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Special Section:

BIOLOGICAL AND CHEMICAL WARFARE

An International Symposium

Edward Teller: The Issue of Peace

Max Born: Physics and Politics

On Disarmament by Vice-President Nixon and Senator Kennedy

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Biological and C

An International

Guest Editorial

SECOND among the specters that haunt modern man is that of biological and chemical warfare. To examine as soberly as possible the nature and extent of this threat, 26 scientists of the Pugwash Movement representing eight nations met last summer from August 24 to 30, to assess the potentialities of these agents as weapons, and to explore possible means for preventing their production or use in war. The statement signed unanimously by these scientists has already been published in the *Bulletin* (October 1959, pp. 337-39). In the present issue, some of the representative papers which were discussed at that meeting are collected, necessarily in somewhat condensed form. Also included are summaries of some of the papers read at the Symposium on Chemical and Biological Defenses in Perspective, held at the 137th annual meeting of the American Chemical Society in Cleveland Ohio, April 5-14, 1960.

The Difficulty of Control

As the Pugwash statement said, "the subject of chemical and biological warfare has been shrouded in official secrecy. For years large projects have existed in several countries with the stated purpose of developing defense means against such weapons." It was inevitable that among those experts in chemistry, pharmacology, bacteriology, and virology who were assembled for the Pugwash conference, not one could be said to have had direct associations with any of these military projects for over a decade; and very few of the scientists present had ever been directly connected with either aggressive or defensive military measures of this kind. Nevertheless, from the diversity of opinion which was represented, certain conclusions emerged which seemed sound to all who were present, on the basis of their scientific knowledge of the problems involved.

However difficult the international control of atomic weapons may be, the international control of bacteriological and chemical weapons seems incomparably more difficult. There are obvious reasons for this. The specific agents, or combinations of agents, which might be selected for use in chemical and biological warfare cannot be foreseen. They lie hidden among many potential agents. Thus the most effective nerve gases and hallucinatory chemicals are closely related to widely manu-

factured and extensively used insecticidal and pharmaceutical agents. Minor chemical changes may convert a relatively harmless substance into a lethal or incapacitating agent of great potency. The most likely bacterial, viral, and fungal agents, again, are among numerous similar infectious organisms which are widely cultivated in microbiological laboratories in the study of disease. Moreover, genetic mutations which may occur spontaneously at any time or may be induced and selected out, may convert a relatively harmless organism into one of high virulence.

Preparation and Dispersal

Another factor in the situation is of paramount importance. The selection and preparation of chemical or biological weapons requires no elaborate, large-scale facilities. The ordinary chemical or microbiological laboratory might be such a center, or a unit in a widely dispersed program. The identification of such centers of preparation for biological and chemical warfare would therefore be extraordinarily difficult. Even in the event of mass production of such agents, the installations are so like those widely used in vaccine or antibiotic production that identification might be very difficult. It follows that small nations as well as large and wealthy ones, industrially undeveloped nations as well as highly industrialized ones, might prepare in complete secrecy for the use of such weapons. It also follows that in this area of military problems we must face acutely the growing danger that with every additional participating power the probability of actual use or provocative incident becomes multiplied. Acts of anonymous attack or sabotage by means of biological agents may lead to local outbreaks of hostilities or may be misattributed as to source and so lead to a world holocaust.

The means of dispersal of chemical and biological agents of warfare are not unique. They are adapted to dispersal from planes and from submarines, by conventional and rocket missiles, as well as by saboteurs. There would therefore be no specific means of controlling the dispersal phase except by a general ban upon modern forms of armaments.

Protection of an aggressor's own population against the backfire of its own chosen chemical and biological agents would not be readily distinguishable in advance

Chemical Warfare

l Symposium

from purely defensive measures against anticipated attacks by other nations or from immunizations carried out purely for reasons of public health.

The Preservation of Peace

One is led to the conclusion that control of the use of chemical and biological weapons by inspection systems is virtually impossible. This being so, what alternatives have we?

It seems clear that international renunciation of the use of such weapons, as in the 1925 Geneva Protocol, cannot be effective unless all nations, small as well as large, ratify such an agreement. Otherwise, under the guise of solely defensive measures, offensive preparations may be conducted on a considerable scale.

It further seems clear that the root of the danger lies in the secrecy with which such military preparations are carried on. The danger rapidly diminishes as general knowledge of the nature of potential chemical and biological weapons is increased, and laboratories are freely opened to visitors.

The most hopeful approach to international regulation of this danger therefore seems to comprise, first, a general agreement by all nations to renounce the use of such weapons, to be followed by, second, a renunciation of secrecy and of all security controls over microbiological, toxicological, pharmacological, and chemical research. In considering the means of implementing the second of these proposals, one may point to the already excellent results achieved by the Report of the United

Nations Scientific Committee on the Effects of Atomic Radiation. A comparable committee, or a permanent U.N. commission, on biological and chemical modes of warfare, could dispel much of the atmosphere of dread and secrecy that now surrounds this phase of military activity. The very existence of such a United Nations organ might in time generate what seems to be ultimately the only effective safeguard against violations: the international conscience of the individual scientists of all nations which would lead them to protest every instance of restriction of the free publication of microbiological, toxicological, pharmacological, and chemical research and to report to the United Nations every suspicious endeavor to carry on preparations for the use of such agents in war. Sadly, it must be admitted that the world is far from possessing such a conscience today.

In the end, only the absolute prevention of war will preserve human life and civilization in the face of these as well as nuclear weapons. No ban of a single type of weapon, no agreement that leaves the general threat of war in existence, can protect mankind sufficiently. We therefore must look forward to a day when national aims will be generally recognized as secondary to the preservation of peace, and when there will be international power to preserve the peace.

