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The Potentialities of Biological Warfare Against Man

—An Epidemiological Appraisal—

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In December 1950, the Executive Office of the President issued the manual, Health Services and Special Weapons Defense, (*1*). This Manual categorically states "an enemy could employ . . . biological warfare against us effectively." As the official position of the Government, this statement deserves the due respect of every citizen regardless of his previous opinions or preconceived ideas. In this country, however, each citizen has the right critically to examine any statement of his Government and to arrive at his own judgment in the light of his past experience and of the available evidence. The publication of the Manual places the problem of biological warfare squarely before the people for serious deliberation and appropriate action.

The Manual does not purport to be a scientific document. No evidence is marshalled to support its many generalizations. Rather it is a set of organized conclusions followed by broad recommendations. Large responsibilities are indicated for the medical, public health, and related professions. To participate effectively, these responsible professions must understand and agree to the scientific principles underlying the conclusions and forming the basis for the recommended defense measures.

At present, the discussion of biological warfare raises strong emotional reactions and evokes bitter controversy. Informed opinions vary in the extreme. It would be futile to argue about the many claims and counter claims that have been presented to the public. Rather the first necessity is to seek for some common ground based on experimental observations and rationally organized epidemiological principles. We need a logical statement of a "theory of biological warfare." If only a small area could be defined to which all professionally qualified persons could agree, this would form the basis for such a theory. Only when this has been achieved can the building of a sound defense program be started. It would provide a base of

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reference for judging new problems. Priorities for assignment of limited personnel and critical materials could be established. Research problems could be defined.

Previous attempts to develop a scientific basis for a theory of biological warfare have been made. Rosebury and Kabat published a lengthy review (*2*) on the subject in 1947. This work was based on the unclassified information available up to 1942. Also in 1947, Rosebury published a second monograph (*3*) entitled, "Experimental Airborne Infection." This is a detailed scientific account of experimental work conducted at the Biological Warfare Research Laboratory of the Army at Camp Detrick during the war years. In 1949, Rosebury published a popular book, Peace or Pestilence (*4*), in which he develops at length his concept of a theory of biological warfare. In November 1950, Capt. F. R. Philbrook, U. S. N., presented a considered appraisal of the subject (*5*) at a meeting of the American Public Health Association, but this has yet to be published in full.[1]

Several hundred scientific papers have been published from Camp Detrick. These have direct application to our present problem. The author is unaware, however, of any comprehensive scientific statement of the broad aspects of the problem that has been published from this official source. The few official statements—such as the Merck Report, 1946 (*6*), and the Forrestal Statement, 1949 (*7*), and others—announce the existence of a research and development program on biological warfare and state generalizations and conclusions.

None of these published papers and statements has resolved the basic controversy that exists among qualified scientists over the potentialities of biological warfare. The present paper is one more attempt to search for a common ground of agreement.

Forms of Biological Warfare

The Manual emphasizes two major forms of possible biological warfare attack: (1) The creation of clouds of pathogenic aerosols over cities, and (2) the contamination of our water or food supplies or the air of strategic buildings by sabotage. The first would be designed to produce large numbers of casualties in urban areas. The second would be directed at localized groups to incapacitate key individuals and industries or to create hysteria and undermine public morale.

The agents an enemy might use are not specified but the Manual states "a wide variety of viruses, rickettsiae, bacteria, fungi, protozoa, and soluble toxins . . . might be employed." No mention is made of a hypothetical new agent of unknown characteristics and "super virulence." Such a concept lies in the realm of pure speculation. Moreover, the concept that a self-propagating epidemic might be ini-

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[1] Subsequent to the presentation of this paper, a comprehensive statement, Medical Aspects of Civil Defense in Biologic Warfare, by Victor H. Haas, has been published in J. A. M. A. 145:900–905 (1951).

tiated is seriously questioned on two grounds: (1) The doubt that such an epidemic could be started, and (2) the confidence that a strengthened public health organization could promptly control one if it did get started. Thus, the most controversial aspects of biological warfare, the super agent and the uncontrollable epidemic, may be dismissed from the present consideration as not pertinent to the search for a common ground of agreement.

Our problem may be limited to known disease agents and the potentialities of their effective use either by inhalation or ingestion. The scientific basis for a critical appraisal of this problem lies in our knowledge of the epidemiology of airborne infections and of common-vehicle epidemics.

The Epidemiology of Airborne Infection

The importance of air as a mode of spread of naturally occurring disease has been a long disputed question. Prior to 1890, it was a general belief, both among scientifically informed persons and the general public, that the air was the dominant mode of spread of infection. This is indicated by the general terms "miasma" meaning noxious vapors and "malaria" meaning bad air. With the advent of bacteriology, however, this belief rapidly disappeared. Although bacteria were found in air by Pasteur, these turned out to be mostly harmless saprophytes. Thorough studies of bacteria in the air were conducted by Fluegge and others in Europe and by Chapin and Winslow and others in this country. It was shown that whole rooms, or even buildings, could be readily contaminated by a spray of such harmless organisms as *B. prodigiosus*, but the weight of the evidence suggested that most pathogenic bacteria either rapidly died or lost their virulence when exposed to air. The attitude of most informed workers in the field swung strongly away from the concept of airborne infection toward the importance of contact and droplets (*8*). This attitude has remained the dominant concept up to the present time.

Approximately 15 years ago several investigators made a concerted attempt to challenge this concept. Wells and Robertson in this country and Allison and Cruickshank in Great Britain and numerous other workers conducted extensive experiments of the mechanisms of airborne infection. A large amount of highly suggestive experimental data has been accumulated. Real advances in the disinfection of the air by means of controlled ventilation, ultraviolet irradiation, glycol vapors, and dust suppression have been accomplished.

The application of these engineering methods to the control of naturally occurring disease in general population groups, however, has been most disappointing. It remains to be proved that airborne infection is an important mode of spread of naturally occurring disease. The challenge to the theory of contact and droplet infection has largely failed (*9*).

Nevertheless the knowledge accumulated during the past 15 years has clearly laid the scientific basis for the mechanisms of airborne infection. This mode of spread is now an established reality in the experimental laboratory and is known to be a common cause of accidental or artificially induced human infections. Of particular importance to our present problem are the physical principles of the penetration and retention of particulates in the respiratory tract and the study of accidental laboratory infections.

Experimental Demonstrations of Airborne Infection

Numerous infections have been transmitted to animals and to man by the airborne route under strictly controlled conditions. For example, in 1926 Dunkin and Laidlaw (*10*), working with the virus of canine distemper, showed that the airborne route of infection readily occurred and extreme precautions were necessary to obtain consistent laboratory results. The viruses of influenza A and B readily infect mice and ferrets by inhalation. Lurie has repeatedly demonstrated direct airborne infection of rabbits with the tubercle bacillus. In a recent paper, Lurie and his co-workers have beautifully shown that one tubercle results in the rabbit lung for each estimated viable tubercle bacillus that reaches the alveoli (*11*).

The extensive studies of Rosebury (*3*) from Camp Detrick show that experimental animals can be readily infected with *Br. suis*, *M. mallei*, *M. pseudomallei*, *P. tularense*, and psittacosis virus by the inhalation of minute doses of agent.

Several diseases have been accidentally shown to be airborne in man. For example, when the Commission on Acute Respiratory Diseases during World War II attempted to transmit primary atypical pneumonia to a group of human volunteers by inhalation of a fine spray, several cases developed concurrently among volunteers who had received only control inoculations and also among staff members and assistants who received no inoculations. Similarly, measles, German measles, and influenza have spread to individuals in the same environment where volunteers were receiving spray inoculations of infectious secretions. The conditions of these experiments exclude other possible routes of infection except the air.

Accidental Laboratory Infections

Research scientists have long recognized the occurrence of accidental infections as an occupational hazard which they have willingly accepted as a calculated risk. Recent studies of Sulkin and Pike (*12*, *13*) reveal the extent and seriousness of this problem. A number of different pathogenic agents are notorious offenders. Attack rates have been high and many fatalities have been recorded. The agents include those causing brucellosis, tularemia, Q fever, typhus fever, Rocky Mountain spotted fever, psittacosis, yellow fever, and certain of the encephalitides, coccidioidomycosis, and many others.

Until recently the commonly accepted mode of transmission of these accidental infections was contact, resulting from errors of technique. Much evidence supported this view. Many infections have been observed to follow relentlessly upon such incidents as the aspiration into the mouth of a virulent culture during pipetting, or the nicking of the hand during an autopsy, or the jabbing of a finger during animal inoculation, or the gross contamination of the whole environment when a flask of agent was spilled or broken in a centrifuge.

