations for a decree. Findings of fact were made by the master, which findings were approved and adopted by the court.

The master's conclusions of law were that the city had created and continued to create a public nuisance on the property of New Jersey and that the latter was entitled to relief in accordance with the prayer of its complaint, but that the city should be given reasonable time within which to put into operation sufficient incinerators. Such conclusions were also approved by the court.

The defendant, in accordance with permits issued by the supervisor of the harbor of New York, dumped garbage into the ocean at points about 10, 12½, and 22 miles, respectively, from the New Jersey shore, and it contended that, as it dumped garbage into the ocean and not within the waters of the United States or of New Jersey, the supreme court was without jurisdiction to grant an injunction. Answering this the court said:

> * * * But the defendant is before the court and the property of plaintiff and its citizens that is alleged to have been injured by such dumping is within the court's territorial jurisdiction. The situs of the acts creating the nuisance, whether within or without the United States, is of no importance. Plaintiff seeks a decree in personam to prevent them in the future. The court has jurisdiction. (Cases cited.)

With regard to the defendant's contention that compliance with the supervisor's permits in respect of places designated for the dumping of its garbage left the court without jurisdiction to grant the injunction prayed and relieved defendant in respect of the nuisance resulting from the dumping, the court held that there was no merit in such contention, saying:

> * * * There is nothing in the act that purports to give to one dumping at places permitted by the supervisor immunity from liability for damage or injury thereby caused to others or to deprive one suffering injury by reason of such dumping of relief that he otherwise would be entitled to have. There is no reason why it should be given that effect.

The court held that a decree would be entered declaring that New Jersey was entitled to an injunction as prayed in the complaint, but that, before injunction should issue, a reasonable time would be accorded to the city within which to carry into effect its proposed plan for the erection and operation of incinerators to destroy the materials such as were being dumped at sea, or to provide other means to be approved by the decree for the disposal of such materials. Inasmuch as the evidence did not disclose what was such reasonable time, the court referred the case to the special master for findings of fact upon that subject.

DEATHS DURING WEEK ENDED JULY 4, 1931

Summary of information received by telegraph from industrial insurance companies for the week ended July 4, 1931, and corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)

	Week ended July 4, 1931	Corresponding week, 1930
Policies in force	75, 049, 104	76, 053, 026
Number of death claims	12, 274	10, 153
Death claims per 1,000 policies in force, annual rate	8. 5	7. 0

Deaths [1] from all causes in certain large cities of the United States during the week ended July 4, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)

[The rates published in this summary are based upon mid-year population estimates derived from the 1930 census]

City	Week ended July 4, 1931				Corresponding week, 1930		Death rate [2] for the first 27 weeks	
	Total deaths	Death rate [2]	Deaths under 1 year	Infant mortality rate [3]	Death rate [2]	Deaths under 1 year	1931	1930
Total (82 cities)	8, 583	12. 5	630	[4] 48	10. 0	628	12. 9	12. 7
Akron	44	8. 9	1	10	7. 1	7	8. 3	8. 2
Albany [5]	15	6. 1	1	20	9. 8	1	14. 6	15. 5
Atlanta	113	21. 2	10	102	13. 0	15	16. 0	16. 8
White	66	-------	5	79	-------	6	-------	-------
Colored	47	(6)	5	144	(6)	9	(6)	(6)
Baltimore [5]	208	13. 3	20	68	10. 2	10	15. 6	14. 7
White	143	-------	11	48	-------	7	-------	-------
Colored	65	(6)	9	141	(6)	3	(6)	(6)
Birmingham	78	15. 1	12	121	17. 5	11	14. 6	14. 4
White	34	-------	7	120	-------	4	-------	-------
Colored	44	(6)	5	122	(6)	7	(6)	(6)
Boston	177	11. 8	20	57	12. 5	18	15. 2	15. 4
Bridgeport	31	11. 0	2	33	10. 3	1	12. 1	12. 2
Buffalo	125	11. 2	9	37	11. 0	13	14. 1	13. 9
Cambridge	19	8. 7	2	40	6. 9	2	13. 4	13. 2
Camden	23	10. 1	3	52	6. 6	1	15. 5	14. 4
Canton	23	11. 2	2	46	10. 4	0	11. 1	10. 9
Chicago [5]	1, 222	18. 4	58	51	9. 1	59	11. 6	11. 1
Cincinnati	147	16. 8	15	90	11. 8	4	16. 8	16. 2
Cleveland	203	11. 6	11	32	8. 7	16	11. 9	12. 0
Columbus	77	13. 6	6	59	12. 2	2	14. 7	17. 1
Dallas	52	10. 0	5	-------	10. 9	7	12. 0	12. 1
White	39	-------	4	-------	-------	5	-------	-------
Colored	13	(6)	1	-------	(6)	2	(6)	(6)
Dayton	51	12. 9	2	28	8. 8	4	12. 9	10. 4
Denver	62	11. 1	8	77	14. 1	12	14. 8	15. 0
Des Moines	40	14. 4	1	18	10. 9	2	12. 0	12. 4
Detroit	222	7. 0	27	43	7. 2	30	9. 1	10. 1
Duluth	8	4. 1	1	25	8. 2	0	11. 0	11. 6
El Paso	25	12. 4	6	-------	22. 3	12	17. 2	18. 8
Erie	15	6. 6	0	0	7. 6	4	11. 2	11. 4
Fall River [5 7]	20	9. 0	0	0	10. 9	3	12. 8	13. 2
Flint	29	9. 2	2	26	5. 9	3	7. 8	9. 9
Fort Worth	29	9. 0	4	-------	11. 8	3	11. 6	11. 6
White	25	-------	3	-------	-------	1	-------	-------
Colored	4	(6)	1	-------	(6)	2	(6)	(6)
Grand Rapids	34	10. 3	3	44	7. 7	2	9. 8	11. 2
Houston	63	10. 6	7	-------	14. 5	7	11. 5	12. 9
White	49	-------	6	-------	-------	3	-------	-------
Colored	14	(6)	1	-------	(6)	4	(6)	(6)
Indianapolis	127	17. 9	6	49	11. 4	2	14. 6	15. 2
White	105	-------	4	38	-------	2	-------	-------
Colored	22	(6)	2	134	(6)	0	(6)	(6)
Jersey City	58	9. 5	2	18	9. 2	6	12. 6	12. 3

Footnotes at end of table.

Deaths [1] from all causes in certain large cities of the United States during the week ended July 4, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)—Continued

City	Week ended July 4, 1931				Corresponding week, 1930		Death rate [2] for the first 27 weeks	
	Total deaths	Death rate [2]	Deaths under 1 year	Infant mortality rate [3]	Death rate [2]	Deaths under 1 year	1931	1930
Kansas City, Kans	38	16.1	5	103	6.8	1	14.2	11.5
White	32		3	74		0		
Colored	6	([6])	2	254	([6])	1	([6])	([6])
Kansas City, Mo	138	17.6	7	53	11.7	10	14.4	13.6
Knoxville	29	13.8	1	21	15.2	5	13.5	14.6
White	22		1	24		4		
Colored	7	([6])	0	0	([6])	1	([6])	([6])
Long Beach	25	8.6	0	0	8.3	2	10.4	10.0
Los Angeles	238	9.4	21	61	10.3	21	11.2	11.5
Louisville	83	14.0	3	26	11.7	5	15.3	14.0
White	66		3	30		5		
Colored	17	([6])	0	0	([6])	0	([6])	([6])
Lowell [7]	18	9.3	3	76	12.4	4	13.5	14.6
Lynn	13	6.6	1	26	7.6	1	10.7	11.6
Memphis	97	19.5	9	95	18.7	13	17.3	18.0
White	49		3	50		6		
Colored	48	([6])	6	174	([6])	7	([6])	([6])
Miami	23	10.7	1	25	10.8	2	12.8	12.0
White	16		0	0		2		
Colored	7	([6])	1	88	([6])	0	([6])	([6])
Milwaukee	163	14.4	15	65	7.1	12	10.2	10.3
Minneapolis	174	19.1	8	52	7.9	6	12.0	11.0
Nashville	65	21.8	6	89	14.2	7	17.5	16.6
White	43		5	100		5		
Colored	22	([6])	1	59	([6])	2	([6])	([6])
New Bedford [7]	23	10.7	4	106	11.1	1	13.2	12.1
New Haven	30	9.6	2	38	9.9	1	12.5	14.2
New Orleans	175	19.5	21	115	14.6	14	17.9	18.7
White	105		10	83		6		
Colored	70	([6])	11	179	([6])	8	([6])	([6])
New York	1,267	9.3	99	41	8.7	113	12.2	11.7
Bronx Borough	194	7.6	10	23	6.2	11	8.9	8.4
Brooklyn Borough	430	8.5	41	43	8.0	40	11.3	10.8
Manhattan Borough	456	13.1	36	61	12.6	46	18.6	17.5
Queens Borough	147	6.6	7	19	6.0	11	7.9	7.6
Richmond Borough	40	12.8	5	90	12.1	5	14.1	14.9
Newark, N. J	106	12.4	8	42	8.2	5	12.7	13.2
Oakland	42	7.5	3	38	10.9	3	11.0	11.5
Oklahoma City	33	8.7	2	28	8.1	5	11.8	10.4
Omaha	95	22.9	4	45	14.3	7	14.8	13.9
Paterson	33	12.4	4	69	10.9	1	14.6	13.2
Peoria	59	28.4	0	0	6.4	1	13.6	12.9
Philadelphia	438	11.6	33	48	11.2	20	14.5	13.3
Pittsburgh	176	13.6	20	69	10.6	17	16.1	14.9
Portland, Oreg	62	10.5	1	12	10.7	4	12.2	13.0
Providence	54	11.0	3	28	10.9	5	14.0	14.3
Richmond	45	12.7	4	58	12.2	5	16.5	15.8
White	29		2	44		3		
Colored	16	([6])	2	87	([6])	2	([6])	([6])
Rochester	104	16.3	6	55	9.4	3	13.0	12.3
St. Louis	444	28.0	18	61	10.8	6	16.9	14.5
St. Paul	98	18.5	4	41	6.5	1	11.6	10.8
Salt Lake City [5]	28	10.2	3	45	10.0	5	12.7	13.5
San Antonio	62	13.5	17		15.4	14	16.0	18.5
San Diego	26	8.7	2	41	12.9	2	14.5	14.7
San Francisco	133	10.7	3	20	10.8	5	13.5	13.3
Schenectady	13	7.0	0	0	6.5	0	10.8	11.9
Seattle	58	8.1	2	19	12.2	4	12.0	11.4
Somerville	13	6.4	1	37	8.0	1	10.3	10.8
South Bend	22	10.6	2	50	9.4	1	8.8	9.5
Spokane	30	13.4	2	52	9.0	0	12.9	13.1
Springfield, Mass	23	7.9	3	46	9.4	4	12.9	13.2
Syracuse	54	13.2	2	24	8.4	3	12.5	12.7
Tacoma	16	7.7	0	0	14.1	0	13.0	13.0
Toledo	55	9.7	6	55	9.3	2	12.7	13.3
Trenton	27	11.4	2	35	11.4	3	17.9	17.5
Utica	22	11.2	1	26	9.7	2	15.2	16.0

Footnotes at end of table.