—BENTLEY GLASS

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Some Historical Considerations

THEODOR ROSEBURY

PREVIOUS Pugwash Conferences have found it comparatively easy to reach agreement on questions of nuclear warfare, simply because the facts are widely appreciated and their import is inescapable. The facts of biological warfare are not so well known, and even when known they are less compelling. If we

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are to assess the significance of this form of warfare we ought to begin by examining the record of its past his-

tory, including what has been done before by others in attempts to control it. I propose to review these and some related matters.¹

DEVELOPMENT AND ALLEGED USE OF BW IN WAR SINCE 1915²

World War I

The history of the use or alleged use of biological weapons in war is characterized by a remarkable circumstance, namely, that although allegations are many, not a single one can be called fully authenticated. In other words, no government, and no responsible government official who was free from duress at the time, has ever admitted waging offensive biological warfare. No other evidence could be fully acceptable to all concerned.

The significant history of biological warfare ("BW") begins with allegations made against the Germans in the First World War. For example, Mr. George W. Merck (1946), in his report to the U.S. Secretary of War that was used in the official press release on American activities in this field during World War II, referred to "incontrovertible evidence . . . that in 1915 German agents inoculated horses and cattle leaving United States ports for shipment to the Allies with disease-producing bacteria." Earlier writers (LeRenard, 1936; Popescu, 1936; Duffour, 1937; LeBourdelles, 1939) had mentioned German attempts to inoculate horses with glanders, and cattle with anthrax, at Bucharest, Roumania, in 1916, and on the French Front in 1917. This Roumanian episode was detailed and documented in a book published in 1919 (de Flers), and was alluded to a few years later by Bordet in a report to the League of Nations (a) Commission at Geneva. There were other allegations in the late 1930's (Duffour; LeBourdelles) of attempts by the Germans to spread cholera in Italy during World War I. That none of these efforts could have achieved a significant military result is suggested by a remark that appears in the League of Nations record in 1924 (a): "In contradistinction to the chemical arm, the 'bacteriological arm' has not been employed in war."³

World War II

There is evidence that during the Second World War both Germany and Japan developed biological weapons.

¹ The use of biological agents to exterminate pests—a humanitarian enterprise—is properly distinguished from warfare under the term "biological control." Since the earliest efforts of Pasteur and Loir (see Dubos, 1950) to kill rabbits by infecting them with *Pasteurella multocida* there have been continued studies in this field down to the present time, notably the work of Steinhaus and his colleagues (1945; Thompson and Steinhaus, 1950; see also Fleschner, 1959) on the use of microorganisms and polyhedrosis virus for the control of insect pests; and the studies of Burnet (1952) and of Fenner and his co-workers (1957; Marshall and Fenner, 1958) with myxomatosis virus against rabbits in Australia.

² The earliest attempt at true biological warfare seems to have been the 18th-century episode involving the spreading of smallpox among American Indians (see Stearn and Stearn, 1945).

The charges against Germany appear in the record of the International Military Tribunal (1947-48) at Nuremberg, where they seem not to have gone beyond "preparation for bacteriological warfare" (my emphasis). In fact, this part of the indictment seems comparatively trivial in the appalling context of other "crimes against peace," "war crimes," and "crimes against humanity" of which the Nazi leaders were convicted. Closely related in this record, however, are the charges of the use of involuntary human subjects in pseudo-scientific "medical experiments," some of which involved inoculation. According to a statement adopted by the General Assembly of the World Medical Association in 1948:⁴

The Soviet Extraordinary Commission established that the Germans took deliberate steps to spread typhus among the Soviet population and the Red Army. . . .

but a year later an official Soviet document⁵ made only the charge of "preparations for employing the bacteriological weapon. . . ." Merck, in the document cited before (1946), mentioned that American Intelligence had obtained

A thorough knowledge of German activities in this field. . . . [and that] 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.

More explicit information is available regarding Japanese BW activities during World War II. The opening "Note to the Editors" in the official U.S. press release (Merck, 1946), to quote from it again, begins as follows:

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 expended 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

³ I have referred elsewhere (Rosebury, 1949) to the plausibly detailed allegations of the British journalist Wickham Steed (1934) regarding German experiments with air-borne *Serratia marcescens* in the underground railways of Paris and London, said to have begun in 1931 and to have continued under order of Hitler. These charges were quickly denied by a German journalist, although less plausibly. They did not figure in later accounts of German BW activities made during the trials at Nuremberg.

⁴ *World Med. Assoc. Bull.* 1949, 1, p. 4.

⁵ *Materials on the Trial of Former Servicemen of the Japanese Army Charged with Manufacturing and Employing Bacteriological Weapons*, 1950, Foreign Languages Pub. House, Moscow.

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. . . .

The American military commentator Hanson W. Baldwin wrote as follows in the same year:⁶

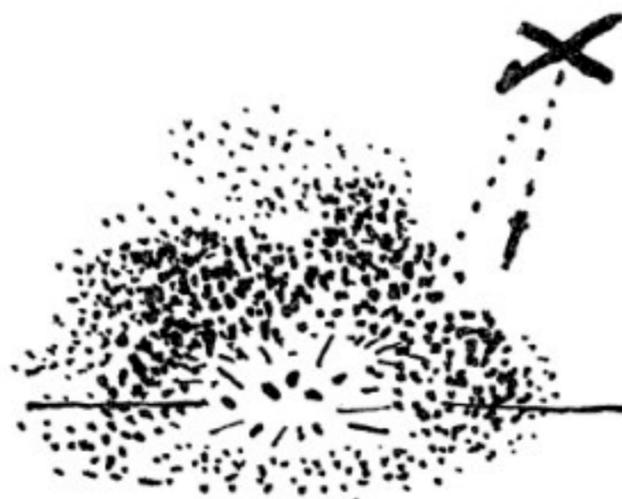
The Japanese are known to have experimented considerably with biological warfare, but the Germans had done little. The Japanese had developed, before the war ended, a crude anthrax bomb, and they had a "BW" (biological warfare) factory near Harbin, Manchuria, which was producing toxins or bacteriological poisons.