Numerous laboratory infections have occurred, however, in the absence of known breaks in technique, even when extreme precautions were being consistently followed. While the explanation of these incidents was obscure, they were usually summarized by the general concept that such agents were "extraordinarily infectious" or that they had the capacity to penetrate through unbroken skin. Although contamination of the air was sometimes implicated, many research workers were reluctant to accept this explanation.

Of special interest are the occasional explosive epidemics that have occurred in research laboratories. These have involved large numbers of persons in widely separated rooms and have occurred under circumstances that adequately preclude direct contact. Three dramatic incidents from a much larger group will be summarized.

A. A psittacosis outbreak of 11 cases occurred in the Hygienic Laboratory of the U. S. Public Health Service between January 25 and March 15, 1930 (*14*). The cases were confined to the 54 individuals working in 1 building while 67 persons in 2 neighboring buildings escaped infection. Infected parrots and parakeets had been shipped to the laboratory for study. Work began January 16. Five individuals handled the birds or attempted cultural work, and three became ill. The remaining eight cases worked in other laboratories in the building and had no known contact with infected material. Seven cases had onsets within a 6-day period from March 10–15, indicating a common source exposure early in March. Dr. C. W. McCoy, in his first brief account of the epidemic, concluded that the cause was unexplained but that "this occurrence suggests the infectiveness of the virus of psittacosis for man is of a very high order." In a later, more comprehensive report of the outbreak, Dr. McCoy considers carefully the possibility that airborne infection was the cause of the epidemic but he was clearly reluctant to accept this explanation (*15*).

B. An epidemic of brucellosis caused by *Br. melitensis* occurred at the Michigan State College in East Lansing between December 10, 1938, and February 10, 1939. A total of 45 clinical cases and 44 subclinical infections were recognized. The diagnosis was confirmed by the isolation of the organism from the blood culture in 38 instances. All cases were associated with one bacteriological laboratory building. Thirty-eight of the 45 clinical cases were students, taking one or more of several general courses. Of these, 32 were concentrated in 3 laboratory sections, comprising a total of 102 students, thus indicating the substantial clinical attack rate of more than 30 percent. The other cases were among laboratory personnel and one salesman who stayed only long enough "to leave advertising matter." None of the students was issued *Brucella* in his laboratory exercises and only a few had exposure in the *Brucella* laboratory located in the basement. In this area, however, large volumes of *Brucella* cultures were being prepared into antigens and skin-test materials. Approximately one month before the epidemic, *Br. melitensis* had been concentrated in an "enclosed Sharples centrifuge," located in the basement hall.

Two accounts of this epidemic have been published. One (*16*) argues that a mass contamination occurred as result of backsiphonage of the water sytem with resultant contamination of the water from a sink where glassware was washed. No epidemiological confirmation of this explanation was obtained, however, such as showing that the cases occurred only among those who may have drunk water during their laboratory courses and not among those who did not drink water while in the building. The other report (*17*) argues strongly against backsiphonage, stating that it could be demonstrated only under extraordinary circumstances which did not apply during the period immediately preceding the epidemic. This second report concludes that a "mass infection" occurred and that critical analysis of the available evidence failed to substantiate how the epidemic originated. The authors did not discuss the possibility that the Sharples centrifuge may have caused the "mass infection" (*18*).

C. An epidemic of 47 cases of Q fever occurred in the Infectious Disease Laboratory of the National Institutes of Health between December 17, 1945, and May 30, 1946 (*19*). The diagnosis was confirmed by the isolation of the rickettsiae in six instances and by serological means in all cases. Forty-four of the cases occurred among 142 employees of building 5 and three cases appeared among individuals who had visited the building within 28 days preceding the onset of their disease. The cases were distributed throughout the building, but there was a greater concentration among those working on the first floor where the Q Fever Laboratory was located. Concurrently, two guinea pig colonies, one on the first floor and one in the attic, became spontaneously infected.

An epidemiological correlation was found between the dates when infected yolk sacs were prepared into antigens by centrifugation and the probable dates of exposure of the cases. The mechanism by which the mass contamination of the entire building occurred was not explained by the author of this report although in a previous epidemic of Q fever in the Hygienic Laboratory in Washington in 1940, airborne infection was considered the most probable explanation (*20*).

For a long time research scientists have been reluctant to accept the explanation of airborne infection for many of these unexplained laboratory infections and epidemics. At the present time, however, the importance of aerial contamination is widely accepted as indicated by the extreme precautions that are being taken when highly infective agents are under study. The new infectious disease laboratory at the National Institutes of Health in Bethesda, Md. is a monument to those who have died from laboratory acquired disease. In this building specially designed hoods, controlled ventilation with the incineration of exhaust air, and the utilization of properly placed ultraviolet lights indicate the extent to which the hazard of airborne infection has been appreciated.

Important in this progressive change in attitude has been the association of accidents with particular types of laboratory procedures such as intranasal instillations, centrifugation of infectious agents and the grinding of tissues in the Waring Blendor. It is now known that these procedures often produce invisible clouds of finely dispersed infectious aerosols which, if uncontrolled, can be carried on air currents throughout a large building.

Of special interest are the studies of Johansson and Ferris (*21*) and Wedum (*22*) who worked at Camp Detrick, Md. These workers showed that even such simple routine procedures as removing a cotton plug from a flask or the transferring of cultures from one tube to another, the withdrawing of a hypodermic needle from a rubber-stoppered vial, or blowing the last drop from a pipette produced aerosols of varying extent and concentration. These studies illustrate in a graphic fashion the manifold opportunities for aerial contamination that exist in laboratories and provide a ready explanation for the occurrence of accidental infection by the airborne route.

The Retention of Particulates in the Lung

The relation between the size of inhaled particles and the depth of their penetration and retention in the respiratory tract has unique application to the theory of biological warfare.

Theoretical calculations applying established physical principles to the known dimensions of the respiratory tract (*23*) and experimental studies using a variety of different techniques (*24*), including radioactive isotopes (*25*), have led to essentially similar results (*26*). They show that the respiratory tract is an exceptionally good filter, considering the volume of air that passes through it.

Particles larger than 5 microns in diameter are almost completely removed in the nose and upper respiratory passages. Below 5 microns in size, progressively increasing proportions of inhaled particles reach the terminal bronchioles and alveoli; in the range of 1 micron some 50 to 60 percent penetrate to the alveoli and are trapped there. Below this range, alveolar deposition again decreases because more particles are exhaled. In the submicroscopic range below 0.25 micron an increase in retention is theoretically expected because Brownian movement comes into greater action.

The fate of inhaled particles larger than 5 microns is quite different from that of smaller particles. Those that impinge on the mucus overlying ciliated epithelium are wafted to the oropharynx where they are most likely to be swallowed or occasionally expectorated. Those that impinge in the anterior chamber of the nose will be wafted to the external nares. The smaller particles that are retained beyond

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the ciliated epithelium must be removed by tissue mechanisms, principally phagocytosis. Thus, for toxic substances such as silica, minerals, or metallic poisons and for those pathogenic agents not normally infective through an upper respiratory portal of entry, inhalation of large particles is essentially equivalent to a slow gastrointestinal instillation or ingestion. Inhalation of particles progressively smaller than 5 microns becomes increasingly similar to an intratissue or subcutaneous inoculation.

In industrial hazards such as silicosis, it is now generally recognized that the proportion of small particles in the air is of much greater importance than the total concentration of silica. The smaller the particle even to submicroscopic dimensions, the greater the pulmonary damage for a given weight of silica retained. This suggests that surface area is the important factor in the pathogenesis of this disease. An essentially similar relation has been found in pulmonary berylliosis and in metallic fume poisoning (*27*).

These principles have direct application to airborne infection. Numerous infective agents such as the streptoccocus, diphtheria bacillus, and the influenza viruses have the capacity to invade through the respiratory epithelium or through the tonsillar tissues of the oropharynx. Airborne particles, large and small, can reach these sites not only by inhalation but also by direct contact. These diseases occur universally throughout the world in endemic and epidemic forms. The resistance and immunity of a large portion of the population to them is high. They are not seriously considered as likely biological warfare agents.

In contrast, many infectious agents, particularly those known to be serious hazards in the laboratory, do not normally invade these sites in the upper respiratory tract. Rather the natural form of infection is a direct inoculation by insect bite as with typhus fever, Rocky Mountain spotted fever, and yellow fever, or by known breaks in the skin as in cutaneous tularemia of rabbit hunters. The inhalation of these infectious agents in particles sufficiently fine to reach the alveoli of the lung, thus becomes equivalent, as explained above, to a subcutaneous inoculation. Thus, minute doses of these agents may induce active infection when inhaled in sufficiently small particles. The inhalation of larger particles would lead to eventual ingestion. While the gastrointestinal tract may be a possible portal of entry for some of these diseases, such as brucellosis, tularemia, and even psittacosis, abundant laboratory evidence indicates that the necessary minimum infecting doses by this route are many hundreds or thousands of times greater than by inhalation.