Deaths [1] *from all causes in certain large cities of the United States during the week ended July 4, 1931, infant mortality, annual death rate, and comparison with corresponding week of 1930. (From the Weekly Health Index, issued by the Bureau of the Census, Department of Commerce)*—Continued

City	Week ended July 4, 1931				Corresponding week, 1930		Death rate [2] for the first 27 weeks	
	Total deaths	Death rate [2]	Deaths under 1 year	Infant mortality rate [3]	Death rate [2]	Deaths under 1 year	1931	1930
Washington, D. C.	145	15.3	12	66	13.5	9	16.8	15.8
White	90		5	41		4		
Colored	55	(6)	7	120	(6)	5	(6)	(6)
Waterbury	19	9.8	1	30	9.4	4	10.3	10.5
Wilmington, Del.[7]	24	11.7	3	65	11.3	2	15.3	15.2
Worcester	31	8.2	2	27	11.5	5	13.5	14.0
Yonkers	15	5.6	0	0	5.4	1	9.4	8.6
Youngstown	39	11.8	4	56	5.8	3	10.9	10.6

[1] Deaths of nonresidents are included. Stillbirths are excluded.
[2] These rates represent annual rates per 1,000 population, as estimated for 1931 and 1930 by the arithmetical method.
[3] Deaths under 1 year of age per 1,000 live births. Cities left blank are not in the registration area for births.
[4] Data for 77 cities.
[5] Deaths for week ended Friday.
[6] For the cities for which deaths are shown by color, the percentage of colored population in 1920 was as follows: Atlanta, 31; Baltimore, 15; Birmingham, 39; Dallas, 15; Forth Worth, 14; Houston, 25; Indianapolis, 11; Kansas City, Kans., 14; Knoxville, 15; Louisville, 17; Memphis, 38; Miami, 31; Nashville, 30; New Orleans, 26; Richmond, 32; and Washington, D. C., 25.
[7] Population Apr. 1, 1930; decreased 1920 to 1930, no estimate made.

PREVALENCE OF DISEASE

No health department, State or local, can effectively prevent or control disease without knowledge of when, where, and under what conditions cases are occurring

UNITED STATES

CURRENT WEEKLY STATE REPORTS

These reports are preliminary, and the figures are subject to change when later returns are received by the State health officers

Reports for Weeks Ended July 11, 1931, and July 12, 1930

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended July 11, 1931, and July 12, 1930

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930
New England States:								
Maine	5	10			31	42	0	1
New Hampshire	1				11	10	0	0
Vermont	1	2			24	10	0	0
Massachusetts	51	37	2	1	330	440	1	2
Rhode Island	4	2			92	11	0	1
Connecticut	5	1		1	110	20	1	1
Middle Atlantic States:								
New York	117	98	[1] 10	[1] 1	1,299	1,075	9	11
New Jersey	35	91		2	352	535	5	2
Pennsylvania	53	71			840	638	9	1
East North Central States:								
Ohio	28	42	4	6	734	194	5	5
Indiana	15	10			94	53	4	4
Illinois	67	113	10	3	631	138	7	8
Michigan	14	54	1	1	198	266	5	6
Wisconsin	5	12	9	2	318	54	1	0
West North Central States:								
Minnesota	3	10			48	99	1	1
Iowa		4			3	53	0	1
Missouri	12	22			16	43	1	3
North Dakota	3				4	4	0	1
South Dakota	1	13			1	50	0	1
Nebraska	2	10			1	10	0	0
Kansas	1	7	4		26	63	1	0
South Atlantic States:								
Delaware	1				34	7	0	0
Maryland [2]	8	12	1	3	119	18	2	0
District of Columbia	4	5			12	22	2	0
West Virginia	3	4	2	9	25	20	0	[illegible]
North Carolina [3]	13	18	2	5	190	30	1	0
South Carolina	4	2		52	36		0	2
Georgia [3]	8	4	8	6	19	10	1	1
Florida [3]	6	4	3	2	26	16	0	0

[1] New York City only.
[2] Week ended Friday.
[3] Typhus fever: 1931, 5 cases; 1 case in North Carolina; 1 case in Georgia; 1 case in Florida; 1 case in Alabama; and 1 case in Texas.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended July 11, 1931, and July 12, 1930—Continued

Division and State	Diphtheria		Influenza		Measles		Meningococcus meningitis	
	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930
East South Central States:								
Kentucky					56		2	1
Tennessee		3		8	11	24	0	3
Alabama [3]	10	6		1	39	36	1	0
Mississippi	6	4					0	2
West South Central States:								
Arkansas	4	1		7	2	4	0	0
Louisiana	20	19	15	3		1	0	1
Oklahoma [4]	3	6	12	4	5	17	0	2
Texas [3]	21	10		1	18	14	0	1
Mountain States:								
Montana		1			18	2	0	1
Idaho	1	1			1	4	0	2
Wyoming	1			1	5	10	0	0
Colorado	6	6			28	68	0	0
New Mexico	1	3			5	13	0	0
Arizona	1				5	61	0	1
Utah [2]			3	1	9	19	0	4
Pacific States:								
Washington	6	6		3	52	192	1	1
Oregon	2	5	12	3	13	32	1	0
California	48	53	9	19	232	552	3	4

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930
New England States:								
Maine	0	0	9	19	0	0	1	0
New Hampshire	0	0	10	1	0	0	0	0
Vermont	0	0	2	0	12	0	0	0
Massachusetts	6	6	113	73	0	0	5	8
Rhode Island	1	0	10	6	0	0	0	1
Connecticut	7	0	19	7	0	0	1	1
Middle Atlantic States:								
New York	36	10	189	121	25	13	17	22
New Jersey	3	0	78	54	1	0	5	8
Pennsylvania	3	1	209	126	0	0	15	12
East North Central States:								
Ohio	0	1	124	121	29	51	22	21
Indiana	0	5	23	42	49	76	3	11
Illinois	2	3	125	146	46	34	17	26
Michigan	0	1	158	99	14	40	4	4
Wisconsin	3	0	21	40	4	10	8	0
West North Central States:								
Minnesota	1	6	19	38	2	1	2	2
Iowa	0	2	10	14	42	48	1	0
Missouri	0	0	15	32	5	12	12	13
North Dakota	0	0	3	3	6	10	0	4
South Dakota	2	1	4	4	1	41	1	0
Nebraska	1	0	2	5	8	10	3	0
Kansas	0	9	7	19	23	21	5	7
South Atlantic States:								
Delaware	0	0	4	9	0	0	1	1
Maryland [2]	0	0	19	18	0	0	14	8
District of Columbia	0	0	11	6	0	0	0	1
West Virginia	0	0	11	9	3	17	6	11
North Carolina [3]	4	6	19	21	0	13	47	58
South Carolina	4	1	1	1	0	0	112	59
Georgia [3]	1	1	10	4	2	0	41	59
Florida [3]	1	0	0	4	0	0	6	2

[2] Week ended Friday.
[3] Typhus fever: 1931, 5 cases; 1 case in North Carolina; 1 case in Georgia; 1 case in Florida; 1 case in Alabama; and 1 case in Texas.
[4] Figures for 1931 are exclusive of Oklahoma City and Tulsa.

Cases of certain communicable diseases reported by telegraph by State health officers for weeks ended July 11, 1931, and July 12, 1930—Continued

Division and State	Poliomyelitis		Scarlet fever		Smallpox		Typhoid fever	
	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930	Week ended July 11, 1931	Week ended July 12, 1930
East South Central States:								
Kentucky	0	0	13	18	1	0	32	22
Tennessee	0	1	6	7	4	10	42	56
Alabama [3]	4	3	15	2	8	0	38	24
Mississippi	4	1	4	4	16	1	38	58
West South Central States:								
Arkansas	0	1	0	4	12	12	64	39
Louisiana	0	29	6	12	9	1	49	34
Oklahoma [4]	0	14	7	11	17	42	23	18
Texas [3]	0	1	17	5	29	24	24	16
Mountain States:								
Montana	0	4	6	23	1	5	6	1
Idaho	0	0	2	0	0	3	2	0
Wyoming	0	0	1	2	1	1	1	0
Colorado	0	0	10	8	0	5	5	3
New Mexico	0	3	1	5	1	2	2	9
Arizona	0	2	2	2	0	0	2	10
Utah [2]	0	0	1	2	0	0	4	0
Pacific States:								
Washington	1	2	23	25	22	43	5	2
Oregon	0	0	2	7	14	9	3	7
California	6	29	47	50	12	33	11	19

[2] Week ended Friday.
[3] Typhus fever: 1931, 5 cases; 1 case in North Carolina; 1 case in Georgia; 1 case in Florida; 1 case in Alabama; and 1 case in Texas.
[4] Figures for 1931 are exclusive of Oklahoma City and Tulsa.

SUMMARY OF MONTHLY REPORTS FROM STATES

The following summary of cases reported monthly by States is published weekly and covers only those States from which reports are received during the current week.

State	Meningococcus meningitis	Diphtheria	Influenza	Malaria	Measles	Pellagra	Poliomyelitis	Scarlet fever	Smallpox	Typhoid fever
June, 1931										
Indiana	17	105	10		1,321		2	354	350	15
Iowa		13			125		1	237	106	7
North Dakota	6	15			172		2	51	48	5
Pennsylvania	39	289			9,061	4	4	1,839	1	52
Porto Rico		45	210	1,623	21	2	0		0	19
Tennessee	20	27	57	106	1,327	86	3	151	55	68
Vermont		2			228		0	22	36	
Wyoming		5			52		1	32	3	

June, 1931	Cases
Chicken pox:	
Indiana	194
Iowa	163
North Dakota	69
Pennsylvania	1,801
Porto Rico	5
Tennessee	69
Vermont	104
Wyoming	30
Colibacillosis:	
Porto Rico	5
Dysentery:	
Porto Rico	33
Tennessee	20
Filariasis:	
Porto Rico	3
German measles:	
Iowa	25
Pennsylvania	819
Tennessee	11
Hookworm disease:	
Tennessee	1
Impetigo contagiosa:	
Tennessee	2
Lethargic encephalitis:	
North Dakota	2
Pennsylvania	6
Mumps:	
Indiana	67
Iowa	83

Mumps—Continued.