In December 1949, twelve Japanese military prisoners, including the former Commander-in-Chief of the Kwantung Army, were tried at Khabarovsk, USSR, on charges of having prepared and employed bacteriological weapons. The proceedings of the trial were published in 1950.⁵ The trial record contains detailed charges especially against the so-called "Ishii Detachment" of the Kwantung Army. General Shiro Ishii, who was not captured by the Soviet forces, was named as the "ideologist of bacteriological warfare" whose laboratory work initiated the Japanese BW program, and who subsequently, with other bacteriologists, acted as its technical leader. The Soviet record, including detailed confessions, supports allegations made earlier in China that the Japanese had used the plague bacillus in attacks on that country. These latter charges had been credited by Thomas Parran, then Surgeon General of the U.S. Public Health Service, and by R. Pollitzer, League of Nation epidemiologist.⁷

From the testimony at the Khabarovsk trial it appeared that extensive Japanese development of BW began in 1931 soon after the occupation of Manchuria, and that two large installations for the work were built in Manchuria in 1936, one of them 20 kilometers from Harbin. Three principal methods of utilizing bacteria for war purposes were said to have comprised spraying them from aircraft, dropping special bacterial bombs from aircraft, and contaminating water sources, pastures, and inhabited areas of land by methods of sabotage. The microbic agent most prominently mentioned was that of plague. "Hundreds of millions of fleas" were said to have been bred in special chambers. The agents of cholera, typhoid and paratyphoid fevers, and anthrax were also mentioned. Chinese and Soviet prisoners were recorded as having been used as subjects in BW experiments, with fatal results; and, beginning in 1939 or 1940, the Ishii Detachment was said to have made actual bacteriological attacks, first against Chinese or Mongolian troops and later against the civilian population of China. Although no details were given as to the consequences, several outbreaks of plague, at least one of which was termed "severe," were said to have resulted;

⁶ N.Y. Times, Sept. 27, 1946.

⁷ Editorial, Med. Record 1942, 155, p. 269.



and other "severe outbreaks of infectious disease," including typhoid fever, were mentioned as having occurred in consequence of BW attacks.

The report of the International Scientific Commission,⁸ which I shall mention again later, speaks of official Chinese records that gave the total number of victims of plague resulting from Japanese BW attacks between 1940 and 1944 as approximately 700. A story in the *New York Times* in 1955⁹ cited a Japanese writer, Hiroshi Akiyama, as giving "a purported eyewitness account of Japanese germ warfare tests in World War II in which 1,500 to 2,000 human guinea pigs supposedly died." The tests were said to have been made at a center near Harbin, Manchuria, which was masked as a Red Cross Unit, and was hurriedly destroyed in August 1945, when the Soviet Union entered the war in that area. Akiyama was quoted as having written, "I hereby dare to make public this report after ten years' silence because I wish to help prevent the third world war."

British, Canadian, and American activity in biological warfare during the Second World War consisted of extensive research and development that have been described in official and unofficial statements, the latter including my book, *Peace or Pestilence* (Rosebury, 1949). These operations are known to be continuing,¹⁰

⁸ Report of the International Scientific Commission for the Investigation of the Facts Concerning Bacterial Warfare in Korea and China, 1952, Peking.

⁹ July 16.

¹⁰ After this paper had been prepared, a news story appeared that is relevant to all three of the paper's subdivisions: it deals with American BW (and CW) activity, with disarmament, and with the public attitude toward such weapons. The AP story (*St. Louis Post-Dispatch*, Aug. 9, 1959) stated that the House Committee on Science and Astronautics said on Aug. 8, in a special report to Congress:

"... the United States is now spending \$35,000,000 to \$40,000,000 a year on such [chemical-biological-radiological warfare] research.

"This represents about one one-thousandth of our defense budget' . . .

"Increasing this amount over a two- to three-year period to a spending level of around \$125,000,000 a year is needed, the committee said, to put this country on a par with the Communists. . . ."

In the account by Jack Raymond in the *New York Times* (Aug. 9, 1959), the following is given among the committee's recommendations:

(footnote continued on next page)

and the wartime Camp Detrick, the research and development center in Maryland, has become Fort Detrick, a so-called "permanent" installation. Among the known activities have been BW field tests, the details of which are secret. It was noted in the press, for example, in 1954,¹¹ that Great Britain conducted such tests in the Bahama Islands area; and in 1957 a biologist at Utah State Agricultural College (Pfeiffer, 1957) published a paper protesting against American field tests of BW at Dugway, Utah. During the War and through 1946, when my official connection with BW ended, I knew of no suggestion that biological weapons had ever been used by the Western Allies for any military purpose or deliberately against human subjects. Just to set the record straight, moreover, and in view of certain inaccurate comments about me to the contrary, let me note that I have never held a policy-making position in this field.

The Korean War

Since the end of World War II allegations of actual military use of biological weapons by the United States have been made on several occasions from countries in the Soviet group.¹² Among these charges only the ones

"Include chemical, biological, and radiological warfare in discussions of international disarmament, with particular attention to the ease of evading detection of such methods."

The *Times* story begins with these words:

"Leading military officials are trying to overcome public horror of chemical, biological, and radiological warfare"

and resumes on this subject further down as follows:

". . . officials decided recently, as a matter of policy, that public support was required to make possible further developments of some promising and rather astounding chemical warfare techniques.

