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JANUARY 3, 1945

BIOLOGICAL WARFARE

REPORT TO THE SECRETARY OF WAR BY MR. GEORGE W. MERCK,  
SPECIAL CONSULTANT FOR BIOLOGICAL WARFARE



Intelligence Reports of investigation conducted by Military Intelligence agencies in Japan after the occupation and received here after Mr. Merck had prepared his report to the Secretary of War show that Japan had made definite progress in biological warfare. From these investigations it is known that the Japanese Army fostered offensive developments in this field from 1936 until as late as 1945.

Intensive efforts were expanded by Japanese military men toward forging biological agents into practical weapons of offensive warfare. Modifications of various weapons developed through research in their laboratories were field-tested at Army proving grounds where field experiments were also conducted in the use of bacteria for purposes of sabotage. These efforts were pursued with energy and ingenuity. While definite progress was made, the Japanese had not at the time the war ended reached a position whereby these offensive projects could have been placed in operational use.

There is no evidence that the enemy ever resorted to this means of warfare. Whether the Japanese Army could have perfected these weapons in time and would have eventually used them had the war continued is of course not known. However, defenses against biological warfare were the subject of an active research and development program in this country.

This report sets forth the combined efforts of American scientists and industry working with the armed forces and in cooperation with similar agencies in the United Kingdom and Canada to develop defenses to enemy attacks by biological warfare.

While the military developments cannot be disclosed in the interest of national security the research contributed significant knowledge to what was already known concerning the control of diseases affecting humans, animals and plants. Arrangements have been made whereby this information of value to humanity as a whole will be made available to the public from those sources responsible for the work. This will be accomplished through reports before scientific bodies, publication in scientific journals and other means by which advances in science and medicine are disseminated in peacetime.

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Dear Mr. Secretary:

The military strength of a nation in war depends not only on the weapons which it actually brings to bear on the enemy but also on the thoroughness with which the nation prepares for all eventualities. This basic military doctrine was followed by the United States in waging war against the Axis,

A type of warfare that might have been employed in World War II--a potential avenue of attack by our enemies--was biological warfare. Biological warfare may be defined as the use of bacteria, fungi, viruses, rickettsias, and toxic agents from living organisms (as distinguished from synthetic chemicals used as gases or poisons) to produce death or disease in men, animals, or plants.

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This type of warfare was not unknown in World War I, although it was employed only on a very limited scale. There is incontrovertible evidence, for example, that in 1915 German agents inoculated horses and cattle leaving United States ports for shipment to the Allies with disease-producing bacteria.

In the years between World War I and World War II a general interest in the possibilities of biological warfare was maintained by scientists and military men in many countries, and many came to believe that this type of warfare was possible or even probable in the future. As the inter-war period drew to a close, opinion in the United States as to the possibilities of biological warfare was by no means united, but common prudence dictated to those responsible for the nation's defense that they give serious consideration to the possible dangers in this field. The counsel of those alert to the possible danger was formally brought to the attention of the War Department in the fall of 1941, whereupon Secretary Stimson promptly requested the National Academy of Sciences to appoint a committee to make a complete survey of the current situation and of future possibilities.

After careful study, this Committee--known as the WBC Committee--drew the conclusion in its report of February 1942 that biological warfare was distinctly feasible and urged that appropriate steps be taken for defense against its use. The report stated in part:

"The value of biological warfare will be a debatable question until it has been clearly proven or disproven by experience. The wide assumption is that any method which appears to offer advantages to a nation at war will be vigorously employed by that nation. There is but one logical course to pursue, namely, to study the possibilities of such warfare from every angle, make every preparation for reducing its effectiveness, and thereby reduce the likelihood of its use."