	Cases
North Dakota	40
Pennsylvania	1,533
Porto Rico	3
Tennessee	57
Vermont	79
Wyoming	35

Ophthalmia neonatorum:

Pennsylvania	8
Porto Rico	3
Tennessee	5

Paratyphoid fever:

Iowa	3
Porto Rico	1
Tennessee	2

Puerperal septicemia:

Pennsylvania	24
Porto Rico	7
Tennessee	3

Rocky Mountain spotted or tick fever:

Wyoming	10

Septic sore throat:

Tennessee	1

Tetanus:

Iowa	1
Pennsylvania	6
Porto Rico	10
Tennessee	4

Tetanus, infantile:

	Cases
Porto Rico	18

Trachoma:

Pennsylvania	2

Tularaemia:

Tennessee	1
Wyoming	1

Undulant fever:

Indiana	2
Iowa	4
North Dakota	1
Pennsylvania	1

Vincent's angina:

Iowa	1
North Dakota	34
Tennessee	5
Wyoming	1

Whooping cough:

Indiana	265
Iowa	168
North Dakota	44
Pennsylvania	1,107
Porto Rico	214
Tennessee	251
Vermont	25
Wyoming	29

Cases of Certain Communicable Diseases Reported for the Month of February, 1931, by State Health Officers

State	Chicken pox	Diphtheria	Measles	Mumps	Scarlet fever	Smallpox	Tuberculosis	Typhoid and paratyphoid fever	Whooping cough
Maine	204	18	103	285	134	0	37	6	229
New Hampshire		1			46	0		0	
Vermont	90	1	62	136	31	1	12	0	75
Massachusetts	1,296	208	2,196	525	1,510	0	483	12	583
Rhode Island	99	40	14	84	246	0	40	4	55
Connecticut	384	45	1,338	281	224	0	79	1	201
New York	2,445	456	3,477	1,428	3,326	38	1,562	40	1,875
New Jersey	1,557	213	2,879	177	1,094	0	389	11	639
Pennsylvania	3,989	405	8,128	1,584	2,359	1	546	55	801
Ohio	2,360	214	1,881	1,067	2,220	239	654	38	421
Indiana	497	174	2,720	57	1,407	432	200	6	200
Illinois	1,543	533	4,484	1,392	1,910	228	641	13	419
Michigan	1,328	163	778	573	1,556	142	493	17	777
Wisconsin	1,688	63	1,326	2,351	631	28	147	8	501
Minnesota	639	55	205		401	43	196	11	216
Iowa	325	34	39	58	554	249	24	1	33
Missouri	510	181	3,692	154	1,339	257	173	13	103
North Dakota	119	42	37	59	132	38	12	5	58
South Dakota	127	29	62	24	93	118	12	1	16
Nebraska	328	48	15	285	212	222	22	5	84
Kansas	727	59	71	339	279	373	161	2	122
Delaware	37	3	65	20	105	0	19	0	20
Maryland	874	87	2,063	225	453	0	195	12	123
District of Columbia		53	270		94	0	98	1	18
Virginia	833	147	2,795		344	8	208	28	384
West Virginia	305	45	251		87	44	39	10	220
North Carolina	813	114	1,446		274	8		8	386
South Carolina	422	108	583	173	58	14	155	15	213
Georgia	266	32	500	171	260	4	107	20	47
Florida	240	30	637	26	31	0	32	13	29
Kentucky [1]									
Tennessee	526	57	1,268	179	477	39	153	20	104
Alabama	38	111	2,063	156	129	27	395	28	54
Mississippi	1,092	67	190	348	131	90	123	20	442

[1] Reports received weekly.

Cases of Certain Communicable Diseases Reported for the Month of February, 1931, by State Health Officers—Continued

State	Chicken pox	Diphtheria	Measles	Mumps	Scarlet fever	Smallpox	Tuberculosis	Typhoid and paratyphoid fever	Whooping cough
Arkansas	167	38	25	29	82	91	[2] 22	19	100
Louisiana	65	174	14	9	100	120	[2] 126	35	24
Oklahoma [3]	100	95	109	20	141	369	50	17	26
Texas		192			183			35	
Montana	109	8	10	161	196	13	45	6	165
Idaho					87			20	
Wyoming	120	3	9	28	131	9		1	61
Colorado	321	37	758	207	200	28	71	5	169
New Mexico	70	19	148	79	30	11	65	2	12
Arizona	78	24	760	27	2	7	116		16
Utah [1]									
Nevada	13	4	39	50	5		11		2
Washington	455	67	198	235	242	125	156	7	229
Oregon	206	41	332	304	104	104	44	1	78
California	2,710	220	3,794	1,217	556	258	941	49	744

[1] Reports received weekly.
[2] Pulmonary.
[3] Exclusive of Oklahoma City and Tulsa.

Case Rates per 100,000 Population (Annual Basis) for the Month of February, 1931

State	Chicken pox	Diphtheria	Measles	Mumps	Scarlet fever	Smallpox	Tuberculosis	Typhoid and paratyphoid fever	Whooping cough
Maine	332	29	168	464	218	0	60	10	373
New Hampshire		3			128	0		0	
Vermont	325	4	224	492	112	4	43	0	271
Massachusetts	393	63	666	159	458	0	146	4	177
Rhode Island	185	75	26	157	460	0	75	7	103
Connecticut	306	36	1,067	224	179	0	63	1	160
New York	248	46	353	145	337	4	158	4	190
New Jersey	489	67	904	56	344	0	122	3	201
Pennsylvania	534	54	1,088	212	316	0	73	7	107
Ohio	455	41	363	206	428	46	126	7	81
Indiana	198	69	1,082	23	560	172	80	2	80
Illinois	259	89	752	234	320	38	108	2	70
Michigan	347	43	203	150	407	37	129	4	203
Wisconsin	739	28	581	1,030	276	12	64	4	219
Minnesota	322	28	103		202	22	99	6	109
Iowa	171	18	21	30	291	131	13	1	17
Missouri	182	65	1,316	55	477	92	62	5	37
North Dakota	226	80	70	112	251	72	23	10	110
South Dakota	237	54	116	45	173	220	22	2	30
Nebraska	308	45	14	268	199	209	21	5	79
Kansas	500	41	49	233	192	257	117	1	84
Delaware	201	16	353	109	570	0	103	0	109
Maryland	689	69	1,626	177	357	0	154	9	97
District of Columbia		140	714		249	0	259	3	48
Virginia	446	79	1,496		184	4	111	15	206
West Virginia	226	33	186		64	33	29	7	163
North Carolina	327	46	581		110	3		3	155
South Carolina	315	81	435	129	43	10	116	11	159
Georgia	119	14	224	77	116	2	48	9	21
Florida	205	26	543	22	26	0	27	11	25
Kentucky [1]									
Tennessee	259	28	624	88	235	19	75	10	51
Alabama	18	54	1,002	76	63	13	192	14	26
Mississippi	699	43	122	223	84	58	79	13	283
Arkansas	117	27	17	20	57	64	[2] 15	13	70
Louisiana	40	106	9	5	61	73	[2] 77	21	15
Oklahoma [3]	62	59	68	12	88	230	31	11	16
Texas		42			40			8	

[1] Reports received weekly.
[2] Pulmonary.
[3] Exclusive of Oklahoma City and Tulsa.

Case Rates per 100,000 Population (Annual Basis) for the Month of February, 1931—Continued

State	Chicken pox	Diphtheria	Measles	Mumps	Scarlet fever	Smallpox	Tuberculosis	Typhoid and paratyphoid fever	Whooping cough
Montana	264	19	24	390	475	32	109	15	400
Idaho					254			58	
Wyoming	682	17	51	159	745	51		6	347
Colorado	399	46	943	258	249	35	88	6	210
New Mexico	212	57	448	239	91	33	197	6	36
Arizona	227	70	2,212	79	6	20	338		47
Utah [1]									
Nevada	183	56	548	703	70		155		28
Washington	373	55	162	193	199	103	128	6	188
Oregon	276	55	444	407	139	139	59	1	104
California	594	48	831	267	122	57	206	11	163

[1] Reports received weekly.

GENERAL CURRENT SUMMARY AND WEEKLY REPORTS FROM CITIES

The 95 cities reporting cases used in the following table are situated in all parts of the country and have an estimated aggregate population of more than 32,815,000. The estimated population of the 88 cities reporting deaths is more than 31,270,000. The estimated expectancy is based on the experience of the last nine years, excluding epidemics.

Weeks ended July 4, 1931, and July 5, 1930

	1931	1930	Estimated expectancy
Cases reported			
Diphtheria:			
46 States	614	650	
95 cities	297	359	592
Measles:			
45 States	6,593	5,538	
95 cities	2,183	1,677	
Meningococcus meningitis:			
46 States	56	70	
95 cities	26	71	
Poliomyelitis:			
46 States	45	173	
Scarlet fever:			
46 States	1,726	1,141	
95 cities	657	462	586
Smallpox:			
46 States	571	781	
95 cities	37	40	28
Typhoid fever:			
46 States	476	532	
95 cities	64	62	63
Deaths reported			
Influenza and pneumonia:			
88 cities	401	341	
Smallpox:			
88 cities	0	0	

City reports for week ended July 4, 1931

The "estimated expectancy" given for diphtheria, poliomyelitis, scarlet fever, smallpox, and typhoid fever is the result of an attempt to ascertain from previous occurrence the number of cases of the disease under consideration that may be expected to occur during a certain week in the absence of epidemics. It is based on reports to the Public Health Service during the past nine years. It is in most instances the median number of cases reported in the corresponding weeks of the preceding years. When the reports include several epidemics, or when for other reasons the median is unsatisfactory, the epidemic periods are excluded, and the estimated expectancy is the mean number of cases reported for the week during nonepidemic years.

If the reports have not been received for the full nine years, data are used for as many years as possible, but no year earlier than 1922 is included. In obtaining the estimated expectancy, the figures are smoothed when necessary to avoid abrupt deviation from the usual trend. For some of the diseases given in the table the available data were not sufficient to make it practicable to compute the estimated expectancy.

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
NEW ENGLAND								
Maine:								
Portland	11	0	0	----------	0	1	1	0
New Hampshire:								
Concord	0	0	0	----------	0	1	0	1
Nashua	0	0	0	----------	0	0	0	0
Vermont:								
Barre	0	0	0	----------	0	4	0	0
Burlington	0	0	0	----------	0	0	0	0
Massachusetts:								
Boston	28	24	31	2	0	41	7	6
Fall River	0	2	2	----------	0	16	4	0
Springfield	1	2	0	----------	0	14	11	0
Worcester	8	2	3	----------	0	1	10	2
Rhode Island:								
Pawtucket	0	0	0	----------	0	3	0	0
Providence	1	4	3	----------	0	66	6	2
Connecticut:								
Bridgeport	1	3	1	----------	0	7	3	3
Hartford	1	2	0	----------	0	1	0	0
New Haven	3	0	0	----------	0	12	1	1
MIDDLE ATLANTIC								
New York:								
Buffalo	9	8	3	----------	0	51	12	18
New York	----------	188	97	6	0	291	----------	80
Rochester	5	6	0	----------	0	147	8	3
Syracuse	15	1	1	----------	0	16	1	3
New Jersey:								
Camden	2	5	4	----------	0	0	0	1
Newark	25	10	6	1	0	10	2	1
Trenton	1	1	1	----------	0	5	2	2
Pennsylvania:								
Philadelphia	48	40	5	1	2	90	12	28
Pittsburgh	17	15	2	----------	1	21	21	13
Reading	15	1	0	----------	0	3	3	1
EAST NORTH CENTRAL								
Ohio:								
Cincinnati	7	4	0	----------	0	20	4	7
Cleveland	31	21	4	----------	0	229	99	15
Columbus	6	2	0	----------	0	4	2	3
Toledo	33	4	4	1	1	15	9	2
Indiana:								
Fort Wayne	2	2	0	----------	0	0	0	1
Indianapolis	9	2	0	----------	0	53	3	11
South Bend	0	2	0	----------	0	2	0	2
Terre Haute	0	0	0	----------	0	2	0	3
Illinois:								
Chicago	94	75	61	1	1	561	33	38
Springfield	1	0	0	----------	0	1	3	2
Michigan:								
Detroit	63	35	13	----------	0	56	19	8
Flint	13	1	0	----------	0	0	2	3
Grand Rapids	4	1	0	----------	0	53	0	0