"The officials recognized the popular aversion to 'unorthodox' warfare, the outcry after the limited use of gases in World War I, and the trumped-up Communist charges that the United States had used germs as weapons in the Korean War. . . .

". . . the space committee said that while chemical, biological, and radiological warfare can be 'just as disagreeable as any of the other forms of destruction in vogue in the world,' it also offers 'some rays of hope for a more sane approach to an activity which we wish could be classified as irrational.'"

¹¹ *N.Y. Times*, Mar. 12, Apr. 13, 1954.

¹² Only recently a brief AP dispatch (*St. Louis Post-Dispatch*, July 5, 1959), repeating earlier charges, attributed the following statement to Soviet commentator Grigoriy Morosov in a Moscow radio broadcast: "In 1949, the United States Army tested biological means of warfare on the Eskimos of Canada, causing an epidemic among them." I have not seen these charges in detail and have no further information on them. The years immediately following World War II, when BW was given wide publicity, seemed to have been favorable for the growth of sensational reports of which two examples may be cited: (a) British press reports that the Nazis had "planned to send an 'ultimatum' to the USA and Great Britain backed up by the threat of deadly germ warfare" (*U.P.*, Feb. 25, 1947); and (b) an American news commentator's charge that the USSR was responsible for the cholera epidemic in Egypt in 1947 (see the story by Albert Deutsch in *PM*, Oct. 14, 1947). In a letter to the *N.Y. Times* printed Oct. 19, 1947, Kabat and I characterized the latter charges as "baseless."

pertaining to the Korean War require close scrutiny; and among the documents on the Korean War our present purpose may be served if we limit our attention to one that was offered as a scientific study of the circumstances. This is the Report of the International Scientific Commission,⁸ published in Peking in 1952, comprising, with appendices, nearly 700 pages. The charges were categorically denied by American authorities, and the depositions made by U.S. military personnel while they were prisoners of the North Korean and Chinese forces were, so far as I can recall, invariably repudiated upon the return of those persons to the United States.¹³

The International Scientific Commission was invited in the name of the Chinese National Academy (*Academia Sinica*) and the Chinese Peace Committee to check the charges of germ warfare made earlier by the North Koreans and Chinese. The signers of the ISC Report comprised six professional men in the fields of public health or of medical or biological science, from Sweden, France, Britain, Italy, Brazil, and the USSR. The best known member of the group in the English-speaking world is Joseph Needham, British biochemist and Sinologist. The Soviet member of the group, Professor Zhukov-Verezhnikov, had been chief medical expert at the Khabarovsk trial.

Only a brief abstract of this document can be given here. Whether it be read as a work of imaginative fiction or as a study in abnormal epidemiology, and in the latter event whether its conclusions be accepted in any degree or not, the Report is nevertheless required reading on the subject of biological warfare. It contains sidelights on BW that are not to be found elsewhere so far as I know. Among them is an abridged translation (given as Appendix Q) of a paper by Ryohei Sakaki, reproducing 3 facsimile pages in Japanese, from the weekly journal, *Maininchi*.¹⁴ Sakaki is listed as a former Major in the "Epidemic Prevention Service" of the Japanese Kwantung Army. His paper begins with a description of a military conference in October 1936, and continues as follows:

To make use of bacteria and other microorganisms as weapons is not only definitely possible, but it is now also certain that they will become very strong and powerful weapons.

¹³ Three Americans, John W. Powell, his wife Sylvia, and an associate, Julian Schuman, have been under trial for sedition in U.S. District Court in San Francisco since 1956 in connection with statements, including the germ warfare charges, against the United States, made in the monthly magazine *China Monthly Review*, published in Shanghai in 1950-1953. The Powells and Schuman had credited these charges and have not recanted. They returned to the United States from China in 1953. Early in 1959, following an order of mistrial on the sedition charge, the U.S. attorney in San Francisco attempted to secure an indictment of the Powells and Schuman on the charge of treason, but the attempt failed for lack of evidence. The three are still under indictment on the sedition charge. See *Christian Science Monitor*, Boston, Feb. 14, 1959; *St. Louis Post-Dispatch*, June 26, 1959; *National Guardian*, New York, July 27, 1959.

¹⁴ No. 1683, Jan. 27, 1952.

Henceforward it will be a main task to find out how to convert them into effective weapons.

Sakaki then proceeds to a discussion of bacterial attack by "spraying," "showering," and "dusting," and follows this with explicit details and diagrams of containers and devices for the dissemination of biological agents, some of them self-destroying, with attached parachutes, in one instance designed to carry plague-infected rats. If this paper be science fiction it has considerable verisimilitude.

The ISC Report itself was presented as having been based on studies made in China and North Korea between June 23 and August 31, 1952, including approximately three weeks in the zones said to have been involved in BW attacks. The principal means by which the Commission arrived at its conclusions were given as examination of Korean and Chinese documentation and "personal tests, examinations, interrogations, etc., carried out by the members of the Commission." It was stated that Shiro Ishii, whom the Khabarovsk trial record had named as a leader of Japanese BW during World War II, had made two visits to South Korea in early 1952; and the Report noted that "whether the American Far Eastern Command was engaged in making use of methods essentially Japanese" was a question considered but not resolved by the Commission.