These diseases are highly localized in their distribution and a very high proportion of the population of this country is known to be susceptible. They form a group that should receive first consideration as agents which might be employed against us in biological warfare.

It should be emphasized that the upper limit to the size of particles that can reach the alveoli, namely 5 microns, is strikingly similar to the dimensions of single bacterial cells, fungal spores, rickettsiae, and virus elementary bodies. This association should not be considered as mere coincidence, but rather as a fact of particular biological significance. The mammalian lung is an intricate structure that has developed by the evolutionary process of natural selection. Its dimensions have been determined, on the one hand, by the viscosity of air and the physiological needs of respiration; and, on the other hand, by the obvious necessity to filter out most other noxious particulate matter. The fact that the human lung successfully removes particles larger than single bacterial cells should be regarded as one of the many factors contributing to the survival of the species.

Furthermore, pathogenic agents rarely exist in nature as single cells; rather, they tend to grow in clumps or chains. They are almost always intimately mixed with mucus, pus, saliva, feces, or other moist organic matter. This means that when they are extruded into the open environment, they tend rapidly to adhere to surfaces or to inert particles of dirt, dust, or lint and thereby become even larger. Although certain exceptions to this general principle can be visualized, it is an entirely reasonable conclusion that single pathogenic cells are only rarely dispersed into the air under natural circumstances; rather, it would seem that the human species has not been forced to contend with a wide variety of finely dispersed bacterial aerosols and therefore has not faced the biological necessity of developing a natural mechanism to defend against them.

Artificial circumstances present an entirely different picture. Using modern laboratory techniques, many pathogenic agents may be grown in almost limitless quantities and may be dispersed into the air as single cells. When this occurs accidentally, as in laboratories, a wholly artificial, man-made situation is created whereby such infectious particles may reach the alveoli of the lung. The purposeful creation of such clouds is biological warfare.

Airborne Infection in Biological Warfare

Let us elaborate on how an enemy might use the airborne route of infection in biological warfare against man.

The frequency with which certain serious and even fatal infections occur among laboratory workers demonstrates that a large proportion of the adult population of this country is susceptible under such conditions of exposure. It further shows that at least some pathogenic agents remain virulent for man when grown under artificial conditions. The question, therefore, resolves itself to the simple proposition: Can the enemy reproduce at will the conditions known to cause accidental laboratory epidemics?

It would seem that no new principles were involved. If grinding infectious tissue in a Waring Blendor will contaminate a room or if concentrating a suspension of pathogenic agents in a centrifuge will contaminate a whole building, such circumstances would be easy to reproduce. Furthermore, by utilizing atomizers or other disseminating devices far greater concentrations of infectious aerosols could be produced. Relatively simple equipment such as could be carried in an ordinary suitcase would be sufficient. Therefore, no theoretical reason precludes the possibility that an enemy saboteur could contaminate the air of any enclosed space where people congregate. An attack rate of disease as high or higher than that observed in explosive laboratory epidemics can be anticipated.

These same principles apply, only on a larger scale, to the use of aerosol clouds over cities. Specially designed bombs, shells, or other types of disseminating devices discharged from enemy aircraft or from warships offshore could create large clouds. Under appropriate but commonly recurring weather conditions, such clouds would remain close to the ground and, like pollen, diffuse with the wind over wide areas and for many miles, or, like smog, hang over a city for many hours.

The attack rate which might be expected from such an attack cannot be accurately predicted until practical demonstrations are made which will establish the concentrations of infective aerosols that can be attained. Theoretical calculations, however, indicate that with reasonably efficient disseminating devices relatively small amounts of material could establish very extensive clouds of high concentrations of agent. The problem would appear to be one of practical technical development rather than one requiring any new or undiscovered scientific principles. It would seem entirely possible that the incidence of casualties among those exposed to such a cloud attack might approach that which could be produced from the gross contamination of a building by sabotage.

Epidemiology of Common Vehicle Epidemics

Our long familiarity and understanding of epidemics caused from contaminated water and food supplies makes it easy for us to comprehend how purposeful and malicious contamination could occur. Major epidemics have resulted from gross fecal contamination of water supplies. We had long and bitter experience with typhoid fever until our standards of purity and maintenance of safe water supplies were universally established. The epidemic of amebiasis in Chicago is merely another example with which we are wholly familiar.

The concentration of pathogenic agents in naturally polluted waters is usually quite low compared to the wide variety of nonpathogenic flora normally present; nevertheless, serious epidemics have occurred. Therefore, the purposeful introduction of a relatively small volume of a highly concentrated suspension of essentially pure pathogenic agent could effectively contaminate a large part of a water distribution system. The principles of backsiphonage are so generally known that any plumber or person with minimum sanitary engineering training could introduce with ease such a pathogenic suspension at many points along a distribution system. The exact point of the introduction would be exceedingly difficult to locate or detect by epidemiological means. An incidence of casualties exceeding those known to occur in accidental waterborne epidemics can be expected because of the greater dosage of agent that can be attained.

Similarly, foodborne epidemics are well understood. These usually result from the contamination of certain types of warm or moist foods that provide an adequate culture medium for the pathogenic agent. While the size of the accidental inoculum may be small, the final concentration in the food actually ingested may be large because of opportunity for incubation and growth. Several foodborne epidemics of typhoid fever have involved a majority of the persons consuming the contaminated food, indicating that high concentrations overcome much of the natural resistance which the normal population may have. Therefore, a saboteur inoculating a high concentration of certain pathogenic agents in the appropriate food at the appropriate time could almost certainly produce epidemics with high attack rates among those who consumed it.

One's imagination is almost unlimited when one considers the wide variety of possibilities and potentialities of this form of warfare. The only limitations of consequence result from the accessibility of such food or water supplies to a subversive agent and the limited distribution of any single food or water supply.

It should be granted that such sabotage methods would not necessarily be limited to the use of biologically living agents. The toxins of *Clostidium botulinum* or other bacterial or vegetable toxins, or any of a wide variety of chemical poisons might similarly be utilized. Biological agents, however, have certain distinct advantages from a saboteur's point of view in that the extended incubation period going for a matter of many hours to days or even weeks would enable him to "do his business" and disappear, leaving few clues, whereas the more immediate effect of chemical poisons might make it more difficult for him.

Conclusion

Therefore, the epidemiology of airborne infection and of common vehicle epidemics forms the basis for developing a theory of biological warfare. The evidence presented supports the conclusion stated in the Manual (*1*) that biological warfare could be employed against us effectively. The planning of appropriate defensive measures must not be delayed.

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Environmental Health: A Critique

By Mark D. Hollis*

This is a significant time to evaluate environmental health, for 1950 not only marks a midcentury point, but also it is the centennial anniversary of Lemuel Shattuck's epochal report on the sanitary survey of Massachusetts. If we are to blueprint the next half century of environmental health services, we must, therefore, exercise the same kind of foresight that characterized our 19th century "visionaries." At the same time, we must recognize that the blueprints must include safety factors appropriate to the stresses imposed by the turbulence of modern history.

Perhaps not more than a handful of us today would agree unanimously on the meaning of "environmental health." We might agree that the term covers health problems relating to man's need for and use of air, water, food, and shelter. But within such a sweeping generalization, there are innumerable specialized functions—and on these, opinions differ.

Health organizations long since have accepted as their primary responsibility the task of providing a safe and satisfying environment for mankind at work, at home, at play, and in all its varying cultural and economic settings. But the task of adjusting environmental health programs to the actual health and welfare needs, and economy, of the people served requires an orderly arrangement of health services through the assignment of priorities and full awareness of the cultural patterns in which the services are to operate.

That the environmental problems of the next 50 years will differ greatly from those of the last 50 can be seen in a review of the technological advances made during the past two decades. Some differences have been introduced also by political and economic changes attended by civil and international conflict.

Measurable progress has been influenced largely by the cataclysms of war and depression. Such dramatic currents of history, tragic as they are, nevertheless have stimulated the development of environmental health programs in the past. For example, the technique of species sanitation in malaria control was delineated during World War I. During World War II, species sanitation, combined with pinpoint

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epidemiology and assisted by newly perfected insecticides, opened the way to the eradication of malaria and other insect-borne diseases.

Another World War II development is the new surface filter, only now emerging as a laboratory aid, which may well alter our entire system of sanitary bacteriological controls. Again, the Federal work projects of the depression years provided some major improvements in rural and community sanitation throughout the Nation. These are but a few illustrations, yet one may well ask why these and other needs invariably seem to await national emergencies.