City reports for week ended July 4, 1931—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST NORTH CENTRAL—contd.								
Wisconsin:								
Kenosha	0	0	0	-	0	3	42	0
Madison	0	0	0	-	-	0	0	-
Milwaukee	-	9	-	-	-	-	-	-
Racine	0	0	0	-	0	2	8	0
Superior	4	0	0	-	0	0	0	0
WEST NORTH CENTRAL								
Minnesota:								
Duluth	3	0	0	-	0		1	0
Minneapolis	7	10	3	-	0	35	5	0
St. Paul	22	6	0	-	0	18	0	4
Iowa:								
Davenport	3	1	0	-	-	0	0	-
Des Moines	0	1	0	-	-	0	0	-
Sioux City	7	0	1	-	-	0	3	-
Waterloo	0	0	0	-	-	0	0	-
Missouri:								
Kansas City	3	2	0	-	0	11	0	7
St. Joseph	0	0	3	-	0	8	0	4
St. Louis	8	21	9	-	-		11	3
North Dakota:								
Fargo	0	0	0	-	0	-	0	0
Grand Forks	0	0	0	-	-	0	0	-
South Dakota:								
Aberdeen	0	0	0	-	-	1	0	-
Nebraska:								
Omaha	2	2	1	-	0	0	7	5
Kansas:								
Topeka	0	1	0	-	2	1	31	1
Wichita	26	0	0	-	1	0	0	2
SOUTH ATLANTIC								
Delaware:								
Wilmington	0	1	1	-	0	2	0	1
Maryland:								
Baltimore	15	13	3	1	1	66	18	12
Cumberland	1	0	0	-	0	0	0	0
Frederick	0	0	0	-	0	0	0	0
District of Columbia:								
Washington	18	5	2	-	0	18	0	7
Virginia:								
Lynchburg	0	0	0	-	0	0	0	1
Norfolk	0	0	1	-	0	0	0	2
Richmond	0	1	0	-	0	7	0	0
Roanoke	1	0	0	-	0	2	0	0
West Virginia:								
Charleston	0	0	0	-	0	0	0	0
Wheeling	1	0	0	-	0	0	0	0
North Carolina:								
Raleigh	0	0	0	-	0	13	0	0
Wilmington	0	0	0	-	0	0	0	1
Winston-Salem	3	0	0	-	0	36	4	0
South Carolina:								
Charleston	0	0	0	6	0	0	0	4
Columbia	-	0	-	-	-	-	-	-
Greenville	0	0	0	-	0	0	0	0
Georgia:								
Atlanta	0	1	0	-	0	5	0	6
Brunswick	0	0	0	-	0	0	1	0
Savannah	8	1	0	4	0	4	2	1
Florida:								
Miami	0	1	0	-	0	8	0	0
Tampa	1	1	0	-	1	1	0	0
EAST SOUTH CENTRAL								
Kentucky:								
Covington	0	0	0	-	0	0	0	1
Tennessee:								
Memphis	1	1	1	-	2	51	1	3
Nashville	0	0	0	-	0	8	0	4

City reports for week ended July 4, 1931—Continued

Division, State, and city	Chicken pox, cases reported	Diphtheria		Influenza		Measles, cases reported	Mumps, cases reported	Pneumonia, deaths reported
		Cases, estimated expectancy	Cases reported	Cases reported	Deaths reported			
EAST SOUTH CENTRAL—contd.								
Alabama:								
Birmingham	0	1	0	....	1	0	1	4
Mobile	0	0	1	....	0	0	0	1
Montgomery	0	0	0	1	....	1	0	....
WEST SOUTH CENTRAL								
Arkansas:								
Fort Smith	0	0	0	....	....	0	0	....
Little Rock	0	0	0	....	0	0	0	2
Louisiana:								
New Orleans	0	5	0	2	2	0	0	11
Shreveport	2	0	0	....	0	1	1	1
Oklahoma:								
Muskogee	0	0	2	....	0	0	0	0
Oklahoma City	0	0	0	....	0	1	0	3
Texas:								
Dallas	0	3	2	....	0	1	1	1
Fort Worth	1	1	0	....	0	7	0	0
Galveston	0	0	0	....	0	0	0	3
Houston	0	2	4	....	0	4	0	2
San Antonio	0	1	2	....	1	1	0	6
MOUNTAIN								
Montana:								
Billings	....	0	....	....	....	....	....	....
Great Falls	4	0	0	....	0	1	0	0
Helena	0	0	0	....	0	0	0	0
Missoula	0	0	0	....	0	0	0	0
Idaho:								
Boise	4	0	0	....	0	0	3	0
Colorado:								
Denver	7	7	1	....	1	17	8	4
Pueblo	1	0	0	....	0	4	0	1
New Mexico:								
Albuquerque	7	0	0	....	1	5	1	0
Arizona:								
Phoenix	0	0	0	....	1	1	0	2
Utah:								
Salt Lake City	8	2	0	....	0	1	4	1
Nevada:								
Reno	0	0	0	....	0	1	0	2
PACIFIC								
Washington:								
Seattle	23	2	2	....	....	5	10	....
Spokane	2	2	0	....	....	2	0	....
Tacoma	0	2	4	....	0	1	3	1
Oregon:								
Portland	5	5	0	....	0	6	3	6
Salem	1	0	0	....	0	0	7	0
California:								
Los Angeles	8	30	15	7	2	32	4	13
Sacramento	1	1	2	....	0	7	0	0
San Francisco	8	9	3	....	0	29	0	5

City reports for week ended July 4, 1931—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
NEW ENGLAND											
Maine:											
Portland	1	1	0	0	0	0	1	0	0	1	21
New Hampshire:											
Concord	0	0	0	0	0	1	0	0	0	0	13
Nashua	0	0	0	0	0	0	0	0	0	0	--------
Vermont:											
Barre	0	2	0	0	0	0	0	0	0	2	2
Burlington	0	0	0	4	0	0	0	0	0	0	6
Massachusetts:											
Boston	9	38	0	0	0	11	1	3	0	21	--------
Fall River	2	2	0	0	0	1	0	0	0	6	20
Springfield	3	3	0	0	0	3	0	0	0	2	24
Worcester	5	13	0	0	0	0	0	0	0	9	31
Rhode Island:											
Pawtucket	0	0	0	0	0	0	0	0	0	0	9
Providence	4	9	0	0	0	6	0	0	0	4	54
Connecticut:											
Bridgeport	3	3	0	0	0	2	0	0	0	0	31
Hartford	2	2	0	0	0	1	0	0	0	6	35
New Haven	2	5	0	0	0	2	0	1	0	6	30
MIDDLE ATLANTIC											
New York:											
Buffalo	15	20	0	0	0	9	0	1	0	32	122
New York	108	117	0	--------	--------	89	14	7	2	--------	1,267
Rochester	5	20	0	0	0	4	0	0	0	12	95
Syracuse	5	5	0	0	0	3	0	0	0	22	54
New Jersey:											
Camden	3	2	0	0	0	3	0	0	0	1	23
Newark	12	20	0	1	0	12	1	0	0	76	132
Trenton	1	3	0	0	0	1	0	0	0	3	27
Pennsylvania:											
Philadelphia	47	91	0	0	0	33	1	2	0	43	438
Pittsburgh	19	22	0	0	0	9	1	1	0	26	176
Reading	2	2	0	0	0	2	0	0	0	0	30
EAST NORTH CENTRAL											
Ohio:											
Cincinnati	8	11	1	0	0	13	1	1	0	1	147
Cleveland	23	15	1	0	0	14	1	0	0	45	203
Columbus	3	0	0	2	0	6	0	0	0	4	75
Toledo	8	2	0	0	0	4	1	0	0	22	55
Indiana:											
Fort Wayne	1	0	1	0	0	1	0	0	0	0	7
Indianapolis	5	0	4	6	0	3	0	0	0	53	--------
South Bend	1	1	0	0	0	0	0	0	0	0	20
Terre Haute	1	0	0	0	0	0	0	0	0	2	18
Illinois:											
Chicago	72	85	1	0	0	52	4	2	0	102	1,222
Springfield	1	2	0	2	0	3	0	0	0	0	49
Michigan:											
Detroit	57	61	1	3	0	22	2	2	0	149	222
Flint	6	5	1	0	0	1	1	0	0	1	29
Grand Rapids	5	5	0	0	0	0	0	0	0	7	34
Wisconsin:											
Kenosha	1	0	1	0	0	0	0	0	0	2	4
Madison	1	0	0	0	--------	--------	0	0	--------	0	--------
Milwaukee	13	--------	0	--------	--------	--------	0	--------	--------	--------	--------
Racine	2	1	0	0	0	3	0	0	0	17	15
Superior	2	0	0	0	0	0	0	0	0	0	10

City reports for week ended July 4, 1931—Continued

Division, State, and city	Scarlet fever		Smallpox			Tuberculosis, deaths reported	Typhoid fever			Whooping cough, cases reported	Deaths all causes
	Cases, estimated expectancy	Cases reported	Cases, estimated expectancy	Cases reported	Deaths reported		Cases, estimated expectancy	Cases reported	Deaths reported		
WEST NORTH CENTRAL											
Minnesota:											
Duluth	5	0	0	0	0	1	0	0	0	0	8
Minneapolis	17	2	0	0	0	2	0	0	0	3	174
St. Paul	10	2	0	0	0	3	0	1	0	35	103
Iowa:											
Davenport	0	1	1	0			0	0		3	
Des Moines	3	2	1	3			0	0		2	40
Sioux City	1	0	1	0			0	0		2	
Waterloo	1	0	0	0			0	0		4	
Missouri:											
Kansas City	5	0	0	0	0	16	1	0	0	3	138
St. Joseph	0	0	0	0	0	0	0	0	0	1	35
St. Louis	13	10	1	1	0	21	2	3	0	30	444
North Dakota:											
Fargo	2	0	0	0	0	0	0	0	0	3	7
Grand Forks	1	0	0	0			0	0		0	
South Dakota:											
Aberdeen	0	1	0	0			0	0		0	
Nebraska:											
Omaha	1	2	2	2	0	4	0	0	0	4	95
Kansas:											
Topeka	0	0	0	0	0	0	1	1	0	2	31
Wichita	1	0	0	2	0	0	0	0	0	6	41
SOUTH ATLANTIC											
Delaware:											
Wilmington	1	3	0	0	0	0	0	0	0	1	24
Maryland:											
Baltimore	18	8	0	0	0	11	2	2	1	70	208
Cumberland	0	0	0	0	0	0	0	0	0	0	11
Frederick	0	0	0	0	0	0	0	0	0	0	
District of Columbia:											
Washington	9	6	0	0	0	10	1	0	0	23	145
Virginia:											
Lynchburg	0	0	0	0	0	0	0	1	0	0	18
Norfolk	0	5	0	0	0	0	0	1	0	7	
Richmond	1	2	0	0	0	5	2	0	0	0	45
Roanoke	0	1	0	0	0	2	0	0	0	4	12
West Virginia:											
Charleston	0	0	0	0	0	2	0	0	0	7	14
Wheeling	1	0	0	0	0	0	0	0	0	2	14
North Carolina:											
Raleigh	0	1	0	0	0	2	0	0	0	11	18
Wilmington	0	0	0	0	0	2	0	0	0	0	12
Winston-Salem	0	0	0	0	0	2	1	0	0	24	17
South Carolina:											
Charleston	0	0	0	0	0	3	1	1	0	0	30
Columbia	0		0				1				
Greenville	0	0	0	0	0	0	1	0	0	22	
Georgia:											
Atlanta	3	6	1	0	0	7	0	0	1	8	113
Brunswick	0	0	0	0	0	0	0	0	0	0	4
Savannah	0	0	0	0	0	0	1	1	2	1	30
Florida:											
Miami	0	0	0	0	0	3	0	0	0	1	23
Tampa	0	0	0	0	0	0	0	0	1	2	22
EAST SOUTH CENTRAL											
Kentucky:											
Covington	0	5	0	1	0	1	0	0	0	0	25
Tennessee:											
Memphis	2	1	0	3	0	7	4	5	0	39	97
Nashville	0	0	0	0	0	2	3	1	0	2	65
Alabama:											
Birmingham	1	2	1	0	0	2	2	1	0	4	78
Mobile	0	0	0	0	0	1	1	0	0	0	28
Montgomery	0	0	0	0			1	0		0	