Anomalous epidemiological phenomena were emphasized among other evidence pointing to artificially induced rather than naturally occurring disease. For example, a variety of arthropods, identified as being not natural but possibly artificial vectors of disease in man, some of them of diseases of plants, were described as occurring in high concentrations and in anomalous locations and seasons. The Report also mentioned bacterial and fungal plant pathogens as having been dropped by American planes. Details of a series of alleged BW incidents were all associated with American planes and included much supporting data. Among them was a plague outbreak with 50 cases and 35 deaths in a population of 600, occurring after the appearance of concentrations of the human flea *Pulex irritans* on a bare hillside in February. In another incident there had been observed large numbers of plague-infected voles, rodents otherwise unknown in the area. Again, *Bacillus anthracis* had been isolated from insects and feathers found with fragments of a metal and calcareous container reported as seen to drop from an American plane; and in another instance, fatal human cases of respiratory anthrax and hemorrhagic anthrax meningitis were described in detail and associated with the dropping of various objects by American planes.

In one case [in the matter of this incident] several people saw an object like a large red thermos flask thrown down, which seemed to burst with an explosive puff and a disagreeable smell like burning skin or horn when about 30 feet from the ground.

Elsewhere, two fatal cases of cholera were attributed to ingestion of contaminated clams in a rural area as part of an episode described in detail as an unsuccessful attempt to contaminate a series of reservoirs from the air. Finally, the Report described an outbreak of an acute encephalitis with a 73 per cent case mortality, thought to be of viral origin and to have followed an attack using the air-borne route of dissemination; but attempts to isolate a virus were unsuccessful, and the evidence of BW was presented as admittedly incomplete. The Report included extensive details of BW containers or bombs, corresponding in many respects with those described by Sakaki and also with "samples of Ishii earthenware bombs collected from the ruins of the factory near Harbin," which were shown in a photograph following Appendix Q.

As I mentioned earlier, this Report stated that some 700 victims of plague had been attributed to Japanese BW attacks on China during the Second World War. Morbidity and mortality data on the alleged attacks during the Korean War were intentionally withheld. The Report suggested that contrary to widespread opinion the development of hygiene throughout China had been so rapid and successful by 1952 as to minimize the effects of BW. Nevertheless there is no implication that the consequences of the alleged attacks were minor. The body of the Report, in fact, ends with this sentence: "All people should be aware of the potentialities of this kind of warfare, with its incalculable dangers."

We need not attempt to judge the validity of these allegations, but it is worth our while to speculate on them. They might conceivably have been inventions; it is possible, although highly unlikely, that they were all natural outbreaks of disease mistaken for BW; or some may have been one and some the other; or there may have been mixtures of the two. Even if we assume, without implying a judgment, that some of the allegations may have had a basis in fact—perhaps exaggerated for purposes of propaganda—it would still follow that biological warfare, as it has been applied thus far in war, is hardly to be compared with nuclear armaments as a weapon of mass destruction. But—continuing the same line of thought—it may be suggested that the attacks with biological weapons that have been made thus far have all been only tentative or exploratory or otherwise below available potential, not to speak of future possibilities. In line with this thought is the suggestion in the ISC Report that BW in the Korean War may have been "Japanese" at least in style. Mr. Merck's remark will be recalled that "the Axis Powers were behind" the Western Allies in BW development at the end of World War II. In sum we are left with no reliable information on the capacity of BW from the history of its alleged use in war. I suggest that in attempting to make the assessment expected of us we keep in mind the phrase used by the ISC, "incalculable dangers," applying to the

adjective both of its alternative meanings, "undeterminable" and "illimitable."

ATTEMPTS TO PROHIBIT OR CONDEMN BW

In the League of Nations, up to 1925

Attempts to control biological warfare by international agreement began in the years between the two World Wars. The Washington Disarmament Conference of 1922 had reaffirmed the prohibition of the Hague Convention of 1907 against poison or poisoned arms and had extended it to "asphyxiating gases and all analogous liquids, materials, or devices," language broad enough to include BW. The first explicit mention I have seen of bacterial warfare in connection with an attempt to limit its use was in 1923, when the Temporary Mixed Commission for the Reduction of Armaments of the League of Nations (b) requested that a statement be obtained "from the most qualified experts" on both chemical and bacterial warfare. A committee consisting of Professors Pfeiffer, Bordet, Madsen, and Cannon reported on July 30, 1924 [League of Nations (a)] that:

... the effects of the bacteriological arm can neither be measured nor localized; they would reach the civilian population, would cross frontiers, and might reappear or continue even after the cessation of hostilities. It may be said that this arm would be aimed indirectly against all mankind.

Professors Pfeiffer, Bordet, and Madsen, however, are of the opinion that such warfare would have little effect on the actual issue of a contest in view of the protective methods which are available for circumscribing its effects.

The pollution of drinking water by cultures of typhus [sic] or cholera germs would be combated by filtering, as already practiced in large centers, or by treating the waters of rivers with chlorine. The enemy would have to contaminate, by means of aircraft, the filtered water of the reservoirs directly: this would be a difficult operation and its effects could be frustrated by preventive vaccination.

The propagation of plague by pest-infected [sic] rats would be as dangerous for the nation employing this method as for its adversary . . . the danger of an epidemic of typhus propagated by lice has greatly diminished . . . the only method presenting a certain danger would be that of dropping from aeroplanes glass globes filled with germs.

Finally, the majority of the experts are of the opinion that bacteriology cannot at present produce infective substances capable of destroying a country's livestock or crops. Professor Cannon, however, . . . admits the possibility of aeroplanes disseminating over wide areas parasites capable of ravaging the crops. The scientists . . . are of the opinion that our present knowledge of hygiene and microbiology would limit the extension of any epidemics that might be spread either among combatants or in any civil population, and that such epidemics could not have any decisive influence on the issue of hostilities. . . .