I

With these conclusions before him, Secretary Stimson recommended to President Roosevelt the establishment of a civilian agency to take full charge of all aspects of biological warfare. Upon the approval of the President, the War Research Service with Mr. George W. Merck as Director was organized in the summer of 1942 and was attached to the Federal Security Agency. In the interests of efficiency, economy, and secrecy, War Research Service remained a small organization. It served primarily as a coordinating agency and drew on the facilities, personnel, and experience already existing in the Government and private institutions. Its recommendations were implemented by orders and directives issued by the various branches of the Armed Services, particularly the Medical Services of the Army and the Navy and the Chemical Warfare Service of the Army. Appropriate Liaison was maintained with the Armed Services, the U.S. Public Health Service, the Department of Agriculture, and the Department of the Interior. Intelligence was obtained from the Army, the Office of Naval Intelligence, the Office of Strategic Services, and the Federal Bureau of Investigation; and public relations matters were handled in cooperation with the Bureau of Public Relations of the War Department, the Office of War Information, and the Office of Censorship. A Committee of prominent scientists--known as the ABC Committee--was set up by the National Academy of Sciences and the National Research Council to advise War Research Service on its special research problems.

The exchange of information on this subject which had been inaugurated some months before with the United Kingdom and Canada was continued and provision was made for the interchange of biological warfare personnel between the three countries.

The first major task undertaken by War Research Service was the development of defensive measures against possible biological warfare attack. Measures were taken in cooperation with the Armed Services to protect the supply of water, food, and milk on the mainland; in Hawaii, the Caribbean Area, particularly the Canal Zone; and finally all overseas theaters.

An extensive program for the collection of intelligence on biological warfare was established, making use of the intelligence collection agencies of the Armed Forces, the OSS, and the FBI, and arrangements were made to send specially trained intelligence officers into operational areas to stimulate the collection of intelligence on biological warfare.

The major achievement of War Research Service, however, was the organization of a program of research and development to extend the boundaries of knowledge concerning the use of pathogenic agents as a weapon of war and the means of protection against possible enemy use of these agents. All known pathogenic agents were subjected to thorough study and screening by scientists of the highest competence in their respective fields to determine the possibilities of such agents being used by the enemy. Those disease-producing agents which seemed to offer some promise were assigned to various university and private research laboratories for intensive experimentation in terms of their lethal properties, means of production, and methods of protection against their use. As the program progressed, however, it soon became clear that exhaustive investigations of biological warfare agents, their use as weapons, and means of protection against them could not be achieved without larger scale developmental operations.

In November 1942 War Research Service requested the Chemical Warfare Service of the Army to prepare to assume responsibility for a larger scale research and development program involving the construction and operation of specially designed laboratories and pilot plants. The site chosen for these facilities was at Camp Detrick, Frederick, Maryland, where construction was begun in April 1943. When these facilities were put into operation, research projects which had been developed under sponsorship of War Research Service were turned over to the Chemical Warfare Service for further development at Camp Detrick. War Research Service continued to exercise general supervision over the entire field and continued to sponsor fundamental research studies in universities and private institutions and to help secure scientific personnel and equipment for the Camp Detrick operations.

In December 1943, the Office of Strategic Services reported to the Joint Chiefs of Staff that there were some indications that the Germans might be planning to use biological warfare agents. While the evidence that the Germans might use such agents was inconclusive, there was considerable concrete information available from work which had been carried on in the United States, the United Kingdom, and Canada that attack by biological warfare agents was feasible. Accordingly, it was decided in January 1944 to step up all work in this field, particularly in terms of the protection of troops against possible enemy use of these weapons, and to transfer a large part of the responsibility for the biological warfare program to the War Department. The complete transfer was accomplished by direction of the President in June 1944 when the Chemical Warfare Service was made responsible for the program in the War Department with the cooperation of the Office of the Surgeon General on certain important defensive phases. The Navy Department continued to make important contributions to the program and continued to work in close collaboration with the War Department in this field. The research and development program was greatly accelerated, although it was directed that no biological warfare agents should be produced in quantity without specific approval of the Secretary of War. In fact, no large stocks of these agents have ever been accumulated.

Upon assumption by the War Department of full responsibility in this field, the Secretary of War appointed the Director of War Research Service as his Special Consultant on Biological Warfare and established the United States Biological Warfare Committee, with Mr. Merck as Chairman, to advise him on policy matters and to maintain close liaison with the British and Canadian groups concerned with biological warfare. This Committee was composed of representatives of the Chemical Warfare Service; the Office of the Surgeon General, U. S. Army; Bureau of Medicine, U. S. Navy; Bureau of Ordnance, U. S. Navy; Army Service Forces; Army Air Forces; New Developments Division, War Department Special Staff; G-2; and the Office of Strategic Services. A new committee--designated the DEF Committee--was formed by the National Academy of Sciences and the National Research Council to advise the War Department on the scientific aspects of the subject.

