Health Service. In some cases trucks and equipment temporarily loaned to the newly formed districts have allowed them to use their limited local funds for labor and larvicide, thus making it possible for them to show results immediately. Another contribution has been the assistance of trained personnel to get the district off to a good start. A practical fieldman assigned for several days to work with a newly appointed local man and to check back from time to time has been the difference between success and failure. Until recently, the Communicable Disease Center furnished such personnel to Virginia, but recent curtailment of funds has required the lay-off of all the practical fieldmen; and this, no doubt, will hamper the creation of additional districts.

The Potentialities of Biological Warfare Against Man: an Epidemiological Appraisal*

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In December 1950 the Executive Office of the President issued a defense manual*** which states categorically, "an enemy could employ..... biological warfare against us effectively." Two major forms of attack are emphasized: (1) the creation of clouds of pathogenic aerosols over cities, and (2) the contamination of water and food supplies or the air of strategic buildings by sabotage. The use of a hypothetical new agent of "super virulence" and the initiation of a "spreading epidemic" are discarded as not based on scientific fact.

The evidence supporting these conclusions may be found in the existing knowledge of the epidemiology of air-borne infections and common vehicle epidemics. These facts form a basis for developing a Theory of Biological Warfare.

Air-borne infection is a serious hazard to research workers in laboratories. Attack rates are high and many fatalities have been recorded. The notorious offenders are the agents causing brucellosis, tularemia, Q fever, typhus fever, yellow fever, psittacosis, coccidioidomycosis, and many others. Until recently, contact was generally thought to be the cause of these infections. Now it is known that many cases result from inhalation of aerial contaminants. Certain procedures such as use of the Waring blender, or the Sharples centrifuge, disperse clouds of fine particles into the air.

Serious epidemics have involved laboratory personnel having no possible contact with the infectious agents. In the Hygienic Laboratory in Washington, 11 cases of psittacosis followed the arrival of infected parrots. At the Michigan State College, 45 cases of brucellosis due to *Brucella melitensis* occurred among students and staff in one laboratory building. A Sharples centrifuge in the basement had been used approximately 1 month prior to the outbreak. Epidemics of Q fever have occurred in many laboratories with attack rates as high as 50 percent. Visitors to laboratories who stayed only a few minutes have been infected. These epidemics have occurred under circumstances that preclude other modes of spread than air-borne infection.

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 incineration of exhaust air, and the utilization of properly placed ultraviolet lights indicate the extent to which the hazard of air-borne infection has been appreciated.

Important to the Theory of Biological Warfare is the fact that the respiratory tract is an extraordinarily fine filter. Only small particles less than 5 microns in diameter can reach the alveoli. Larger particles settle or impinge on the mucus overlying ciliated epithelium and are eventually swallowed.

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***Health services and special weapons defense. Executive Office of the President. U. S. Government Printing Office, Washington, D.C. (Dec. 1950).

Animal experiments have shown that the infectious dose in the form of small particles is many hundreds or thousands of times smaller than the infective dose of large particles. Under natural conditions, infectious particles sufficiently small to reach the aveoli rarely get into the air. Under artificial conditions, as in laboratories, this may happen readily. Thus, disease agents which in nature are spread by insect bite or other routes may be acquired through the respiratory tract if inhaled in artificially created small particles.

Now, if the air of a whole laboratory building can be contaminated accidentally, the air of any building could be contaminated maliciously. By using appropriate disseminative devices, such as atomizers, far greater concentrations of aerosol could be created than occur in laboratories. Attack rates as high or higher than those known to occur among research workers can be anticipated.

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

Epidemics caused by contaminated food and water supplies have long been understood. It is easy to comprehend how a saboteur could readily create one at will by introducing a high concentration of infectious or toxic agent at the appropriate time and place. An almost unlimited variety of possibilities can be imagined. The only limitations of consequence result from the accessibility of such food and water supplies and the limited distribution of any one supply.

It may be concluded, therefore, that the epidemiology of air-borne infections and common vehicle epidemics forms a scientific basis for developing a Theory of Biological Warfare. Established scientific principles indicate that biological warfare can be used against us effectively. The planning of appropriate defense measures must not be delayed.

Bloomington Field Training Center

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Training Services of the Communicable Disease Center, in cooperation with the Illinois State Department of Public Health and McLean County Health Department, in the fall of 1950 set up a field training station at Bloomington, Ill. This follows the previously established policy of the Public Health Service to assist the States in developing training facilities for their personnel. The Midwestern States are beginning to form a number of county health departments and there exists a need for field training of sanitation personnel for these departments. It was felt that most of the trainees would be drawn from the States of Indiana and Illinois, with possibly some from Wisconsin and Minnesota. The intention is that this station shall function until Indiana and Illinois have built up enough demand to justify a full-time field training program of their own.

The first course in the fall of 1950 was given for sanitarians employed by local health departments of Illinois and Indiana and was a standard 3-month Environmental Sanitation Course. Another similar course will be given in the spring of 1951 and another in the fall.

Illinois is one of the more important milk-producing States, since the Chicago milkshed affects the northern part of the State and the St. Louis milkshed the southern part. Due to the lack of local health departments, the sanitation program emphasis has been controlled by State health department personnel and to a considerable extent by fieldmen employed by the milk industry. Frequently, there has been a lack of uniformity in the interpretation of various ordinance requirements among the local health department personnel, State health department personnel, and the industry fieldmen.

At the request of the industry and the State

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