In providing basic sanitation services, nowhere have we historically placed greater emphasis than on the problems of the populous areas. Although our efforts to clean up gross insanitary conditions have yielded a high ratio of return per dollar expenditure, we have nevertheless concentrated on the city and paid insufficient attention to the small community and the rural area.

Environmental health services, for the most part, have been provided and financed in cities as a result of public demand and the response of local government to that demand. But many urban services are still deficient, and even these have not been extended to nonurban areas. Only a third of the rural farm population has running water in the home, but nearly two-thirds have electricity. Such a contrast raises an interesting question: Have we not failed to develop practical and economical rural sanitation facilities which could be installed and maintained as a public utility somewhat in the manner of the facilities installed and maintained by the rural electrification authorities? It goes without saying that the engineering and economic obstacles attending the installation of sewage lines are not comparable to those involved in stringing electrical facilities, but the analogy is there.

If the environmental health specialist would relate himself more actively to public needs and community affairs generally, as well as to specific public demands, he would find new and broader opportunities for service. By drawing on his professional background, he could contribute to the making of policy instead of merely adjusting himself to it after it has crystallized.

In comparison with world averages, progress in basic sanitation in the larger cities has kept pace reasonably well with national growth. The quality of public water supplies, the extent of sewerage services, and the suppression of disease-carrying insects, generally, are satisfactory. At least, the gross health hazards of these environmental factors by and large have been brought under control. To a lesser extent, existing knowledge has been applied to milk and food sanitation, control of stream pollution, and sanitation of metropolitan fringe areas. Similarly in need of improvement are sanitation services for schools and, as noted, for smaller communities and rural areas.

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These are areas in which, so far, we have not applied all the knowledge we possess. But, not even diagnosed as yet is the full health significance of radiological developments, substandard housing, excessive noise, refuse disposal problems, inadequate recreational facilities, and air pollution. Nor have health officials developed their potential role in reducing appalling home accident fatality rates. Of course, one of the greatest drawbacks to the development of environmental health activities today is the extreme paucity of trained personnel. These environmental health problems have been intensified by the economic strains engendered by emergency measures to build up national strength. High levels of health and vigor are needed, if not to resist possible injury by hostile forces, then at least to contribute as much as possible to American production.

We have made some notable advances toward the protection of our public water supplies. For example, typhoid fever incidence, once the standard gage of water's sanitary quality, has been practically eliminated. Other endemic physcial disorders in which water is known to be a contributory factor, however, have not yet received a corresponding degree of epidemiological attention. For example, a blood condition frequently fatal to infants is known to be related to a concentration of nitrates in well water, and studies are being made to determine the extent of this problem and develop methods of correcting it. There is also a medical question in the effect on cardiovascular patients of drinking water with a high sodium content.

Research on the relationships of fluorides in water to mottled enamel and dental caries has opened the field of fluoridation and defluoridation of public water supplies. Questions are arising, also, as to whether there are harmful physiological effects from industrial chemical wastes and perhaps from phosphates, the latter often added in water conditioning. And, too, the possible role of water in the transmission of virus diseases has been accepted as a hypothesis worth thorough study. Although the generally high quality of the Nation's public water supplies stands as a real achievement of the professional sanitary engineer, one must conclude that there is still a job to be done in this field.

Bound up with the problem of public water supply is the whole question of water pollution. Surface and underground waters are among the Nation's top natural resources, yet the seriousness of water pollution today, considering the speed with which it is increasing, is difficult to exaggerate. Each large new industrial development further complicates the pollution problem. Because water pollution is a by-product of increased industrial and urban development, continued national growth—both industrially and numerically—makes us increasingly dependent on our great water resources. Therefore, aggressive action for proper remedial measures is mandatory. Water pollution control ranks with the topmost domestic needs of this country. Failure to meet needs such as these today may make them prohibitively expensive to fulfill at some future date.

With the enactment of Public Law 845 in 1948, Congress for the first time acknowledged the Nation-wide character of water pollution problems. Past remedies for pollution have been applied piecemeal, in the form of "shotgun" therapy of local problems, as a rule, only because the situation was beyond esthetic tolerance. Until passage of the Water Pollution Control Act in 1948, except for a few cases, we had formulated no concept for developing and using the Nation's major watersheds to a point where each was capable of contributing its full benefits to the people. The development of such a concept involves the adjustment of all allied uses of water to the over-all public interest. Development and administration of the national antipollution program, therefore, will be a practical test of Federal, State, and interstate cooperation.

In general, the technology of sanitary control over milk and food is fairly well established; yet there is more confusion and lack of uniformity in public health administration of these basic services than is apparent in any other phase of environmental health. The multiplicity of codes, conflicting standards, and variations in interpretation are hard to explain. Moreover, they not only discourage public support, but they also contribute to inefficient service and high consumer costs. It is a wonder we in public health have been able to "get away with it" so long. These differences are producing chaos in the industries and confusing the manufacturers of sanitary equipment. In fact, the several industries concerned have appealed repeatedly, through their national organizations, for relief from multiple inspections and nonuniformity in health requirements.

The only apparent solution is one which divides itself into three phases: (1) adoption by States and communities of a uniform ordinance and code, sufficiently simple to minimize variations in application; (2) local administration of the general provisions by well-trained competent personnel; and (3) establishment of some central testing "facility" whose findings on sanitary equipment will be accepted nationally.

Pressure is mounting for some practical methods of controlling the sanitary quality of milk shipped in interstate traffic. The more than 13 million pounds of fluid milk shipped interstate daily from surplus to shortage areas serve to indicate the magnitude of the present need for some control measures. Techniques which have proved successful in the interstate shipment of shellfish might be considered for general application to this problem.

The time-temperature relationship involved in the death of the

Q fever rickettsia in milk is another problem yet to be solved. So is the use of synthetics in processing certain foods, a practice which has raised questions as to the nutritive value of foods so treated. This is a job calling for cooperative research in the fields of sanitation and human nutrition.

Dawes, the English authority who last year studied sanitary practices in this country, was surprised at our failure to regard refuse disposal as an essential environmental health service. The continuing prevalence of trichinosis and renewed interest in controlling flies and rodents are highlights in refuse disposal problems of the day.

Progress in the control of insect-borne diseases has been generally satisfactory. For example, the transmission of malaria virtually has been halted and endemic typhus fever is declining. However, control of the fly-borne infections, including gastroenteritis and equine encephalitis, have not been as satisfactory.

Because flies eventually develop resistance to DDT, its scientific rotation with other chemicals, such as chlordane and dieldrin, offers real promise. On the other hand, toxicity of many of our insecticides and rodenticides to man has not been too well defined.

Sanitation in public institutions has been disregarded for so long that few of us today have a clear picture of the situation in many of these places. The overcrowding that generally exists today in public institutions demands every practical safeguard, yet because institutional sanitation is not especially complicated, only simple and economical techniques are needed. This problem offers a challenge to State and local sanitarians.

Over the past three decades, gratifying progress has been made in the industrial hygiene field. Technical knowledge has kept pace fairly well with industrial developments. At the same time, the industrial hygiene concept has expanded from the rigid control of specified occupational diseases to the broader approach which embraces the workers' total health needs. The 2-year experiment started in May to develop a sound national plan for uniform reporting of occupational diseases is an example of the expanding scope of this field. Ten States in the eastern half of the country have agreed to conduct pilot programs of this type, using standard recording forms supplied by the Public Health Service.

Air pollution, especially in the heavily industrialized areas, is also attracting national attention. The Donora incident of 1948 has served to dramatize the importance of controls in this field. If they are to be developed, close cooperation between a variety of agencies, industry, and the public will be necessary.

The relationship between housing and health has long been recognized by public health authorities. The problem so far has been to develop knowledge of this relationship into a program designed to improve both housing and health. It is ironic that we have expended greater effort to improve our industrial environment than our individual home environment. As a consequence, more than 10,000,000 American families live in substandard housing. This problem, therefore, cannot be ignored any longer. Health officials at all governmental levels can take the first step toward improving housing standards by working with official agencies and voluntary groups in the housing field. The new regulations recently adopted by the Massachusetts Department of Public Health to establish minimum health standards for human habitations represent a step in the right direction.

Home accidents continue to attract attention by their prominence among the leading causes of death and injury. Accidents, exclusive of motor vehicle, ranked as the fifth leading cause of death in 1948. Home accidents accounted for the major portion of these deaths.

Home accident prevention is logically a public health function. Health agencies have the epidemiological experience, engineering talent, nursing services, statistical skill, and educational facilities needed. The 3-year old Home Accident Demonstration Project being conducted by the City-County Health Department at Kalamazoo, Mich., offers alert health agencies a potential source of realistic control techniques.