City reports for week ended July 4, 1931—Continued

Division, State, and city	Scarlet fever: Cases, estimated expectancy	Scarlet fever: Cases reported	Smallpox: Cases, estimated expectancy	Smallpox: Cases reported	Smallpox: Deaths reported	Tuberculosis, deaths reported	Typhoid fever: Cases, estimated expectancy	Typhoid fever: Cases reported	Typhoid fever: Deaths reported	Whooping cough, cases reported	Deaths all causes
WEST SOUTH CENTRAL											
Arkansas:											
Fort Smith	0	0	0	0	--------	--------	0	3	--------	6	--------
Little Rock	0	0	0	0	0	0	1	0	0	0	2
Louisiana:											
New Orleans	3	3	0	5	0	16	3	2	3	4	175
Shreveport	0	0	0	0	0	5	0	4	0	4	35
Oklahoma:											
Muskogee	0	0	1	0	0	0	0	0	0	0	--------
Oklahoma City	1	2	1	2	0	0	1	4	0	8	33
Texas:											
Dallas	2	8	1	0	0	4	2	2	0	30	53
Fort Worth	1	1	1	5	0	1	1	2	0	11	29
Galveston	0	0	0	0	0	1	0	0	0	0	20
Houston	2	1	0	1	0	2	1	10	0	1	63
San Antonio	1	0	1	1	0	5	1	0	0	1	62
MOUNTAIN											
Montana:											
Billings	0	--------	0	--------	--------	--------	0	--------	--------	--------	--------
Great Falls	0	0	0	0	0	0	0	2	0	5	7
Helena	0	0	0	0	0	0	0	0	0	0	4
Missoula	0	0	0	0	0	0	0	0	0	0	6
Idaho:											
Boise	0	0	0	0	0	0	0	0	0	0	6
Colorado:											
Denver	6	2	0	0	0	4	0	0	0	31	69
Pueblo	1	1	0	0	0	2	0	2	0	7	9
New Mexico:											
Albuquerque	0	0	0	0	0	6	0	0	1	1	12
Arizona:											
Phoenix	0	0	0	0	0	1	0	1	0	0	--------
Utah:											
Salt Lake City	2	1	1	0	0	2	0	0	0	24	28
Nevada:											
Reno	0	0	0	0	0	0	0	0	0	0	4
PACIFIC											
Washington:											
Seattle	4	7	1	0	--------	--------	1	0	--------	41	--------
Spokane	2	0	3	3	--------	--------	0	0	--------	5	--------
Tacoma	1	2	1	3	0	1	0	0	0	0	16
Oregon:											
Portland	4	1	7	6	0	1	0	0	0	1	62
Salem	0	0	1	0	0	0	0	0	0	0	--------
California:											
Los Angeles	21	9	3	0	0	17	2	1	1	17	238
Sacramento	2	1	1	0	0	0	1	1	1	3	19
San Francisco	9	5	0	1	0	7	0	0	0	7	164

City reports for week ended July 4, 1931—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
NEW ENGLAND									
Maine:									
Portland	0	0	0	1	0	0	0	0	0
Massachusetts:									
Boston	0	0	0	0	0	0	0	3	0
MIDDLE ATLANTIC									
New York:									
New York City [1]	3	1	0	3	0	0	2	5	1
New Jersey:									
Newark	1	0	0	0	0	0	0	0	0
Pennsylvania:									
Philadelphia	1	2	0	0	0	0	0	0	0
Pittsburgh	1	0	0	0	0	0	0	1	1
EAST NORTH CENTRAL									
Ohio:									
Cincinnati	0	0	0	0	0	0	0	1	0
Cleveland	3	2	2	0	0	0	0	0	0
Indiana:									
Indianapolis	1	4	0	0	0	0	0	0	0
South Bend	1	0	0	0	0	0	0	0	0
Illinois:									
Chicago	7	7	0	0	0	0	0	2	0
Michigan:									
Detroit	0	1	3	1	0	0	0	0	0
Grand Rapids	0	0	0	1	0	0	0	1	0
WEST NORTH CENTRAL									
Minnesota:									
Minneapolis	0	0	0	1	0	0	0	0	0
Missouri:									
St. Louis	1	1	0	0	0	0	0	1	0
Kansas:									
Topeka	1	0	0	0	0	0	0	0	0
SOUTH ATLANTIC									
Maryland:									
Baltimore	1	2	0	1	0	0	0	0	0
North Carolina:									
Raleigh	0	0	0	0	1	1	0	0	0
Winston-Salem	0	0	0	0	0	1	0	0	0
South Carolina:									
Charleston	0	0	0	0	3	2	0	0	0
Georgia:									
Atlanta	1	1	0	0	2	2	0	0	0
Brunswick	0	0	0	0	0	1	0	0	0
Savannah [1]	0	0	0	0	2	0	0	0	0
Florida:									
Miami	0	0	0	0	0	1	0	0	0
Tampa	0	0	0	0	0	1	0	0	0
EAST SOUTH CENTRAL									
Tennessee:									
Nashville	1	2	0	0	0	0	0	0	0
Alabama:									
Birmingham	1	0	0	0	1	1	0	0	0
Mobile	0	0	0	0	2	1	0	0	0

[1] Typhus fever: 1 death and 2 cases; 1 death at New York City, N. Y.; 1 case at Savannah, Ga; and 1 case at Fort Worth, Tex.

City reports for week ended July 4, 1931—Continued

Division, State, and city	Meningococcus meningitis		Lethargic encephalitis		Pellagra		Poliomyelitis (infantile paralysis)		
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases, estimated expectancy	Cases	Deaths
WEST SOUTH CENTRAL									
Louisiana:									
New Orleans	1	1	0	0	1	1	0	0	0
Texas:									
Fort Worth [1]	0	0	0	0	0	1	0	0	0
Houston	1	1	0	0	0	0	0	1	0
MOUNTAIN									
Utah:									
Salt Lake City	0	1	0	0	0	0	0	0	0
PACIFIC									
Washington:									
Tacoma	0	1	0	0	0	0	0	0	0
California:									
Los Angeles	0	0	0	0	0	1	1	2	0
San Francisco	0	0	0	0	2	1	1	0	0

[1] Typhus fever: 1 death and 2 cases; 1 death at New York City, N. Y.; 1 case at Savannah, Ga.; and 1 case at Forth Worth, Tex.

The following tables give the rates per 100,000 population, for 98 cities for the 5-week period ended July 4, 1931, compared with those for a like period ended July, 5 1930. The population figures used in computing the rates are estimated midyear populations for 1930 and 1931, respectively, derived from the 1930 census. The 98 cities reporting cases have an estimated aggregate population of more than 33,000,000. The 91 cities reporting deaths have more than 31,500,000 estimated population.

Summary of weekly reports from cities, May 31 to July 4, 1931.—Annual rates per 100,000 population, compared with rates for the corresponding period of 1930 [1]

DIPHTHERIA CASE RATES

	Week ended—									
	June 6, 1931	June 7, 1930	June 13, 1931	June 14, 1930	June 20, 1931	June 21, 1930	June 27, 1931	June 28, 1930	July 4, 1931	July 5, 1930
98 cities	67	75	54	78	66	66	54	65	[2] 47	57
New England	46	94	41	39	41	39	67	68	96	56
Middle Atlantic	74	68	55	78	65	77	47	62	53	56
East North Central	75	112	64	128	89	92	72	97	[3] 51	91
West North Central	55	52	61	60	52	35	42	72	33	37
South Atlantic	39	54	49	44	43	36	45	26	[4] 12	26
East South Central	12	12	17	12	6	12	23	12	12	36
West South Central	68	38	27	80	85	80	68	35	27	49
Mountain	191	18	35	35	26	9	9	0	[5] 9	9
Pacific	49	65	53	36	71	47	51	54	51	32

MEASLES CASE RATES

	June 6, 1931	June 7, 1930	June 13, 1931	June 14, 1930	June 20, 1931	June 21, 1930	June 27, 1931	June 28, 1930	July 4, 1931	July 5, 1930
98 cities	1,096	934	876	815	723	642	568	489	[2] 347	270
New England	933	1,596	601	1,546	635	1,144	438	832	402	544
Middle Atlantic	1,101	1,021	838	1,033	663	776	511	607	283	322
East North Central	1,446	512	1,304	453	1,178	377	921	331	[3] 643	168
West North Central	817	420	448	370	331	302	296	269	143	139
South Atlantic	1,473	523	1,102	397	766	411	591	256	[4] 310	180
East South Central	1,140	371	820	161	844	239	588	227	349	126
West South Central	254	115	149	94	88	77	47	17	24	24
Mountain	870	5,665	705	3,410	609	2,687	479	1,454	[5] 215	731
Pacific	511	1,903	580	1,340	302	1,069	362	798	149	451

SCARLET FEVER CASE RATES

	June 6, 1931	June 7, 1930	June 13, 1931	June 14, 1930	June 20, 1931	June 21, 1930	June 27, 1931	June 28, 1930	July 4, 1931	July 5, 1930
98 cities	310	208	269	183	221	141	168	107	[2] 104	75
New England	414	252	291	218	272	126	238	135	188	73
Middle Atlantic	355	186	318	147	280	112	194	85	135	54
East North Central	422	293	386	301	310	226	240	182	[3] 121	115
West North Central	258	265	168	238	132	151	78	99	31	105
South Atlantic	197	170	122	158	77	106	93	68	[4] 54	62
East South Central	151	96	169	48	93	60	64	54	47	12
West South Central	41	73	88	35	30	98	30	38	41	45
Mountain	104	194	96	132	78	203	96	62	[5] 36	167
Pacific	86	93	80	97	57	73	57	49	47	38

SMALLPOX CASE RATES

	June 6, 1931	June 7, 1930	June 13, 1931	June 14, 1930	June 20, 1931	June 21, 1930	June 27, 1931	June 28, 1930	July 4, 1931	July 5, 1930
98 cities	14	20	10	14	7	10	8	13	[2] 6	6
New England	0	0	0	0	5	0	0	0	0	0
Middle Atlantic	0	1	1	0	0	0	1	0	0	0
East North Central	16	8	12	11	5	7	5	10	[3] 8	5
West North Central	42	118	36	54	29	31	19	52	10	14
South Atlantic	18	4	0	8	14	2	12	10	[4] 0	2
East South Central	17	30	23	36	12	18	17	6	23	18
West South Central	41	21	24	21	20	24	30	21	24	0
Mountain	26	62	17	35	0	35	70	53	[5] 0	53
Pacific	33	59	25	49	16	36	6	43	14	32

[1] The figures given in this table are rates per 100,000 population, annual basis, and not the number of cases reported. Populations used are estimated as of July 1, 1931 and 1930, respectively.
[2] Milwaukee, Wis., Columbia, S. C., and Billings, Mont., not included.
[3] Milwaukee, Wis., not included.
[4] Columbia, S. C., not included.
[5] Billings, Mont., not included.