The Committee noted, however, that the statement of the experts

... does not . . . constitute the final word on the subject; for

although the conclusion drawn may be comparatively reassuring for the present, they nevertheless direct attention to the possibilities which the development of bacteriological science may offer in the future. . . . (*loc. cit.*)

The Geneva Protocol

Following these discussions the Geneva Protocol was signed on June 17, 1925, by 47 countries, among them the British Empire, China, France, Germany, Italy, Japan, the United States, and the Soviet Union, and came into force February 8, 1928 [League of Nations (c)]. The Geneva Protocol prohibits "the use in war of asphyxiating, poisonous, or other gases, and of all analogous liquids, materials, or devices," and extends the prohibition to "the use of bacteriological methods of warfare." Six of the signatory countries failed to ratify the Protocol, including Japan and the United States. Among the ratifying countries sixteen specified that the Protocol was binding only as regards States that had signed and ratified it or acceded to it (among them Britain and its Dominions, France, and the USSR); and the same nations with three additional ones reserved the right of reciprocity—that is, the right to use the weapon against another nation that used it first.

The League of Nations, 1928–33

After the 1925 protocol had been signed, a Preparatory Commission for the Disarmament Conference continued discussions on both chemical and biological warfare as well as on other weapons. During this period, while the clouds of the Second World War were gathering, chemical warfare continued to claim the greater attention; BW, in fact, seemed hardly to be taken seriously. The idea of reciprocity, which had been attached to the Geneva Protocol by individual ratifying nations, was introduced for chemical warfare in 1929 [League of Nations (d)] as part of the wording of the draft prohibition, and persisted to the final draft; but BW continued to be prohibited "unreservedly." A Special Committee was appointed by the General Commission on May 19, 1932, to consider chemical and bacterial warfare in the light of a resolution distinguishing qualitative from quantitative disarmament. The Committee reported back on May 31, 1932, offering the unanimous opinion that both chemical and bacterial warfare should be included within a system of qualitative disarmament because they were the most threatening to civilians. It was further stated by this Committee:

That the use of pathogenic microbes for the purpose of injuring an adversary is condemned by the conscience of humanity. . . .

... that all methods for the projection, discharge, or dissemination in any manner, in places inhabited or not, of pathogenic microbes in whatever phase they may be (virulent or capable of becoming so), or of filter-passing viruses, or of infected substances, whether for the purpose of bringing them into immediate contact with human beings, animals, or plants, or for the purpose of affecting any of the latter in any

indirect manner—for example, by polluting the atmosphere, water, foodstuffs, or any other objects—should be included in qualitative disarmament [League of Nations (e), p. 104].

A final draft Disarmament Convention was prepared in 1933 incorporating provisions regarding chemical and bacterial warfare in accordance with the preceding discussions. This work was interrupted by the withdrawal of Germany from the Conference and from the League of Nations on October 14, 1933. The principal features of the provisions relating to chemical and bacterial warfare in the draft Convention were summarized in the Preliminary Report of the Work of the Conference published in 1936 [League of Nations (e), p. 111] as follows:

... The use of chemical, incendiary, or bacterial weapons against any State or in any war whatever its character, is prohibited. All preparations for such warfare are prohibited in time of peace as in time of war. The right of reprisals, however, is recognized, as is the freedom of the contracting parties in respect of material or installations intended to ensure individual or collective protection. . . .

These provisions may be characterized, if only by hindsight, as contradictory and unworkable, since to reserve the right of reprisals, in particular, would have vitiated the prohibition against preparation for such warfare, which would in turn have seriously weakened the primary prohibition against the use of chemical and bacterial weapons. In this respect, therefore, adoption of the draft Convention of 1933 would have represented a step backward from the Geneva Protocol of 1925. This opinion must be considered, of course, in the context of the political history of the period.

BW in the United Nations

After World War II the question of biological warfare again emerged; and in view of its development during the war it now overshadowed chemical warfare; but nuclear weapons have of course become the primary problem of disarmament in the post-war period. Beginning with the Truman-Attlee-King Declaration of November 15, 1945, and continuing through the establishment of the U.N. Atomic Energy Commission on January 24, 1946, the same phrase recurs in the terms of reference, namely, "the elimination from national armaments of atomic weapons and of all other major weapons adaptable to mass destruction." Weapons of mass destruction were defined by the U.N. Commission for Conventional Armaments [United Nations (a)] so as explicitly to include biological weapons. Biological weapons, however, were only mentioned occasionally¹⁵ during the subsequent discussions of the UNAEC; and on July 5, 1948, Secretary-General Trygve Lie commented regarding both chemical and biological warfare that:

... not a single proposal has been made by any of the Member nations for any system of preventing or controlling their

¹⁵ Polish UNAEC delegate I. Zlotowski suggested a ban on BW in the U.N. in 1947. See U.P. dispatch by Robert Manning, Oct. 2, 1947; *N.Y. Herald-Tribune*, Oct. 3, 1947.

manufacture, nor has there been any discussion or study of the problem in the United Nations. . . . [U.N.(b)].

At the Fourth Regular Session of the U.N. General Assembly in 1949, General Romulo, presiding, proposed calling an international scientific conference. This proposal was taken up by the Secretary-General, who also proposed that a discussion of the international control of weapons of mass destruction, including biological weapons, be held at a special meeting of the Security Council. Early in 1950 I was asked and agreed to serve temporarily as a consultant in the U.N. Secretariat to help compile an annotated bibliography of BW to be used in connection with such a meeting. This work was interrupted soon after the outbreak of the Korean War in June 1950, and to my knowledge has never been completed.