The impact of the atomic age on health is yet to be fully evaluated. Man's unleashing of atomic energy has not only made possible great advances in science and industry but also has confronted him with new and potentially serious health problems. Eventually, the responsibility for protecting the population against harmful effects of ionizing radiation will fall upon public health officials.

Radioactive isotopes, for example, are being used on an increasingly wide scale in industry and medicine. Today, shipments are reaching institutions in almost every State at a rate of about 6,000 a year. Thus, where the care and handling of radioactive materials once was the province of a few trained experts, today the growing number of persons involved in handling the materials presents a potential public health problem, one which should be recognized and anticipated by alert health departments.

The public health profession also must fully respect the security controls imposed by the Atomic Energy Commission. At the same time, we must prepare immediately to meet our responsibility for health protection against radiological hazards. The Public Health Service is proceeding with all possible speed in this direction to carry out a four-point program, the objectives of which are: (1) to train a group of its officers as experts in the field of radiological health; (2) to furnish State health agencies with pertinent information as it becomes available through security channels, and to provide them with consultation on emergency problems; (3) to develop at the Environmental Health Center (Cincinnati, Ohio) a training facility for selected State and local health personnel; and (4) in collaboration with the Atomic Energy Commission to carry out essential research.

Three major problems already are under study in the research phase of this program: (1) the development of practical methods of handling and disposing of radioactive wastes; (2) the development of techniques of detection and decontamination for affected public water supplies; and (3) the accumulation of data on the behavior and effect of radioactive waste in surface streams.

As environmental health horizons expand, adjustments will be needed in State health organizations. Already a few States have established bureaus of environmental health within their respective health departments. Yet, if environmental health services are to be interpreted so as to win public support, attention must be given not only to organizational realignment within public health agencies but also to the establishment and maintenance of effective liaison with professional and responsible voluntary agencies working in this field. The expansion of public health medical programs within the last decade indicates the value of this kind of teamwork.

The need for public health officials at all levels to play their rightful role in the planning of all public programs affecting health cannot be underscored too emphatically. It involves effective coordination between the public health agency and those whose activities impinge upon health. In some areas, however, it will require enterprising leadership to bring about recognition of the health implications of many activities outside the official health agency.

If environmental health programs are to recruit their fair share of trained personnel, an effective plan for recruitment must be adopted. In the past few years, the Public Health Service has made some progress in this respect by approaching the universities with a view to interesting promising students in a public health career.

In view of the international uncertainties, a discussion of environmental health would be incomplete without some mention of our responsibilities to national security. The modern potential of armed conflict and the sinister war tools known to exist dramatize the need for related public health control measures in a manner unimagined a decade ago. Civilian defense planning today calls for complete and faithful cooperation from health agencies at all governmental levels. And a fair portion of such cooperation includes a searching evaluation of the environmental factors involved. Difficult though it is to rate any one environmental factor above another, certain basic essentials always come high on the list.

Control of water pollution, though not immediately related to a threat of water borne epidemics, is urgent to assure an adequate supply of useful water for industries and their workers in certain drainage basins. Pollution controls will serve also as an additional safeguard against water borne diseases, whether they are carried by microorganisms, chemicals, or radioactivity.

The importance of food in civilian defense is well understood in England which succeeded in raising the general level of nutrition during the last war despite shortages and deprivations, and despite recourse to rationing and community kitchens. Apart from nutrition problems, our chief dietary concern in this country is to avert infection or poisoning in restaurants, dairies, dining cars, and other places handling large amounts of milk and other foods. The migration of defense workers to milk shortage areas accentuates the need to protect the quality of milk shipped interstate. Oklahoma and Texas now permit the sale of market milk only if the producing State certifies that it was handled in conformance with the Public Health Service Standard Milk Ordinance and spot-checked by the Public Health Service. South Carolina requires certification of out-of-State milk by the Public Health Service.

Shifts in population, aggravated by emergency demands, also encourage housing practices which, if not directly dangerous, certainly impair the morale and efficiency of the occupants. Health departments have the responsibility to see that such abuses are corrected. Particularly in defense areas, they can anticipate the value of correcting substandard housing conditions.

Atmospheric problems include both the contamination of the general atmosphere and the special atmospheric conditions which affect the health of industrial workers. The death of 18 copper smelter employees from arsine poisoning may not seem significant numerically, but the strategic effect in the industry, and upon employees in the industry, is of major dimensions. It is important to protect the health of workers in strategic industries not only by control of atmospheric conditions but also by providing general in-plant health services.

The problem of protecting the health of the civilian population against the use of special weapons is at this stage occupied chiefly with research into the possible forms and channels of such weapons, their detection, and protective and remedial measures. Unquestionably, health officials have much to contribute to the organization of forces and methods to cope with possible attacks.

One other form of defense for the Nation is to help overcome the human distress, the suffering and misery that so often encourage discontent at home and aggression abroad. On the international scale, this task is in the hands of the World Health Organization.

The program of the World Health Organization features environmental sanitation as one of its six priority activities. Here again success in developing environmental health services will depend on maintaining a balance between the order of health service priorities and the economic and development levels of the areas to be served. A good example of what can be done has been demonstrated in Latin America by the Health and Sanitation Division of the Institute of Inter-American Affairs.

Among the many factors that will influence the development of environmental health services, at least three are worthy of special mention:

1. The boldness with which we redefine and reestablish functions at the Federal, State, and local levels. There is a serious doubt that, as presently administered, the most effective use is being made of our available funds and manpower. Direct application of environmental health techniques is primarily the job of State and local health authorities, a fact which reemphasizes the need to strengthen our local health structures. The Federal health arm is more profitably employed in fields of research, planning, expert consultation, and as a central secretariat for establishing standards and developing and demonstrating control techniques. In other words, the Federal job as we see it, exclusive of our statutory obligations, is to carry out those functions that go beyond the resources and facilities of the individual States.

2. The competence we display in formulating our respective environmental health programs to meet the economic and social needs of the Nation. As we all know, the public health profession, as a whole, is shifting emphasis from epidemic diseases to the diseases of the aging population—the so-called chronic diseases. In environmental health, there is an overwhelming need to broaden operations to include problems of the physical environment that go beyond the control of specific germ diseases. True, existing programs remain extremely important, but we must not fail to recognize and explore the newer fields of public service.

3. The question of professional leadership. Since environmental health embraces such a wide range of health functions, it should be evident that the field belongs exclusively to no single profession. It is an interdisciplinary job. It requires a synthesis of skills through teamwork and includes recognition of the personal as well as the professional qualifications of the individual. The orderly development of public health programs, therefore, allows no professional isolationism. For example, teamwork approach involving a variety of professional disciplines has contributed to the success of industrial hygiene programs and malaria control. In the Public Health Service, this interdisciplinary approach will also characterize our water pollution control, radiological health, and hygiene of housing activities.

As the public health family matures, its leaders will be selected more and more on the basis of such qualities as leadership and vision than on the basis of specific profession. The day is passing when any discipline can expect to control a major segment of the public health movement in any way other than by dynamic leadership and demonstrated professional competence. Speaking as a professional sanitary engineer, I would say that most of us are willing to accept this challenge with full confidence in our ability to continue playing a prominent role.

There are absorbing and productive developments in the environmental health picture of the future, but we must not lose sight of present responsibilities by chasing too ardently the rainbow of things to come. Nonetheless, there is a pressing need among environmental health leaders to bring research and program planning in their field up to a level commensurate with the needs of the people in our changing contemporary environment. Whether we shall achieve a desirable balance in our public health programs depends largely upon our own foresight and our own boldness in planning. If we succeed in evolving a keen and valiant plan of our own, we may be confident of the sympathetic understanding and support of our professional colleagues and of the people we serve.

Incidence 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

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UNITED STATES

Reports From States for Week Ended March 10, 1951

In collaboration with the Influenza Information Center, National Institutes of Health, the following report on influenza has been prepared.

The number of reported cases of influenza for the current week was 14,448 compared with 10,675 for the previous week and 15,921 for the same week last year.

The prevalence of respiratory disease in the Chicago area increased about the first of February but is now apparently declining, according to Dr. C. G. Loosli of the University of Chicago and Dr. Albert Milzer of the Michael Reese Hospital, collaborating laboratories of the Influenza Study Program. The severity of the illness varied but, in general, was relatively mild, lasting only 3 or 4 days. It was characterized by sudden onset, fever, headache, general aches and pains, and minimal respiratory symptoms. Nine of 30 throat washings collected by Dr. Loosli yielded influenza viruses which preliminary test indicates are influenza A-prime strain. Serological tests in these laboratories have shown a rise in antibody titer in a total of 12 of 26 paired specimens against FM–1 strain of influenza A-prime virus. Two paired serum specimens showed significant rises againt the type B Lee antigen.