Summary of weekly reports from cities, May 31 to July 4, 1931.—Annual rates per 100,000 population, compared with rates for the corresponding period of 1930—Continued

TYPHOID FEVER CASE RATES

	Week ended—									
	June 6, 1931	June 7, 1930	June 13, 1931	June 14, 1930	June 20, 1931	June 21, 1930	June 27, 1931	June 28, 1930	July 4, 1931	July 5, 1930
98 cities	6	8	7	9	9	8	10	13	[2] 10	10
New England	2	5	0	10	10	0	0	10	10	7
Middle Atlantic	5	6	7	8	12	4	4	5	5	5
East North Central	1	4	4	4	4	2	6	10	[3] 3	1
West North Central	10	10	4	6	6	8	10	14	10	8
South Atlantic	20	22	14	16	14	24	16	40	[4] 10	28
East South Central	17	12	17	24	12	48	35	60	41	84
West South Central	10	35	24	17	14	24	54	31	71	45
Mountain	17	0	9	9	0	9	52	35	[5] 36	0
Pacific	4	2	12	16	10	6	14	4	4	4

INFLUENZA DEATH RATES

	June 6, 1931	June 7, 1930	June 13, 1931	June 14, 1930	June 20, 1931	June 21, 1930	June 27, 1931	June 28, 1930	July 4, 1931	July 5, 1930
91 cities	6	5	4	6	7	4	4	3	[2] 3	4
New England	2	0	0	2	7	2	2	0	0	2
Middle Atlantic	5	4	4	5	8	5	2	2	1	4
East North Central	2	4	4	6	5	4	6	2	[3] 1	2
West North Central	6	12	6	15	6	0	0	0	9	0
South Atlantic	14	10	6	2	4	2	6	6	[4] 4	6
East South Central	38	13	13	13	0	13	6	13	19	6
West South Central	10	11	3	25	14	7	7	11	10	14
Mountain	0	9	0	0	9	0	0	0	[5] 9	0
Pacific	7	2	5	5	5	0	2	2	5	7

PNEUMONIA DEATH RATES

	June 6, 1931	June 7, 1930	June 13, 1931	June 14, 1930	June 20, 1931	June 21, 1930	June 27, 1931	June 28, 1930	July 4, 1931	July 5, 1930
91 cities	86	83	75	83	70	72	67	66	[2] 64	54
New England	120	80	60	89	65	75	60	53	36	36
Middle Atlantic	102	100	88	96	72	78	76	71	67	55
East North Central	59	58	60	66	60	52	51	56	[3] 61	40
West North Central	138	132	71	78	106	111	38	87	77	63
South Altantic	77	102	83	80	89	70	103	72	[4] 67	60
East South Central	76	71	145	97	82	117	139	91	82	142
West South Central	86	78	79	100	76	64	90	85	90	78
Mountain	87	115	70	88	78	132	35	79	[5] 72	62
Pacific	48	32	43	57	34	60	41	45	46	52

[2] Milwaukee, Wis., Columbia, S. C., and Billings, Mont., not included.
[3] Milwaukee, Wis., not included.
[4] Columbia, S. C., not included.
[5] Billings, Mont., not included.

FOREIGN AND INSULAR

CANADA

Provinces—Communicable diseases—Week ended June 27, 1931.—The Department of Pensions and National Health of Canada reports cases of certain communicable diseases for the week ended June 27, 1931, as follows:

Province	Cerebro-spinal fever	Influ-enza	Poliomy-elitis	Small-pox	Typhoid fever
Prince Edward Island[1]					
Nova Scotia		1			
New Brunswick					1
Quebec	2				19
Ontario	1			14	20
Manitoba			1		
Saskatchewan				13	
Alberta	1		1		
British Columbia			1		1
Total	4	1	3	27	41

[1] No case of any disease included in the table was reported during the week.

Quebec Province—Communicable diseases—Week ended July 4, 1931.—The Bureau of Health of the Province of Quebec, Canada, reports cases of certain communicable diseases for the week ended July 4, 1931, as follows:

Disease	Cases	Disease	Cases
Chicken pox	29	Scarlet fever	34
Diphtheria	25	Smallpox	1
Erysipelas	5	Tuberculosis	61
Measles	144	Typhoid fever	9
Mumps	2	Whooping cough	13
Puerperal septicemia	2		

COSTA RICA

San Jose—Communicable diseases—January–April, 1931.—During the months of January, February, March, and April, 1931, certain communicable diseases were reported in San Jose, Costa Rica, as follows:

Disease	January		February		March		April	
	Cases	Deaths	Cases	Deaths	Cases	Deaths	Cases	Deaths
Cerebrospinal meningitis		2		6		9		7
Diphtheria		5	1	1	2	1	1	
Dysentery (amebic)	75	9	97	12	86	8	83	5
Gastro-enteritis	66	61	64	72	59	94	158	139
Hookworm disease	114	3	104	2	64	7	109	3
Influenza	128	7	214	10	224	26	186	18
Malaria	547	54	469	27	277	40	273	27
Measles	21	22	25	28	19	4	19	10
Paratyphoid fever			1			2	1	
Tuberculosis		35		35		34		38
Typhoid fever	4	2	2	3	2	6	2	8
Whooping cough		1		1	1	1	5	2

GREAT BRITAIN

Scotland—Vital statistics—Quarter ended March 31, 1931.—The Registrar General of Scotland has published the following statistics for the first quarter of the year 1931:

Population (provisional)	4,842,554
Births	23,558
Birth rate per 1,000 population	19.7
Deaths	20,189
Death rate per 1,000 population	16.9
Marriages	7,068
Deaths under 1 year	2,653
Deaths under 1 year per 1,000 births	113
Deaths from—	
Bronchitis	1,758
Broncho-pneumonia	1,203
Cerebrospinal fever	90
Diabetes	166
Diphtheria	118
Dysentery	4
Erysipelas	56
Deaths from—Continued.	
Heart disease	2,550
Influenza	764
Lethargic encephalitis	28
Measles	56
Nephritis (acute)	58
Nephritis (chronic)	376
Pneumonia	941
Poliomyelitis	5
Puerperal sepsis	55
Scarlet fever	41
Syphilis	28
Tetanus	1
Tuberculosis	1,202
Typhoid fever	4
Whooping cough	438

JAMAICA

Communicable diseases—Four weeks ended June 20, 1931.—During the four weeks ended June 20, 1931, cases of certain communicable diseases were reported in Kingston, Jamaica, and in the Island of Jamaica outside of Kingston as follows:

Disease	Kingston	Other localities	Disease	Kingston	Other localities
Cerebrospinal meningitis	1	1	Poliomyelitis		2
Chicken pox	1	20	Puerperal fever		2
Diphtheria		2	Scarlet fever	7	12
Dysentery		1	Tuberculosis	49	95
Erysipelas		2	Typhoid fever	16	57
Leprosy		1			

MEXICO

Vera Cruz—Deaths—June 1 to 28, 1931.—During the four weeks ended June 28, 1931, deaths from certain causes were reported in Vera Cruz, Mexico, as follows:

Disease	Deaths	Disease	Deaths
Bronchitis	1	Sprue	1
Cancer	5	Syphilis	5
Cerebrospinal meningitis	3	Tetanus	1
Gastro-enteritis	42	Tuberculosis	15
Hookworm disease	1	Typhoid fever	3
Malaria	3	All other causes	63
Pneumonia	6		
Puerperal septicemia	2	Total	151

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

From medical officers of the Public Health Service, American consuls, International Office of Public Hygiene, Pan American Sanitary Bureau, health section of the League of Nations, and other sources. The reports contained in the following tables must not be considered as complete or final as regards either the list of countries included or the figures for the particular countries for which reports are given.

CHOLERA

[C indicates cases; D, deaths; P, present]

Place		Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Mar. 8–Apr. 4, 1931	Week ended— April, 1931			May, 1931					June, 1931				July, 1931	
					11	18	25	2	9	16	23	30	6	13	20	27	4	11
Ceylon: Colombo	C			1								1	1					
	D											1	1					
China: Canton	C				1						2				1			
	D										1							
India	C	15,334	11,544	8,968	3,161	3,067	2,668	2,566	3,242	3,013								
	D	8,123	6,131	4,550	1,571	1,550	1,360	1,286	1,806	1,598								
Bombay	C	21			2													
	D	9			1													
Calcutta	C	121	170	436	95	82	62	71	72	89	49	55	94	74	50			
	D	86	112	256	55	51	26	44	39	44	34	32	57	47	26			
Karikal	C		9	12	10	8	1		10		1	1						
	D		8	12	5	8	1		5		1	1						
Madras	C	39	72	20	3	1	4	18	18	23	11		3	6				
	D	47	29	10	5	1	3	5	6	8	2	1		4				
Negapatam	D	3	3															
Rangoon	C											2			2			
	D	1										1			1			
Tuticorin	C	1	1															
Vizagapatam	C															1		
India (French):																		
Chandernagor	C	1	5	7	3	2	1		3		1			1				
	D	1	5	6	3	2			3		1			1				
Pondicherry	C	19	100	100	5	3	5	11	3	8	2	4	1	1	1			
	D	11	34	18	1	3				3		4	1	1	1			
Indo-China (see also table below):																		
Pnompenh	C	4	9		1	1							1					
	D	2	5	1			1		2				1					
Saigon and Cholon	C	6	4	5	2	3	7	15	25	23	34	22	18	16	14	13		
	D	3	4	5		3	6	13	20	18	25	13	9	14	9	9		
Persia: Rafsanjan [1]	C								31	1	4							
	D								12		2							