In May 1952, the U.N. Human Rights Commission rejected a Soviet proposal which, according to its sponsors, would have prevented governments from "criminal misuse" of science for the development of atomic bombs or germ warfare;¹⁶ and on December 1, 1955, Rickard Sandler, Swedish representative, suggested to the General Assembly Political and Security Committee that since control of nuclear weapons had failed, the problem of the prohibition of chemical and bacteriological warfare should be taken up.¹⁷

Other Declarations

Condemnation of BW, nearly always explicit, sometimes qualified, has come since World War II from several additional sources, including international scientific and medical congresses and two groups of the International Red Cross. Details are given in an appendix to this paper.

FURTHER LEGAL AND ETHICAL CONSIDERATIONS OF BW

There is one curious respect in which biological warfare seems pre-eminent with little dispute: it is widely thought of as the most odious or abhorrent form of warfare. I mentioned this opinion in my book, written in 1948. It seems worth examining again from a later perspective, and I propose to do so briefly, first in general terms and then more specifically.

This judgment of biological warfare may be looked upon as a footnote to the history of attempts to formulate rules for the conduct of war. I have in mind not the rules of war devised by, or for the specific benefit of, military commanders or heads of state; but rather those conceived in the name of mankind generally. Conspicuous, perhaps pre-eminent, among writers in the second group, is Jean Jacques Rousseau. A passage from *The Social Contract*, published in 1762,¹⁸ is pertinent:

¹⁶ *N.Y. Times*, May 15, 1952.

¹⁷ *N.Y. Times*, Dec. 2, 1955.

¹⁸ Trans. G. H. D. Cole, *Everyman's Library*, p. 9.

War . . . is a relation, not between man and man, but between State and State, and individuals are enemies only accidentally, not as men, nor even as citizens, but as soldiers; not as members of their country, but as its defenders. Finally, each State can have for enemies only other States, and not men. . . .

. . . The object of the war being the destruction of the hostile State, the other side has a right to kill its defenders, while they are bearing arms; but as soon as they lay them down and surrender, they cease to be enemies or instruments of the enemy, and become once more merely men, whose life no one has any right to take . . . war gives no right which is not necessary to the gaining of its object. . . .



These words are part of the great tradition of political democracy out of which both the American and the French revolutions arose. They have not achieved universal acceptance in either country; but their continued viability at least up to 1907 is witnessed by the presence of almost identical ideas in the preamble and text of the Hague Convention of that year. Indeed, one can also find clear suggestions of them in documents, embodying fundamental aspects of international law, as recent as the Charters of the Nuremberg Tribunal and of the United Nations itself. The same tradition, it seems to me, is also traceable in the specific conventions on chemical and biological warfare, or the attempts to formulate them, of the 1920's and 1930's.

Possibly even closer to the roots of the same tradition is the basic opinion or sentiment that finds in biological warfare a focus of violent distaste. The implied judgment is not objective or quantitative; it seems to me rather that BW somehow suggests in unmitigated form all those characteristics of war that people find hateful: that BW is a sort of type species of abhorrence.

That biological warfare is in fact regarded with distinctively virulent aversion is a matter not easily documented; but a sampling may suggest it. I think the feeling is common in the comparatively mute general public, whom I cannot cite; but it has been shared and expressed by articulate persons whose responsibility and general rationality seem to meet ordinary standards. As early as 1932, the Special Committee of the Preparatory Com-

mission in the League of Nations called bacterial warfare "so particularly odious that it revolted the conscience of humanity more than any other form of warfare" [League of Nations (f)]. When Mr. James F. Byrnes was U.S. Secretary of State, on November 16, 1945, he declared that "bacteriological warfare [is] an even more frightful method of human destruction" than the atomic bomb.¹⁹ The Fourth International Congress of Microbiology, in 1947, called BW "barbaric" and "absolutely unworthy of any civilized community" (Rosebury, 1949); and Niels Bohr, in 1950, expressed an opinion that I think may be fairly typical when he spoke of biological weapons as "terrifying." A similar view seems to be implicit in some of the statements of several American military leaders, among them James Forrestal, when he was Secretary of Defense,²⁰ and recently, retired Brig. Gen. J. H. Rothschild,^{21,10} in that their attempts to reassure the public that BW is not so horrible as they thought presupposes the thought.

An attitude toward BW in Communist countries, if I am able to assess it correctly, seems a little different but not opposed. It is expressed in the record of the Khabarovsk trial by the repetition of such words as "criminal," "inhuman," and "brutal": but there is no implied comparison with other forms of warfare. In another statement,²² in which the United States is accused of "war crimes in Korea," the terms used are "a most grave and horrible crime," "inhuman," and "a new degree of savagery"—the last phrase presumably implying that BW is more "savagery" than the atomic bombings of Japan in 1945. In the ISC Report on Korea,⁸ on the other hand, such phraseology is absent. Yet implicit in that document, and possibly also in the violence of the reaction to these charges in the United States, is this idea of extreme abhorrence, which does not seem to attach in a comparable way to any other weapon, including napalm and nuclear weapons. The use in war of both these latter has of course been freely admitted.

This feeling of horror or extreme aversion with which biological warfare is commonly regarded may have a consequence that has not been explicitly considered to my knowledge. The assumption is often made that part of the military effectiveness of such weapons would depend on terror and a demoralization resulting from terror, not directly (in contrast to the expected effects of such chemical warfare agents as LSD), but rather indirectly, associated with the occurrence of strange phenomena of disease, not amenable to the customary means of detection or control. The reasoning behind this presupposition may depend in part on analogy with great natural epidemics of history, particularly those of plague as they

¹⁹ N.Y. Times, Nov. 17, 1945.

²⁰ N.Y. Times, Mar. 13, 1949.

²¹ Harper's Magazine, June 1959, p. 29.

²² Report on War Crimes in Korea, Commission of International Association of Democratic Lawyers, Peking, Mar. 31, 1952.