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## II

At the height of its development, the Special Projects Division of the Chemical Warfare Service of the Army, which carried the main responsibility for the program after June of 1944, had a total personnel of nearly 3900, of which some 2800 were Army personnel, nearly 1000 Navy, and nearly 100 civilian. The projects carried on by the Special Projects Division at its four installations were combined operations--with Army, Navy, and civilian personnel working together in the closest cooperation. They worked under high pressure and the strictest secrecy. Their achievements have been most remarkable.

The first installation established by the Special Projects Division in April 1943 was the parent research and pilot plant center in Maryland; the second, field testing facilities established in the summer of 1943 in Mississippi; the third, a plant designed for the investigation of larger scale production acquired early in 1944 in Indiana; and the fourth, field testing facilities established in the summer of 1944 in Utah. These installations were unique in many respects requiring, as they did, special designing to meet the completely new problems under investigation. The need for great precision and rigid safety requirements created many complex engineering problems. Special equipment had to be designed, constructed, and installed to handle processes never before exploited and on a scale of operation never before undertaken.

While it is not possible to reveal at this time the specific agents on which intensive work was done at these installations, the general nature of the problem and the type of information that was obtained in this field can now be told. It should be emphasized that while the main objective in all these endeavors was to develop methods for defending ourselves against possible enemy use of biological warfare agents, it was necessary to investigate offensive possibilities in order to learn what measures could be used for defense. It was equally clear that the possibility of retaliation in kind could not be disregarded in the event such agents were used against us. Accordingly, the problems of offense and defense were closely interlinked in all the investigations conducted. This is implicit in the discussion which follows.

A wide variety of agents pathogenic for men, animals, and plants was considered. Agents selected for exhaustive investigation were made as virulent as possible, produced in specially selected culture media and under optimum conditions for growth, and tested for disease producing power on animals or plants. Intensive investigations were conducted on many aspects of this field, including studies of how well various organisms of high disease-producing power would retain their virulence and how long they would remain alive under different storage conditions; biological, physical, and chemical protective measures; the numbers of organisms required to produce infection; the effectiveness of antibiotics and chemo-therapeutic agents; the incubation period of various diseases; and the effectiveness of certain chemicals (or coagents) when used with pathogenic agents or toxins in influencing their disease producing powers. From these and other studies has come much new information which, when published in scientific journals, will make significant contributions to the advancement of knowledge. Extensive studies of biological and chemical agents which might have been used in attacking our crops resulted in certain discoveries which will undoubtedly prove of great value to agriculture.

Studies were made of methods and means by which biological warfare agents might be employed against us. This involved not only the perfection of anti-sabotage measures--information on which was made available to appropriate civilian and military authorities--but also studies of the various types of munitions that might be employed for the dissemination of biological warfare agents. A strong intelligence program was instituted which operated very effectively in all theaters of operation with the result that a thorough knowledge of German activities in this field was obtained. Similar investigations of Japanese activities are now being conducted. When these investigations are completed it will be possible to evaluate fully the work carried on in this field by our enemies. All evidence to date indicates that the Axis powers were behind the United States, the United Kingdom and Canada in their work on biological warfare. It is also known that after early 1942 Germany obtained no information concerning United States activity in biological warfare, and that no serious leaks of information on this subject occurred in this country. The intelligent and whole-hearted cooperation of the press and radio of the nation, working in conjunction with the Office of Censorship, helped very materially in this regard.