Philippine Islands:[2]																		
Iloilo	C	2																
	D	2																
Provinces—																		
Capiz	C	59	186	48		3	8	18	11	3		3	4					
	D	47	146	41		3	8	13	11	3		1	4					
Iloilo	C	145	95	7									8	7	5	6	24	8
	D	110	65	4									6	5	6	4	22	8
Masbate	C			21														
	D			9														
Negros, Occidental	C	90	4													2		
	D	56	4													1		
Negros, Oriental	C	1																
	D	1																
Pampanga	C								1									
Siam	C	3	1	10	1	1	1	13	11					1	3			
	D	1		2				4	3					1	1			
Ayudhaya District	C			1														
Bangkok	C	3	2	3	1		1	1	1	1	1					1		
	D	1	1	2			1	1			1					1		
Bismulok Province	C			8														
	D			2														
On vessel:																		
S. S. Arankola, at Rangoon from Culcutta	C											1						
S. S. City of Eastborne, at Calcutta from Cocanada	C												1					
S. S. Tairea, at Penang from Calcutta	C													1				

Place		December, 1930	January, 1931	February, 1931			March, 1931			April, 1931			May, 1931			June, 1931	
				1-10	11-20	21-28	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20
Indo-China (French) (see also table above):																	
Cambodia[3]	C	28	62	71	35	19	14		65					44	40	83	96
Cochin-China[3]	C	8	24	5	5	19	39		33				1	52	75	71	69

[1] From May 11 to 30, 1931, 109 cases of cholera and 57 deaths were reported at Rafsanjan, in Kerman District, Persia.
[2] Figures for Cholera in the Philippines Islands are subject to correction.
[3] Reports incomplete.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE

[C indicates cases; D, deaths; P, present]

Place		Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Mar. 8–Apr. 4, 1931	Week ended— April, 1931			May, 1931					June, 1931				July 4, 1931
						11	18	25	2	9	16	23	30	6	13	20	27	
Algeria:																		
Algiers	C	1	2	1	1													
	D				1													
Bone	C		1											1				
Constantine, vicinity of	C	50	1	1														
	D		1															
Philippeville	C	1																
	D	1																
Argentina:																		
Cordoba Province	C		1	2														
Entre Rios Province—Diamante	C			2														
Jujuy Province—Palpala	C		1	1														
Santa Fe	C			2														
Belgian Congo	C				2										1			
	D				2										1			
British East Africa (see also table below):																		
Tanganyika	C	2		22	8			3	5	17	5	7						
	D	2		4	1			10	11	11	2	8						
Uganda	C	67	25	15	19	8	3	10	14	11	33	31						
	D	67	24	15	19	8	3	9	12	11	26	28						
Ceylon: Colombo	C	9	8	11	8	1	3			1								
	D	9	6	13	7	1	2			1								
Plague-infected rats			2	3	4		1					5						
China: Amoy	C									1								
	D									1								
Dutch East Indies:																		
Batavia and West Java	C	239	180	141	84	19	24	20	11	18	12	14						
	D	238	168	128	80	18	23	20	10	18	12	14						
East Java and Madura	C		4	1	4			1		1								
	D		4	1	4			1		1								
Java and Madura	D	615	427	376	277	58	73	70	42	47	41	46	42					

Egypt:																		
Alexandria	C	3	1	2	1											3	1	1
	D															3	1	1
Plague-infected rats		1	1	1														
Assiout	C	7	26	41	18	5	16	8	3	4	5	8	1	4		5	2	
	D	1	6	11	6		11	4	2	2	4	1					1	
Beni-Suef	C		1					10	2	3		2						
	D		1					3		1		2						
Cairo	C				1													
Deirout	C		21	16					3	7	1		2	3				
	D		4	4					1	2	2			1				
Gharbieh	C		1												1			
	D		1												1			
Girga	C	7	1		86	31	9	4		1	1	5						1
	D	2	1		24	13	3	5	1	1	1							
Kena	C				5			3				1						
	D				2			1				1						
Manfalut	C	23	30	15	17													
	D	5	6	5	3													
Minieh	C		2		3		1			5		1		3				
	D		1		2					2		1		1				
Port Said	C														1	1		1
Hawaii Territory: Hamakua—Plague-infected rats												1						
India	C	3,740	5,335	5,457	9,139	2,503	1,603	1,258	778	434	139							
	D	2,226	3,422	3,661	7,037	1,980	1,377	1,092	750	335	143							
Bassein	C	2	4	1					1			1						1
	D	1	3	1					1			1						1
Bombay	C		1	1	4	4	4	1	2	5		1	1					1
	D		1	1	3	4	4		3	4	1	1						
Plague-infected rats		38	34	32	70	34	43	30	30	26	30	17	21	10	10	10		
Calcutta	C					1	1											
	D					1	1											
Madras Presidency	C	220	312	74	28	3				1	1							
	D	154	182	40	21	2					1							
Rangoon	C	2	2		1	1				1			1		1			
	D	1	1		1	1				1			1		1			
Plague-infected rats		2	4	8	7	1	3			1	1	3	2		3			
Indo-China (see also table below): Pnompenh	C	1	7	1										1		1		
	D	1	7	4	6	2	1	1						1		1		
Iraq:																		
Baghdad	C		5	3	8		5	10	8	7	10	4	2	10	6	1	6	1
	D		4	2	5		2	5	1	3	4	2		1	4	1	3	1
Maudhan	C												2					
Madagascar (see also table below): Tamatave	C	2	9															
Morocco	C	19	13															
	D	8	4															
Nigeria: Lagos	C	5	1			2	2	1										
	D	5	1			2	2	1										
Plague-infected rats		5				3	3											
Peru (see table below).																		
Senegal (see table below).																		

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

PLAGUE—Continued

[C indicates cases; D, deaths; P, present]

Place		Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Mar. 8–Apr. 4, 1931	Week ended— April, 1931: 11	18	25	May, 1931: 2	9	16	23	30	June, 1931: 6	13	20	27	July 4, 1931
Siam	C		4	18	31	1				1			1					
	D		2	14	7	1				1			1					
Bangkok	C	3	8	6	29													
	D	3	8	5	6													
Nagara Rajsima	C	17	9	7	1													
	D	10	10	6														
Syria: Beirut	C	1	1	1														
Tripolitania	C		8	1	1													
	D		3															
Tunisia: Tunis	C	13	1	14	10	5	7		4	7		8	1		8	2	1	
	D			7	4	4	2		2	3					1			
Union of Socialist Soviet Republics:																		
Gouranduz	D		28															
Transcaucasia—Karabakh	C		6															
Union of South Africa:																		
Cape Province	C					2	1											
Orange Free State	C	2	P	1	6	1	1					1	1					
	D	2		1	1	1	1						2					
On vessel: S. S. Marionga de Thermiotis at Avonmouth	C	1																

Place		Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931	May, 1931	June, 1931
British East Africa (see also table above):							
Kenya	C	69	21	7	345	221	
Indo-China (see also table above)	C			4	2		2
Madagascar (see also table above):							
Ambositra Province	C	100	92	70	30		
	D	96	88	66	29		
Antisirabe Province	C	66	84	83	48		
	D	57	79	74	47		
Miarinarivo Province	C	28	31	19	6		
	D	26	29	19	6		
Moramanga Province	C	7	7	1			
	D	5	7	1			
Tananarive Province	C	92	145	90	41		
	D	89	139	81	40		

Place		Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931	May, 1931	June, 1931
Peru	C	29	12				
	D	8	6				
Senegal:							
Baol [1]	C					4	
	D					3	
Dakar [1]	C				2	63	64
	D				1	49	56
Louga [1]	C			14	1	5	
	D			6		2	
Rufisque [1]	C		2			1	2
Thies [1]	C						12
	D						3
Tivaouane [1]	C				4	19	3
	D					11	2

[1] Reports incomplete.

SMALLPOX

Place		Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Mar. 8–Apr. 4, 1931	Week ended— April, 1931			May, 1931					June, 1931				July 4, 1931
						11	18	25	2	9	16	23	30	6	13	20	27	
Algeria:																		
Algiers	C	1	1	1	2		2					1			7	1		
Bone	C		1															
Constantine	C				1					1								
Arabia: Aden	C		1	1														
Belgian Congo	C	79	50								7	10						
Belgium	C			1														
Brazil: Porto Alegre (alastrim)	C		3	7	49	20	19	8	6	2	4	7						
	D			1	1													
British East Africa (see also table below):																		
Tanganyika	C	84	70	91	8						13							
	D	4	5	13	3													
British South Africa: Southern Rhodesia	C	18	13															
Canada:																		
Alberta	C	19	7	1														
British Columbia	C	3	2	8														
Manitoba	C		1	1														
Winnipeg	C	1		1						4								
Nova Scotia	C		1		1													
Ontario	C	17	49	29	9	4		6	7	17	5		8		4	3	14	
Kingston	C	6	1	1				2	3									
North Bay	C	2		1														
Ottawa	C	2	3	1												1		
Sault Ste. Marie	C	1	30	2		3	1				1							
Toronto	C				2		4			1						1		
Quebec	C		2															1
Saskatchewan	C		38	63	58	5	16	3	22	7	15	18	8	7	16	18	13	
Regina	C			1	2			2		2								
Canary Islands: Las Palmas	C				1													
Chile: Chanaral	C												1					
China:																		
Amoy	C				1				2	2	1	1	2	1	2			
	D				1				1	1		1	1	1	1			
Canton	C			3	7	1	2	1				1	2			1		
Chungking	C	2																

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX—Continued

[C indicates cases; D, deaths; P, present]

Place		Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Mar. 8–Apr. 4, 1931	Week ended— April, 1931 11	April 18	April 25	May, 1931 2	May 9	May 16	May 23	May 30	June, 1931 6	June 13	June 20	June 27	July 4, 1931
China—Continued.																		
Foochow	C	P	P	P	P	P			P				P					
Hong Kong	C	1	1	9	2		1	2					1					
	D			3	2			1		1			1					
Manchuria—																		
Harbin	C		1	4	2					1	1		1					
Kwantung—Dairen	C	1			2			1	1	1			1					
Nanking	C	P	P	P	P	P	P	P	P	P	P	P						
Shanghai—																		
Foreigners only	C	14	12	16	6	2	1	2	2	1	4	1	1	2		2		
Including natives	D	11	13	14	10	2	7	4	5	1		3	3	1	5	4	3	
Swatow	D	5	7	13	26	2												
Tientsin	C		1							2								
Chosen (see table below).																		
Colombia: Cali	D									1								
Dutch East Indies:																		
Batavia and West Java	C	4	28	2	1						1	1						
	D	2	2	1														
East Java and Madura	C												1					
Finland	C						1											
France (see table below).																		
Great Britain:																		
England and Wales	C	665	958	745	795	177	163	212	192	186	166	111	107	83	94	62	48	
Bradford	C	1	4	1	2	1		1	4	1	3	1	3			5		
Leeds	C	2			1		1	1		1		1						
London	C	161	140	98	147	51	39	84	53	66	44	37	36	25	50	31	16	
London and Great Towns	C	560	693	683	554	142	126	162	128	139	108	84	72	57	84	49	38	
	D			1		1		1						1				
Sheffield	C		3	32	10	4	2	1										
Stoke-on-Trent	C		1	1														
Greece (see table below).																		