Dr. Morris Pollard of the University of Texas, Galveston, reports that influenza A-prime virus has been isolated, and antibody rises against A-prime strains in paired sera were determined in cases of influenzalike disease occurring there recently. The outbreak now appears to be waning. Paired serum specimens from two patients from the University of Texas infirmary in Austin showed significant hemagglutination inhibition titer increases between February 25 and March 4. According to Dr. H. V. Irons, Texas State Department of Health, one showed a fourfold rise against the FM–1 strain and the other showed an eightfold rise against the PR–8 strain.

Dr. A. P. McKee, Director of the Regional Laboratory at the University of Iowa, reports that an increase in influenzalike disease was noted in Iowa City in the early part of February. The first case to be diagnosed by serologic test had onset February 6. Since that time, a number of cases have occurred, and all have shown antibody rises against the FM-1 strain of influenza A-prime virus by hemagglutination inhibition.

A strain of influenza A-prime virus from throat washings collected February 15 from a patient in Stuyvesant Falls, N. Y., is reported by Dr. Irving Gordon, Director of the Regional Laboratory, New York State Health Department. This strain shows a closer relation to strains isolated last year than to the FM-1 strain.

The Department of Virus and Rickettsial Diseases, Army Medical Service Graduate School, reports isolation of influenza A-prime strain similar to the Cuppett strain from a patient in the Washington, D. C. area. Influenza A-prime strain also similar to the Cuppett strain has been isolated from throat washings sent from Fort Sam Houston, Tex.

The Preventive Medicine Division, Office of the Surgeon General of the Army, reports that of eight paired serum specimens from a military installation in Kentucky, three showed antibody rises against type A, three against both type A and type A-prime, and one against A-prime in the hemagglutination inhibition test. One of two paired serum samples from an Air Force base in Virginia showed a rise against influenza type A-prime virus.

Dr. W. R. Geidt, Washington State Department of Health, reports the serologic diagnosis of influenza A-prime in two cases in the Puget

Comparative Data for Cases of Specified Reportable Diseases: United States

[Numbers after diseases are International List numbers, 1948 revision]

Disease	Total for week ended—		5-year median 1946–50	Seasonal low week	Cumulative total since seasonal low week		5-year median 1945–46 through 1949–50	Cumulative total for calendar year—		5-year median 1946–50
	Mar. 10, 1951	Mar. 11, 1950			1950–51	1949–50		1951	1950	
Anthrax (062)	------	2	-------	(1)	(1)	(1)	(1)	15	4	10
Diphtheria (055)	75	143	203	27th	3,847	5,904	8,573	940	1,633	2,215
Encephalitis, acute infectious (082)	18	13	11	(1)	(1)	(1)	(1)	123	120	85
Influenza (480–483)	14,448	15,921	3,753	30th	65,446	66,639	66,639	50,904	56,055	56,055
Measles (085)	19,211	9,497	20,408	35th	150,157	83,212	148,553	121,456	64,082	122,429
Meningitis, meningococcal (057.0)	121	103	90	37th	2,073	1,799	1,799	1,112	885	870
Pneumonia (490–493)	2,494	2,764	-------	(1)	(1)	(1)	(1)	19,788	24,541	-------
Poliomyelitis, acute (080)	67	86	40	11th	33,370	42,532	25,376	1,151	1,058	579
Rocky Mountain spotted fever (104)	1	2	1	(1)	(1)	(1)	(1)	3	10	9
Scarlet fever (050) [2]	2,569	1,924	3,008	32d	38,584	34,139	50,564	22,893	17,700	26,745
Smallpox (084)	1	1	8	35th	[3] 14	20	52	[3] 6	12	31
Tularemia (059)	7	30	24	(1)	(1)	(1)	(1)	136	236	236
Typhoid and paratyphoid fever (040, 041) [4]	65	63	54	11th	3,321	3,844	3,844	406	471	437
Whooping cough (056)	1,574	2,807	2,254	39th	38,023	46,803	46,803	16,421	25,267	22,390

[1] Not computed. [2] Including cases reported as streptococcal sore throat.
[3] Deductions: Wisconsin, week ended February 17, 1 case; Nevada, week ended January 6, 1 case.
[4] Including cases reported as salmonellosis.

Sound area. High prevalence of upper respiratory illness has been general throughout the State for the past 2 months.

Dr. W. L. Halverson, California State Director of Public Health, reports that approximately 100 cases of clinical influenza among residents of the Veterans Administration Center in Los Angeles were reported on February 28. He reports no increase in mortality. Complement fixation tests are in process. Southern California continues to release information indicating a sharp increase in prevalence of acute respiratory influenzalike illness.

The World Health Organization at Geneva reports mild influenza to be widespread in Switzerland, Italy, Trieste, and Turkey with cases also being reported in Portugal and Canada. A new outbreak of the disease is reported in Japan. The disease appears to be type A-prime everywhere with some type B in Italy.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Mar. 10, 1951

[Numbers under diseases are International List numbers, 1948 revision]

Area	Diphtheria (055)	Encephalitis, infectious (082)	Influenza (480–483)	Measles (085)	Meningitis, meningococcal (057.0)	Pneumonia (490–493)	Poliomyelitis (080)
United States	**75**	**18**	**14,448**	**19,211**	**121**	**2,494**	**67**
New England	**7**		**3,276**	**593**	**6**	**199**	
Maine			1,925	7	1	50	
New Hampshire			537	23	1	35	
Vermont			91	108			
Massachusetts	5			360	1		
Rhode Island			50	3		4	
Connecticut	2		673	92	3	110	
Middle Atlantic	**9**	**5**	**463**	**2,040**	**25**	**435**	**7**
New York	5	4	[1] 295	673	9	138	7
New Jersey		1	168	488	4	129	
Pennsylvania	4			879	12	168	
East North Central	**5**	**8**	**84**	**3,146**	**19**	**151**	**10**
Ohio	2			746	5		
Indiana	2			253		3	2
Illinois	1	5	9	533	4	86	3
Michigan		3	75	695	7	62	5
Wisconsin				919	3		
West North Central		**1**	**39**	**1,411**	**8**	**121**	**3**
Minnesota			3	127	1	11	
Iowa				30	1		
Missouri			5	413	4	2	
North Dakota			27	107		94	
South Dakota		1		42			
Nebraska				14			3
Kansas			4	678	2	14	
South Atlantic	**18**		**2,874**	**1,264**	**14**	**269**	**10**
Delaware			45	35			
Maryland			8	89	1	43	
District of Columbia			3	48		11	
Virginia	1		876	420	2	113	
West Virginia	2		771	50	2	20	
North Carolina	6			97	5		1
South Carolina	4		318	34	1	39	2
Georgia	5		853	433		43	1
Florida				58	3		6
East South Central	**7**		**119**	**1,314**	**12**	**198**	**3**
Kentucky	1		8	1,046	5	37	
Tennessee	3		57	74	3		1
Alabama	2			71	3	106	
Mississippi	1		54	123	1	55	2
West South Central	**20**	**3**	**665**	**4,819**	**22**	**845**	**8**
Arkansas	2		414	812		90	
Louisiana	5		73	209	4	105	2
Oklahoma	3	1	178	361	1	55	
Texas	10	2		3,437	17	595	6
Mountain	**3**		**2,431**	**1,928**	**2**	**145**	**5**
Montana	1		34	47	1		
Idaho				41			1
Wyoming			1	50		9	
Colorado			54	959	1	21	
New Mexico	1		10	36		32	
Arizona	1		2,049	695		83	3
Utah			266	69			1
Nevada			17	31			
Pacific	**6**	**1**	**4,497**	**2,696**	**13**	**131**	**21**
Washington			2,115	402		17	2
Oregon	3		1,981	62	2	54	2
California	3	1	401	2,232	11	60	17
Alaska			103				
Hawaii			11	1		1	1

[1] New York City only.