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In all work on biological warfare carried on in the United States, extreme care was taken to protect the participating personnel from infection. Many new techniques were devised to prevent infection and proved highly successful. Hospitals and dispensaries were maintained at all installations, staffed with both Army and Navy medical personnel and well equipped to treat accidental infections. As the result of the extraordinary precautions taken, there occurred only sixty cases of proven infection caused by accidental exposure to virulent biological warfare agents which required treatment. Fifty-two of these recovered completely; of the eight cases remaining, all are recovering satisfactorily. There were, in addition to the sixty proven cases, 159 accidental exposures to agents of unknown concentrations. All but one of these received prompt treatment and did not develop any infection. In one instance, the individual did not report exposure, developed the disease, but recovered after treatment.

Obviously none of these cases were brought about intentionally, and were not, therefore, "controlled" experiments, but in any event certain valuable information was obtained from their treatment, particularly with regard to new antibiotics, chemotherapeutic agents, and immunizing procedures, which, but for these cases of accidental infection, could otherwise have been tested only on animals. Considering the variety of highly pathogenic agents handled, the scale of operations employed, and the relatively large number of people involved, the safety record of our biological warfare program is truly remarkable.

The activities of the United States in the field of biological warfare, undertaken under the goad of necessity and aimed primarily toward securing for this nation and its troops in the field adequate protection against the possible use by our enemies of biological warfare agents, were carried on with that teamwork which has characterized so many of our efforts in wartime. The branches of the Army and Navy, many civilian scientists, university and private research institutions, and several Departments of the Government all worked together to the common end. This was a matter of great urgency, and many of the problems were unique and most complex. The objective was attained; adequate defenses against a potentially dangerous method of warfare were devised, the possibility of surprise from this quarter was forestalled. Apart from the military objectives attained, however, much information of great and lasting value for human welfare was obtained. Unique facilities were established for research and experimentation on pathogenic agents on a scale never before possible. These facilities will be of inestimable value to future military and civilian biological investigations. In general terms, these were some of the more important accomplishments of the program:

1. Development of methods and facilities for the mass production of microorganisms and their products.
2. Development of methods for the rapid and accurate detection of minute quantities of disease-producing agents.
3. Significant contributions to knowledge of the control of airborne disease-producing agents.
4. Production and isolation, for the first time, of a crystalline bacterial toxin, which has opened the way for the preparation of a more highly purified immunizing toxoid.
5. Development and production of an effective toxoid in sufficient quantities to protect large scale operations should this be necessary.
6. Significant contributions to knowledge concerning the development of immunity in human beings and animals against certain infectious diseases.
7. Important advances in the treatment of certain infectious diseases of human beings and animals, and in the development of effective protective clothing and equipment.
8. Development of laboratory animal propagation and maintenance facilities to supply the tremendous number of approved strains of experimental animals required for investigations.

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9. Applications of special photographic techniques to the study of airborne microorganisms and the safety of laboratory procedures.

10. Information on the effects of more than 1000 different chemical agents on living plants.

11. Studies of the production and control of certain diseases of plants.

Steps are being taken to permit the release of such technical papers and reports by those who have been engaged in this field as may be published without endangering the national security. It is important that this be done, for much of the information developed in the course of this undertaking will be of great value to public health, agriculture, industry, and the fundamental sciences.

### III

While it is true that biological warfare is still in the realm of theory rather than fact, in the sense that it has not actually been used in military operations, the findings of the United States in this field along with the findings of groups engaged in similar work in the United Kingdom and Canada have shown that this type of warfare cannot be discounted by those of this nation who are concerned with the national security. Our endeavors during the war provided means of defending the nation against biological warfare in terms of its presently known potentialities, and explored means of retaliation which might have been used, had such a course been necessary. Although remarkable achievements can be recorded, the metes and bounds of this type of warfare have by no means been completely measured. Work in this field, born of the necessity of war, cannot be ignored in time of peace; it must be continued on a sufficient scale to provide an adequate defense.

It is important to note that, unlike the development of the atomic bomb and other secret weapons during the war, the development of agents for biological warfare is possible in many countries, large and small, without vast expenditures of money or the construction of huge production facilities. It is clear that the development of biological warfare could very well proceed in many countries, perhaps under the guise of legitimate medical or bacteriological research.

In whatever deliberations that take place concerning the implementation of a lasting peace in the world, the potentialities of biological warfare cannot safely be ignored.

Respectfully yours,

GEORGE W. MERCK  
Consultant