Honduras:																		
Amapala	C			1														
Ocotepeque and Gracias districts	C			P														
Puerto Castilla	C	4	11	3														
Tegucigalpa	C							1										
Tela	C					1												
India	C	5,623	9,623	12,222	11,791	3,980	3,749	3,468	3,068	3,422	2,836							
	D	1,381	2,245	2,660	2,261	807	684	680	752	709	572							
Bassein	C												1					
Bombay	C	2	7	6	10	2	2	1	3	3		6	1		2			
	D	2	1	3	4	1			4	1	1	1	1		1			
Calcutta	C	59	143	251	283	101	60	61	65	24	30	19	16	14	19	14		
	D	40	100	188	203	78	42	50	54	18	25	17	15	12	18	11		
Cochin	C	15	29	59	46	10	11	12	6	3								
	D	1		3														
Karachi	C		3	4	4		5		1							2		
	D		2		2											1		
Madras	C	4	16	8	22	12	4	1	2	1	3	3	1			1		
	D			1	3	2	1	1	1		1	5						
Moulmein	C		2															
Negapatam	C					1	1		1							2	1	
Rangoon	C			4	3	2	2	1	6	7	5		1		1	4	1	
	D				1				1	2	1	1	1		1		1	
Vizagapatam	C		1	8	2	2	2	4	2			5	1	2	1		3	
	D			2	1	1		1				1			1		1	
India (French):																		
Chandernagor	C	5	9	12	14	3	1	4	2	3		4						
	D	3	1	1	2	3	1	2	1	3		2						
Karikal	C	3	5	19	3		1	1	2	1	1	1	1	1	2			
	D	2	4	18			1		2	1	1	1	1	1	2			
Pondicherry Province	C	34	45	19	14	3			3	1	2	7	1	3	2	1	1	
	D	32	45	19	14	3	3		3	1	2	7	1	3	2	1	1	
India (Portuguese)	C	4	5	14	8		19	2				3						
	D			3	3		4	2				1						
Indo-China (see also table below):																		
Pnompenh	C	2	1		1							1		2				
	D		1									1						
Saigon and Cholon	C		6	4	8	1					1		1					
	D		4	1	8	1					1							
Iraq:																		
Baghdad	C			9				1	1			1	2		1			
	D												2					
Basra	C												2		1			
Mosul Liwa	C	1	3	5														
	D			1														
Ivory Coast (see table below).																		
Japan:																		
Kobe	C			2														
Taiwan	C		1															

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

SMALLPOX—Continued

[C indicates cases; D, deaths; P, present]

Place		Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Mar. 8–Apr. 4, 1931	Week ended— April, 1931: 11	April 18	April 25	May, 1931: 2	May 9	May 16	May 23	May 30	June, 1931: 6	June 13	June 20	June 27	July 4, 1931
Mexico (see also table below):																		
Jalisco (State)—Guadalajara	D		1		1				1	1		1			1			1
Mexico City and surrounding territory	C	10		23	33	17	9	11	6	4	10	10	21	5	4	16		
	D	6	1	8	22	4	6	4		4	3	2	2	4	3	6		
Monterrey	C													1				
Torreon	C						1				1					1	2	
	D						2									1	1	
Vera Cruz	C			3	2		1		1	1								
Morocco (see table below).																		
Nicaragua: Porto Cabezas	C	2																
Nigeria: Lagos	C				2													
Panama Canal Zone	C		2															
Poland	C	25		1									3	1	1		1	
Portugal: Lisbon	C	72	103	40	52	8	18	11	10	19	14	16	18	5	17	12	14	
Siam	C	1	4	2				1				3	3					
	D	1											1					
Spain	C	P	P	P	P													
Straits Settlements	C	6	7	2	4	1		9										
	D	3	1	1	1	1	1	3										
Sudan (Anglo-Egyptian)	C	64	11	97	8				8		3		1					
	D	6	7	10	2								1					
Sudan (French) (see table below).																		
Syria (see table below).																		
Tunisia: Tunis	C	17	8		4													
Turkey (see table below).																		
Union of South Africa:																		
Cape Province	C	P	P	P	P	P	P	P		P	P							
Orange Free State	C		P	P	P	P	P	P		P	P	P	P					
Transvaal	C	P	P	P	P													
Upper Volta	C	4		18	3		3			1	2		85	11		1		
	D	2			1								1					

		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
On vessel:																		
S. S. Clan Macteggart at Suez	C			2														
S. S. Muncaster Castle at Manila from Hong Kong	C	1																
S. S. Matheran at Suez from Calcutta	C		1															
S. S. Clan Buchanan at Suez	C			2														
S. S. Rotterdam at Naples from Venice	C				1													
S. S. Clan McTavish at Manila from Chittagong	C						1											
S. S. Benevue at Sydney from Shanghai	C		1															
S. S. Clan MacBrayne at Cochin	C			1														
S. S. Chilka at Rangoon	C			1														
S. S. Taif (pilgrim ship) at Suakin from Jeddah	C								1									
S. S. Talodi at Suakin	C										1							

Place		December, 1930	January, 1931			February, 1931			March, 1931			April, 1931			May, 1931			June, 1931	
			1-10	11-20	21-31	1-10	11-20	21-28	1-10	11-20	21-31	1-10	11-20	21-30	1-10	11-20	21-31	1-10	11-20
Indo-China (see also table above)	C	81	47	48	46	95	46	27	125		139	100				17	41	30	16
Ivory Coast	C	9																	
Sudan (French)	C	139							4		P								
	D	20																	
Syria: Beirut	C			1															1

Place		Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931	May, 1931
Chosen	C		1		11		
	D		1		3		
France	C		4	16	15		
Greece	C	4		4			3
Mexico (see also table above)	D	1		8		1	1
Morocco	C	25		4	6	7	49
Turkey	C	116	63	37	1		9
	D	9	7	6			

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

TYPHUS FEVER

[C indicates cases; D, deaths; P, present]

Place		Dec. 14, 1930–Jan. 10, 1931	Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Mar. 8–Apr. 4, 1931	Week ended— April, 1931: 11	April 18	April 25	May, 1931: 2	May 9	May 16	May 23	May 30	June, 1931: 6	June 13	June 20	June 27	July 4, 1931
Algeria:																		
Algiers	C			2	3			2	1	3		1	3	4	4		1	
Constantine Department	C	6	31	4	3	2		6	1	8	3	5	6	6	3	1	16	
Oran	C		3	1				1					2	2				
Australia, Western	C	3			1					1								
Bulgaria	C	1	13	5	9		26	4			5	8	3	11	10			
	D				2		3				1		3	2				
Chile: Valparaiso	D			1														
China:																		
Canton	C		2		1													
Manchuria—Harbin	C		3	5	3			8										
Shanghai	C		2															
Tientsin	C					1	1											
Chosen (see table below).																		
Czechoslovakia (see table below).																		
Egypt:																		
Alexandria	C						1								1	1		
Beheira Province	C	1				3	1											
Cairo	C	1	1															
Port Said	C		1															
Eritrea: Asmara	C				1													
Great Britain: Scotland	C		1															
Fife County	C												1					
Glasgow	C		2															
	D		1															
Greece (see table below).																		
Guatemala.[1]																		
Iraq: Baghdad	C			5	2					2								
	D			1						2								
Irish Free State:																		
Cork County—Skibbereen	C														1		1	1
Kerry County—																		
Dingle	C									1								
Listowel	C																1	

Limerick County—																		
Limerick	C																	4
Michelstown	C																	1
Mayo County—Belmullet	C						1											
Latvia (see table below).																		
Lithuania (see table below).																		
Mexico (see also table below):																		
Durango	D		1															
Mexico City, including municipalities in Federal District	C	12	39	35	216	67	34	38	31	16	27	17	15	7	12	27		
	D	10	34	16	84	18	7	17	14	9	7	7	10	4	4	11		
San Luis Potosi	D			5	5	1	2					1	1					
Morocco	C	8	8	28	7		1		12		13	29			31	42	28	
	D		2	1					1		2	2			2	3	1	
Palestine	C	4	2	3	5	1	2		2	2	1	1			2	3		2
Panama Canal Zone—Balboa	C										1							
Paraguay: Asuncion	D		4	1	1													
Poland	C	63	166	189	287	93	176	140	129	92	81	58	67		48	33		
	D	3	8	19	15	8	7	6	7	6	4	5	3		2	1		
Portugal: Oporto	C		1															
Rumania	C	113	193	152	214	70				63	52	54		42				
	D	5	16	24	16	8				10	5	3		4				
Syria	C										1	3						
Tunisia:																		
Sbeitla, vicinity of	C				20	2			10									
	D				7													
Sfax	C				2													
Tunis	C		16	18	14	2		1	10	12	9	8			64	9		
	D									1	2				4			
Turkey (see table below).																		
Union of South Africa:																		
Cape Province	C	P	P	P	1	P	P	P		P	P	P	P					
Municipality of East London	C	3	3		P													
Natal	C	P	P	P	1	P	P	P	P	P		P	P					
Orange Free State	C	P	P	P	P	P	P	P			P	P	P					
Transvaal	C	P	P	P	P	P	P	P		P	P	P	P					
Yugoslavia (see table below).																		

Place		Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931	May, 1931
Chosen: Seoul	C	1	1		3	4	
Czechoslovakia	C	24	60	26		5	
Greece	C	10	10	17	8	22	6
	D		2	2	1	3	
Latvia	C			12			

Place		Dec., 1930	Jan., 1931	Feb., 1931	Mar., 1931	Apr., 1931	May, 1931
Lithuania	C	6	26	3	90	34	10
	D	3	3	1	3	5	
Mexico (see also table above)	D	85	66	83			
Turkey	C	2	17	18	15		3
Yugoslavia	C	1	20	12	10	43	14
	D	1	2		1	5	

[1] On Feb. 27, 1931, the Director General of Public Health of Guatemala reports an unusual outbreak of typhus fever in a small village in Guatemala.

CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER—Continued

YELLOW FEVER

[C indicates cases; D, deaths; P, present]

Place		Jan. 11–Feb. 7, 1931	Feb. 8–Mar. 7, 1931	Mar. 8–Apr. 4, 1931	Week ended— April, 1931: 11	April, 1931: 18	April, 1931: 25	May, 1931: 2	May, 1931: 9	May, 1931: 16	May, 1931: 23	May, 1931: 30	June, 1931: 6	June, 1931: 13	June, 1931: 20	June, 1931: 27	July, 1931: 4	July, 1931: 11
Brazil:																		
Bahia State	C			2														
Ceara State	C	1		2				2		1			1					
	D	1						2		1								
Minas Geraes State	C			2	1		2	2	1		1							
	D			1			1	1	1									
Rio de Janeiro State	C			1						1	1							
	D		1	2														
Cambucy	C	3	2	1														
	D	3	1															
Friburgo (imported)	C	1																
Padua	C	2	1															
	D	2	1															
Sergipe State	C													1				
British Cameroons: Mamfe	C									3			1					
	D									2								
Gold Coast:																		
Akuse	C																2	
	D																1	
Tamale	C																	2
	D																	2