DEFENSE AGAINST BIOLOGICAL WARFARE*

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Biological warfare, "Public Health in Reverse," calls for new methods of fighting disease, because when disease is willfully spread, it can take on new aspects. By understanding why an enemy may choose to use BW instead of some other weapon, we may be able to forecast its use and prepare to repel it.

Various BW agents, means of distribution, and required properties are discussed. Although countering forces now exist in the health services of the United States, we must fashion and learn to use special defensive weapons.

The author outlines four essential elements in a program of defense against BW.

In recent months, several talks have been presented by highly qualified persons on the subject of biological warfare. These presentations have all avoided the spectacular and pointed out the basic ideas which we, as health workers, must understand to carry our share of the burden if this method of warfare is ever used against our country. This restraint was not always present, as was pointed out in the Federal Civil Defense Administration's publication, entitled "What You Should Know About Biological Warfare," which all public health workers especially should read without delay. For each of us has a heavy responsibility, one that can be borne only if we know something about the potentialities and the limitations of this weapon.

What is biological warfare? How could it be used? With what effect? And what are we doing to defend ourselves against it? This paper will attempt to answer these questions.


WHAT IS BIOLOGICAL WARFARE?

Biological warfare may be described as the "intentional use of living disease agents and their toxic biological products, or of chemical plant regulators to produce disease or death in man, animals, or crops." Attacks on animals or crops are of concern chiefly to professions other than public health and will not be discussed in this presentation. Biological warfare differs from our normal struggle against disease in that the resulting illnesses are willfully brought about by man and hence can conceivably take on new aspects, man having gone to the aid not of his fellow man but of the disease organisms. Some have called this process public health in reverse, a term which fits well.

Without getting into the question of moral values in the use of biological warfare — though you may be sure this phase of the problem has received and will continue to receive much attention — we should understand why an enemy might wish to use BW instead of some other weapon. This will help us to foretell how and when an attack might be made and enable us better to prepare for it.

In many respects, the BW weapon is in a class by itself. It is relatively cheap; capable of being perfected and produced by any country, large or small, which has a supply of good biological scientists; and can be fashioned to meet a very wide variety of circumstances. This flexibility is one of the most important attributes of the BW weapon. Microorganisms, or agents, could be chosen which would produce a high fatality rate in susceptible individuals. Perhaps, however, an enemy's purposes would be better served by a debilitating disease, one that would make people ill for a long while, tie down medical and nursing care, and take workers away from production lines. If so, a variety of agents could qualify for this task. Or possibly, an enemy would want to make a selected strategic area difficult to occupy. Widespread contamination of the area with a resistant disease agent would do this. Such attacks might be made openly by disseminating fine sprays or aerosols, or might be carried out entirely by acts of sabotage. Attacks might be directed at selected groups of persons, either before or after an open declaration of war, by introducing disease germs or...
bacterial toxins into the air, food, or water supplying these groups. If cleverly carried out, it might be very difficult to tell whether BW had been used or whether the outbreak was just an unfortunate breakdown in normal disease controls.

While it is true we have no evidence that any major use has been made of BW, we know quite positively that all the previously mentioned applications of BW are possible and we feel sure if such attacks were made, they would be at least partially successful. Inspite of all we might do, some people would get sick.

**How It Could Be Used**

It is important for health workers to realize that because biological warfare agents are purposely selected, grown, and disseminated by man, we can expect the worst his ingenuity can bring about. A little thought on the matter will show any qualified bacteriologist that an effective BW agent would have to be as highly virulent as possible, and that its virulence would need to persist through whatever method of dissemination might be selected. For example, it should be able to withstand reasonably well such adverse conditions as the drying effects of air dispersal, or the trip through a public water supply system. The agent should be capable of quick production in large amounts and yet have good storing properties. Furthermore, it should preferably be an organism for which there exists no effective immunization and no effective treatment. Special culturing methods might be used to bring about particularly desired characteristics in the various agents chosen.

Having considered any of several organisms which might meet these requirements, one might now question the possible effects of infections distributed through unusual routes. A disease which normally spreads by way of the gastro-intestinal tract or the bite of an insect, might be adapted very well to infection spread artificially through the lungs in the form of a aerosol or mist, perhaps with quite different symptoms. Accidental infections in many of our research laboratories show that there are possibilities of such an occurrence. The situation might be further complicated by dispersing a virus and a bacterial agent simultaneously, thus making both diagnosis and therapy more difficult.

**Defense Procedure**

To a considerable extent, the forces necessary to counteract an enemy BW attack already exist in the well-developed health and medical services of our country. These forces consist of persons well-trained and experienced in the principles of the medical and sanitary sciences. However, special defensive weapons still must be fashioned, and we must learn to use them. We must adapt our arsenal to the stresses of what could be a more difficult battle than any the public health profession has yet faced.

Obviously, in order to prevent infection from BW agents, we must keep them from reaching us and invading our bodies. It might be very difficult, however, if not impossible, for us to know when a cloud of BW agents had been loosed in a target area before someone becomes ill. The saboteur might succeed in infecting a water supply or the output of a food-packing establishment without being discovered. It should be clear, therefore, that we should plan our program of defense against BW to include the following major items:

1. Improvement of our system of reporting of communicable diseases.
2. Strengthening of our public health and diagnostic laboratories.
4. Establishment of a system of internal security to aid in preventing BW sabotage activities.