Reported Cases of Selected Communicable Diseases: United States, Week Ended Mar. 10, 1951—Continued

[Numbers under diseases are International List numbers 1948 revision]

Area	Rocky Mountain spotted fever (104)	Scarlet fever (050)	Smallpox (084)	Tularemia (059)	Typhoid and paratyphoid fever [1] (040,041)	Whooping cough (056)	Rabies in animals
United States	**1**	**2,569**	**1**	**7**	**65**	**1,574**	**160**
New England		**182**			**4**	**138**	
Maine		19				23	
New Hampshire		[2] 7				24	
Vermont		1				13	
Massachusetts		127			4	49	
Rhode Island		10				20	
Connecticut		18				9	
Middle Atlantic		**428**			**33**	**215**	**23**
New York		[2] 235			2	79	22
New Jersey		82			1	75	1
Pennsylvania		111			30	61	
East North Central		**766**			**1**	**249**	**17**
Ohio		244				40	4
Indiana		48				8	[3] 10
Illinois		97			1	41	2
Michigan		352				78	1
Wisconsin		25				82	
West North Central		**139**	**1**	**1**		**77**	**8**
Minnesota		43				16	1
Iowa		9				5	7
Missouri		32				8	
North Dakota		2				1	
South Dakota							
Nebraska		9	1				
Kansas		44		1		47	
South Atlantic		**242**		**3**	**4**	**161**	**28**
Delaware		4				2	
Maryland		40				8	
District of Columbia		22				6	
Virginia		34				30	1
West Virginia		16				28	12
North Carolina		85				41	
South Carolina		6			1	15	12
Georgia		16		3	3	16	3
Florida		[3] 19				15	
East South Central		**85**			**4**	**132**	**38**
Kentucky		30				92	12
Tennessee		49			3	27	13
Alabama		4			1	6	13
Mississippi		2				7	
West South Central		**107**		**2**	**11**	**377**	**36**
Arkansas		6		1	1	44	1
Louisiana		12		1	4	4	
Oklahoma		21				46	6
Texas		68			6	283	29
Mountain	**1**	**236**		**1**	**2**	**160**	
Montana	1	5				5	
Idaho		79		1		5	
Wyoming		1				16	
Colorado		18				12	
New Mexico		6			2	15	
Arizona		11				96	
Utah		[3] 116				11	
Nevada							
Pacific		**384**			**6**	**65**	**10**
Washington		91			1	8	9
Oregon		51				1	
California		[2] 242			5	56	1
Alaska							
Hawaii		4				1	

[1] Including cases reported as salmonellosis.
[2] Including cases reported as streptococcal sore throat.
[3] Two weeks report.

FOREIGN REPORTS

CANADA

Reported Cases of Certain Diseases—Week Ended Feb. 24, 1951

Disease	Total	New-found-land	Prince Ed-ward Island	Nova Scotia	New Bruns-wick	Que-bec	On-tario	Mani-toba	Sas-katch-ewan	Al-berta	Brit-ish Co-lum-bia
Brucellosis	2					2					
Chickenpox	1,325			21		275	629	33	25	109	233
Diphtheria	1							1			
Encephalitis, infectious	1								1		
German measles	397	2		44		23	226	8	20	26	48
Influenza	10,391	1,763		3,695	973		993	65	1,661		1,241
Measles	2,287	3		25		266	1,796	70	22	49	56
Meningitis, meningococcal	5			1			2	2			
Mumps	1,301	3		9	1	185	506	50	77	222	248
Scarlet fever	348	1		1		71	54	33	15	64	109
Tuberculosis (all forms)	194	10		14	9	84	34	12	4	7	20
Typhoid and paratyphoid fever	8					3				1	4
Venereal diseases:											
Gonorrhea	233	10		6	6	62	34	21	12	29	53
Syphilis	80	4		14		24	16	8	2	5	7
Primary	2			1			1				
Secondary	10			1		3	4		1		1
Other	68	4		12		21	11	8	1	5	6
Whooping cough	159	1		3	5	34	39	6	3	2	66

WORLD DISTRIBUTION OF CHOLERA, PLAGUE, SMALLPOX, TYPHUS FEVER, AND YELLOW FEVER

The following tables are not complete or final for the list of countries included or for the figures given. Since many of the figures are from weekly reports, the accumulated totals are for approximate dates.

CHOLERA

(Cases)

Place	January-December 1950	January 1951	February 1951-week ended— 3	10	17	24
ASIA						
Burma	2,436	[1] 361	[1] 5	[1] 4	[1] 7	[1] 5
Akyab	2	7				
Bassein	16	64	2	4	5	3
Kyaukpyu	2					
Maubin	3					
Moulmein	1					1
Pegu	1					
Rangoon	[2] 7	4	3		2	1
Toungoo	8					
India	174,153	10,495	[1] 121	[1] 93	[1] 126	[1] 112
Ahmedabad	10					
Allahabad	3					
Bombay	[2] 431		1			
Calcutta	9,522	229	82	71	96	87
Cawnpore	1					
Cocanada	2					
Cuddalore	60	1		1	1	
Lucknow	12					

See footnotes at end of table.

Place	January-December 1950	January 1951	February 1951-week ended—			
			3	10	17	24
ASIA—continued						
India—Continued						
Madras	1,136	41	17	12	7	11
Masulipatam	47					
Nagpur	[2] 90	56			2	
Negapatam	[2] 145	44	7	4	10	3
New Delhi	125					
Port Blair (Andaman Islands)	[3] 2					
Telicherry	27					
Tiruchirappali	50	38	14	3	7	9
Trichinopoly	1					
Tuticorin	77	16		2	3	2
India (French):						
Karikal	505	1	8	3	12	
Pondicherry	814	9	9	17	36	
India (Portuguese)	17					
Indochina:						
Cambodia	15					30
Viet Nam	15	1				4
Giadinh	3					
Haiphong						3
Rachgia	1					
Saigon	1					
Soc Trang						1
Pakistan	29,992	2,147		[1] 2	[1] 1	
Chittagong	187	1				
Dacca	203	14		2	1	

[1] Preliminary. [2] Includes imported cases. [3] Imported.

PLAGUE

(Cases)

Place	January-December 1950	January 1951	February 1951-week ended 3	10	17	24
AFRICA						
Belgian Congo	32	1		1		
Costermansville Province	16					
Stanleyville Province	16	1		1		
Madagascar	154	64		[1] 15		
Rhodesia, Northern	2					
Union of South Africa	17					
Cape Province	3					
Orange Free State	11					
Transvaal Province	1					
Johannesburg	1					
ASIA						
Burma	364	77				
Bassein	1					
Bhamo	[2] 4					
Henzada	15					
Kyaiklat	34					
Minhla	2					
Moulmein	[2] 3					
Myaungmya	5					
Myingyan	2					
Pegu	[2] 5					
Prome	[3] 1					
Pyapon	3					
Rangoon	[2] 8					
Yenangyaung	58					
China:						
Chekiang Province	42					
Wenchow	[4] 4					
Fukien Province	1,037					
Amoy	10					
Kwangsi Province	[4] 63					
Kwangtung Province	634					
India	42,554	[5] 935				
Allahabad	[2] 20	[3] 4				
Bombay	[2] 5					
Calcutta	[2] 3					
Cawnpore	18					
Lucknow	[2] 10					

See footnotes at end of table.

Place	January-December 1950	January 1951	February 1951-week ended—			
			3	10	17	24
ASIA—continued						
Indochina:						
Cambodia	[6] 46					
Pnompenh	3					
Viet Nam	136	10	1	3		1
Phanthiet	96	5	1	2		1
Saigon	1					
Laos	2					
Indonesia:						
Java	[7] 250	[5] 3		[5] 1		
Bandoeng	6					
Djakarta	3	[3] 1				
Jogjakarta	241	2				
Semarang				[3] 1		
Pakistan	1					
Karachi	1					
Thailand	58	7				
SOUTH AMERICA						
Brazil	53					
Alagoas State	19					
Bahia State	16					
Ceara State	2					
Paraiba State	5					
Pernambuco State	10					
Sao Paulo State: **Santos**	1					
Ecuador	27					
Chimborazo Province	4					
El Oro Province	4					
Loja Province	19					
Peru	28					
Ancash Department	3					
Lambayeque Department	2					
Libertad Department	1					
Lima	11					
Piura Department	11					
Venezuela	5					
Miranda State	5					

[1] Feb. 1-10, 1951. [2] Includes imported cases. [3] Imported. [4] Deaths. [5] Preliminary figure. [6] Includes suspected cases. [7] Corrected figure.

SMALLPOX

(Cases)

Place	January-December 1950	January 1951	February 1951-week ended— 3	10	17	24
AFRICA						
Algeria	146	2		[1] 4		
Angola	371					
Bechuanaland	231					
Belgian Congo	4,960	159	41			
British East Africa:						
Kenya	12					
Nyasaland	289	8	1	4		
Tanganyika	4,744	31				
Uganda	6					
Cameroon (British)	447					
Cameroon (French)	134	42			[2] 22	
Dahomey	537	122		[1] 36	[2] 21	[2] 50
Egypt	9					
Eritrea	1					
Ethiopia	46					
French Equatorial Africa	459				[2] 7	
French Guinea	12			[1] 1		
French West Africa: Haute Volta	244	3				
Gambia	7					
Gold Coast	442	120	36	67	20	
Ivory Coast	699	44		[1] 1	[2] 2	
Libya	2					
Mauritania	1					
Morocco (French)	18	5				
Mozambique	377	19				
Nigeria	20,213	636				
Niger Territory	1,272	82		[1] 34		
Rhodesia:						
Northern	5					
Southern	982					

See footnotes at end of table.

Place	January–December 1950	January 1951	February 1951—week ended—			
			3	10	17	24
AFRICA—continued						
Senegal	2					
Sierra Leone	38					
Sudan (Anglo-Egyptian)	83	11		1		
Sudan (French)	328	88		[1] 28		
Togo (French)	127	16			[2] 1	
Tunisia	2					
Union of South Africa	989					
ASIA						
Afghanistan	612	52				
Arabia	334					
Bahrein Islands: Bahrein	36					
Kamaran Island: Kamaran	[4] 2					
Burma	5,121	59	14	11	38	64
Ceylon	[5] 3					
China	788					
India	151,707	17,516	831	681	904	969
India (French)	787	42	91	67	177	
India (Portuguese)	102					
Indochina:						
Cambodia	99	7	2	1		
Viet Nam	269	10	6	4	4	7
Indonesia:						
Borneo	1,495					
Java	7,977	51	1		7	[3] 7
Sumatra	348					
Iran	451	42	11	26	25	
Iraq	272	76	3	16	4	
Israel	17					
Japan	8				7	8
Korea (Republic of)	1,331					
Lebanon	[5] 2					
Netherlands New Guinea	3					
Pakistan	21,780	4,151	3	3	16	
Palestine	95					
Straits Settlements:						
Singapore	[5] 2					
Syria	16					
Thailand	460	20				
Transjordan	35					
Turkey. (*See* Turkey in Europe.)						
EUROPE						
Great Britain:						
England:						
Brighton	15	15				
Liverpool	1					
Scotland: **Glasgow**	21					
Greece	15					
Portugal	1					
Sicily	2					
Spain: Canary Islands	1					
Turkey	9					
NORTH AMERICA						
Guatemala	10					
Mexico	495					
SOUTH AMERICA						
Argentina	517					
Brazil	112					
British Guiana		8				
Chile	3,588					
Colombia	415					
Ecuador	257	11				
Paraguay	15					
Peru	2,680					
Uruguay	1					
Venezuela	1,538					
OCEANIA						
Australia: **Freemantle**	1					

[1] Feb. 1-10, 1951. [2] Feb. 11-20, 1951. [3] Feb. 21-28, 1951. [4] Imported. [5] Includes imported cases.

TYPHUS FEVER *

(Cases)

Place	January-December 1950	January 1951	February 1951-week ended—			
			3	10	17	24
AFRICA						
Algeria	127	3				
Basutoland	24					
Belgian Congo	[1] 90					
British East Africa:						
Kenya	23					
Mombasa	[2] 3					
Somaliland		1				
Uganda	2					
Egypt	95	21	4	2	1	3
Eritrea	37	1				
Ethiopia	1,255					
French Equatorial Africa	5					
Gold Coast	10					
Libya:						
Cyrenaica	27					
Tripolitania	73	1				
Madagascar	2					
Morocco (French)	10	1				
Morocco (International Zone)	2					
Morocco (Spanish Zone)	6					
Mozambique	3					
Nigeria	1					
Rhodesia, Southern	[1] 7					
Sierra Leone	[2] 5					
Sudan (Anglo-Egyptian)	5					
Tunisia	63					
Union of South Africa	115					
ASIA						
Afghanistan	1,331	71				
Burma	[1] 15					
Ceylon	4					
China	[1] 20					
India	363	[2] 8		3		
India (Portuguese)	90					
Indochina: Viet Nam	35	2				
Indonesia:						
Java	6					
Sumatra	1					
Iran	220	15	8	3	4	5
Iraq	137	2	1		1	1
Japan	931					
Korea (Republic of)	[2] 1,161					
Lebanon	[1] 2					
Netherlands New Guinea	2					
Pakistan	103	5				
Palestine	7					
Straits Settlements: Singapore	[1] 8					
Syria	[1] 39					
Transjordan	29	1				
Turkey (see Turkey in Europe).						
EUROPE						
France	1					
Germany (British Zone)	[1] 2					
Germany (French Zone)	2					
Germany (United States Zone)	3					
Great Britain:						
England: Liverpool	[2, 4] 1					
Island of Malta [1]	41					
Greece	28					
Hungary	4					
Italy	53					
Sicily	41					
Poland	37					
Portugal	5					
Spain	48					
Turkey	227					
Yugoslavia	264					
NORTH AMERICA						
Costa Rica [1]	17					
Guatemala	33					
Jamaica [1]	34	[2] 1				
Mexico [1]	362					
Panama Canal Zone [1]	6					
Puerto Rico [1]	26					
Virgin Islands	1					

See footnotes at end of table.

Place	January-December 1950	January 1951	February 1951-week ended—			
			3	10	17	24
SOUTH AMERICA						
Argentina	2					
Chile	143					
Colombia	515					
Curacao	3					
Ecuador	370					
Peru	1,089					
Venezuela	133			[2] 1		[3] 1
OCEANIA						
Australia [1]	105					
Hawaii Territory [1]	8					

* Reports from some areas are probably murine type, while others include both marine and louse-borne types.
[1] Includes murine type. [2] Murine. [3] Includes suspected cases. [4] Imported.

YELLOW FEVER

(C—cases; D—deaths)

Place		January-December 1950	January 1951	Feb. 3	Feb. 10	Feb. 17	Feb. 24
AFRICA							
Belgian Congo	C	3					
Stanleyville Province	C	3					
French Equatorial Africa	C	[1] 1					
Port Gentil	C	[1] 1					
Gold Coast	C	18	[1] 1				
Accra	D	[2] 4					
Ankobra Ferry	D	1					
Bogoso	C	[2] 2					
Kade	C	1					
Oda Area:							
Akwatia	C	[2] 8					
Atiankama	C	1					
Bawdua	D	1	[1] 1				
Taquah Aboso	D	[2] 1					
Nigeria	D	[2] 2					
Calabar	D	[2] 1					
Ibadan	D	[1] 1					
Sierra Leone	C	[1] 2			[1] [3] 1		
Koinadugu District	C	[2] 2					
Freetown	C				[1] [3] 1		
NORTH AMERICA							
Panama:							
Colon	D	1					
SOUTH AMERICA							
Bolivia	C	867					
Chuquisaca Department	C	[4] 850					
La Paz Department	C	[5] 17					
Brazil	D	22					
Bahia State	D	1					
Ipiau	D	1					
Goiaz State	D	[6] 20	[6] 2,000				
Uruacu	D	[6] 20					
Maranhao State	D	1					
Colins	D	1					
Matto Grosso State	D		1				
Colombia	D	10	11				
Boyaca Department	D	1	1				
Chizu	D	1					
Otanche	D		1				
Caqueta Commissary	D		1				
Magdalena Department	D	1					
Los Angeles, Rio de Oro	D	1					
Meta Territory	D	2					
Puerto Lopez	D	2					
North Santander Department	D	1	4				
La Vega	D		3				
Ocana	D	1					
Rionegro	C		1				
Putumayo Commissary	D	3					
Mocoa Locality	D	3					
Santander Department	D	2	5				
Campohermoso	D		1				
Cuesta Rica	D	1					

See footnotes at end of table.

Place	January-December 1950	January 1951	February 1951-week ended—			
			3	10	17	24
SOUTH AMERICA—continued						
Colombia—Continued						
Santander Department—Continued						
Guamales D		1				
Landazuri D	1					
Maradales D		1				
Tambo Redondo D		1				
Veneoas D		1				
Peru D	14					
Cuzco Department D	2					
Quincemil D	2					
Huanuco Department D	6					
Tingo Maria D	6					
Junin Department D	1					
San Ramon D	1					
Loredo Department D	1					
Pucalpa D	1					
San Martin Department D	4					
Belavista D	1					
Juanjui D	1					
Lamas D	1					
Tarapoto D	1					
Venezuela D	3					
Bolivar State D	2					
Argelia D	1					
La Parida D	1					
Tachira State D	1					
El Milagro D	1					

[1] Suspected. [2] Includes suspected cases. [3] Imported. [4] Estimated number of cases reported in an outbreak in Asero Province, Jan. 1-Mar. 14, 1950. [5] Outbreak in North and South Youngas Provinces. [6] The number of deaths from Dec. 1-Jan. 20 was estimated to be 20. An estimate of 2,000 cases covers the period Dec. 1-Feb. 20.