1. We should improve our system communicable diseases to obtain more complete information more promptly. Early reporting may save many lives. Remember, the epidemiology of a BW disease might not be the same as the occurrence of that disease in its normal manner. We might get a sudden and widespread incidence of an illness which normally would appear only sporadically or spread only very slowly among any considerable number of persons. Only prompt and complete reporting will enable us to act effectively in meeting such an outbreak. Necessary as reporting of communicable disease is to a public health program in normal times, it becomes all the more urgent when disease organisms are intentionally guided to their hosts. The National Office of Vital Statistics, the Public Health Service Communicable Disease Center in Atlanta, and the National Institutes of Health in Bethesda, Maryland, have already begun a concerted effort to improve our entire program of disease reporting. In order that we may be prepared to identify a BW outbreak, physicians and laboratory technicians especially should be on the alert not only for diseases of an unusual character but also for diseases not normally present in an area. There is a need for specially trained epidemiologists to help meet this eventuality.

2. Public health laboratories must be prepared to receive many specimens which they may never have handled before. Obviously, not all public health laboratories can be staffed and equipped to handle adequately the gamut of bacteria, viruses, rickettsiae, and fungi with which they might be confronted. However, by careful advance planning and a well-prepared system of inter-laboratory cooperation, most areas should be able to handle this situation. Special training for laboratory workers should be developed, with guidance given in the intricate task of planning for mutual assistance. One badly needed laboratory tool is an identification key especially suited for
use by laboratories which may be called upon to identify potential BW agents. No adequate key is available now. Without, one, much valuable time surely would be lost.

There is a good possibility, too, that as more people become alert to the potentialities of BW, our laboratories will be receiving varieties of specimens which have no real significance. Nevertheless, many of these will have to be run down in the laboratory if we are to practice vigilance. This work must be made as efficient as possible.

3. In this discussion so far, no mention has been made of any special techniques for the detection of BW agents prior to their appearance in infected persons. Those of you who are familiar with methods used in the field of industrial hygiene for sampling air will know that a wide variety of devices is available for tracking down the various pollutants associated with air hygiene, including some particularly adapted to bacterial sampling. However, you also know that even if these sampling techniques are well developed, the time required for classical laboratory determination of the bacterial samples is a least several days. If we were to become interested in the viruses, it might take our laboratories much longer to tell us what virus has been collected. Meanwhile, the outbreaks of human illness from these agents might have given us the answer before the laboratory staff could.

While several plans are under way to shorten the time necessary for ordinary identification for biological samples by the usual processes of culturing, our strongest hope for success in this problem seems to lie in a completely new approach. Physicists and chemists are working closely with the bacteriologists in an attempt to apply certain principles from these related sciences to this very difficult problem. It may be that we can depend on certain inherent chemical or physical properties of potential BW agents to bring about rapid identification in the laboratory. This problem calls for the application of our best talent.

4. As important as any single action we might take to protect ourselves from BW attack will be the organization of a system of internal security to guard against the covert dissemination of BW agents. We must remember that certain groups of people, such as key administrative talent and hard-to-get technical and mechanical personnel, and public facilities such as waterworks and food-and-milk-packing plants, are attractive to the saboteur. The BW agent is in some ways almost an ideal weapon in the hands of a clever saboteur, because it might be entirely possible for him to perform his tasks and be hundreds of miles away before its results can be detected.

Perhaps of greatest importance in our effort to meet the threat of biological warfare to our country is the need to adopt completely open minds on new developments in the field of biology and public health. Many of our everyday methods, though adequate now, are simply not sufficiently effective to combat the malicious workings of an enemy mind when it sets out to assist what we might call "the natural development of disease in the population." We must expect efforts to outguess us, and we must work diligently to prepare for the worst. There is no reason to become alarmed about this threat, but there is every reason in the world for understanding it completely and facing it squarely. I cite as an example of what hysteria can do to a population the recent excitement raised in one of our major cities when it was rumored that the water supply had been poisoned. The mindless behavior of large masses of people gripped in the paralysis of this sort of fear can be as destructive as any agent of warfare yet devised. BW works silently. It cannot be seen. Nobody knows where or when it will strike next.

Hence, apprehension, mounting to fear, and finally reaching the heights of mass hysteria, is a possible development to be guarded against.

Public health workers must assume their obvious responsibilities in this part of the over-all problems of civil defense.

Some Aids in the Mathematics of Milk Control

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of cardboard with one of the plate counts scales pasted on it as a ruler.

If the logarithmic average indicated falls to the left of the line indicating the maximum logarithmic average count, no further attention need be paid to it.

When a new count is to be entered, the last three counts are transferred to the line below, beginning at the left index line. The new count is added to the three previous ones. An example of how the graphic record is carried appears on the sample sheet. (Fig. 1)

A similar system may be used for recording temperatures, and calculating the arithmetic average of the last four temperatures. When an arithmetic average is involved, the scales are equally divided rather than logarithmic.

Fig. 2 shows a graphic temperature record. The individual temperatures are transferred from the small scale to the record lines just as in the case of the logarithmic average above. The temperature values indicated in the record section are the arithmetic averages of the last four temperatures.

In calculating surveys made according to the United States Public Health Service methods, employing Form No. 9421, the nomograph shown in fig. 3 is helpful in reducing the arithmetic involved. The method of operation is given in the text on the nomograph.