CONCLUSION

It is most auspicious that an international group of qualified scientists has finally been brought together to consider the problem of biological warfare and what to do about it. Such an undertaking is approached by first attempting to delineate and assess the problem, and my remarks are offered as a first step in such a process. But it is safe to predict that the technical approach, although indispensable at the outset, will not be enough. Even with nuclear weapons, for which technical information is much more extensive and available, and of which the issues to the scientist are clear with hardly any argument, the methods of science and technology alone have been no more effective in solving the problem of world security than the methods of politics alone. The problem of biological weapons seems sure to be even more refractory if approached in the same way. Let me close, therefore, by urging that we go back to a first principle as it was put forward on June 23, 1946, by Albert Einstein: *Science has brought forth this danger, but the real problem is in the minds and hearts of men.*

APPENDIX

OTHER DECLARATIONS ON BW

were described by Boccaccio and Defoe. Behind the argument may lurk an assumption that the attacked population would be ignorant and undisciplined. I suggest that the whole idea may be an error. It seems to me possible that if the use of biological weapons were to inspire aversion or hatred rather than terror, its effect might be to strengthen morale rather than to destroy it. Assuming that an attack, of which BW was strongly suspected to be a part, did not bring total devastation in its train, then the effect of a weapon considered particularly loathsome might be to arouse the attacked population so that they would gather up all their remaining strength and mobilize every latent resource to resist the attackers. I suggest as a possibility, then, that if the effects of biological warfare could ever be objectively known, such weapons might turn out, from the strictly military point of view, to be useless or less than useless. The results of the Nazi bombings of England have been thought of in this way; and according to Blackett (1948), the strategic bombings of Germany during the Second World War failed to accomplish their purpose presumably for just such reasons.

IN ADDITION to the resolution of the Fourth International Congress of Microbiology noted in the text, another was approved during the same month (July 1947) by the International Cytological Congress, meeting in Stockholm, which stated that:

“... we as biologists are especially concerned with the prevention of all warfare, and in particular with biological warfare”

and undertook to

“set up a committee to offer technical advice and assistance to the United Nations Organization . . . and [to] invite the International Association of Microbiologists to form a joint committee with us for this purpose.”²³

It is doubtful that such a committee ever came into being: unsuccessful attempts were made by the staff of the U.N. Secretariat in 1950, while I was working there, to obtain information about it.

The General Assembly of the World Medical Association adopted a statement in September 1948, in the course of which, after mention of the charges, including those of BW, made by the International Military Tribunal at Nu-

remberg and by the Soviet Extraordinary Commission (as mentioned in the text), as well as allegations from other sources, the following paragraph appears:

“Having considered this evidence and the statements made to the General Assembly by medical representatives of countries which had been occupied by the Germans and by doctors who had personally experienced German brutality, the World Medical Association endorses the judicial action taken to punish those members of the medical profession who shared in the crimes, and it solemnly condemns the crimes and inhumanity committed by doctors in Germany and elsewhere against human beings, both during the Second World War and in the years preceding that war.”²⁴

In April 1952 a Belgian journal of military medicine published three consecutive papers (Constant et al., 1952) reporting on a meeting of military doctors held at Vichy in 1951 and on the initial results of a questionnaire that had been authorized at that meeting. The series was presented under the general title, “The Limits of the Medical Role in Biological Warfare.” The meeting, at which delegates were pres-

ent from 14 small countries, principally of Europe, was concerned about problems of professional ethics in relation to BW, and “anxious not to be the war criminals of tomorrow.” The delegates voted to authorize an international inquiry as a step toward codification of medical practices in relation to war, and especially to biological warfare. The questionnaire, drawn up accordingly, elicited responses from 16 countries. The questions dealt with (1) the role of physicians in research on so-called ABC (atomic-biological-chemical) warfare; (2) the propriety of publishing such research; (3) the responsibility of medical authorities for the work of their subordinates in such research; (4) the responsibility of military medical personnel to their non-medical superiors in such research; and (5) the physician's recourse if he should refuse to follow orders in the preceding category. The replies were far from unanimous or in any way decisive. Research was held generally to be permissible with restrictions on the use of human beings as subjects (a matter more recently reviewed, apart from BW, by Beecher, 1959). There was no resolution of the matter of publication. Physicians were held to be fully responsible for the acts of subordinates; but complete confusion reigned in the next area of their responsibility under orders from above;

²³ See W. L. Lawrence, *N.Y. Times*, July 27, 1947.

²⁴ *World Med. Assoc. Bull.* 1949, 1, p. 4.

nor was there any agreement on the final question of appeal.

The Eighth General Assembly of the World Medical Association, held in Rome in the fall of 1954, heard an address by Pope Pius XII in which the Pope "re-echoed an appeal for the effective proscription of what he called 'ABC' warfare which was contained in his Easter message" and went on to speak of the role of physicians in such warfare in terms difficult to quote briefly. Their tenor is suggested by the following excerpts from a report of his address:²⁵

"... one prefers not to see the doctor occupied with a task of this sort. It is in too great a contrast to his basic duty; to give aid and cure, not to do injury or kill. . . ."

On an earlier occasion the Pope had said:

"... may the doctor put his knowledge and activity at the service of ABC warfare? 'Injustice' he can never support, even in the service of his own country, and when that type of war constitutes an injustice, the doctor may not take part in it."

²⁵ *World Med. Journ.* 1955, 2, p. 111.

The following newspaper story, relating to the same WMA meeting, is quoted in full:²⁶

"Rome, Sept. 30 (AP)—The World Medical Association approved today a resolution condemning bacteriological warfare.

"A U.S. amendment provided that any limitation must be equally applicable to all countries. The amendment, as approved, also eliminated from the resolution a clause 'prohibiting physicians from taking any part in bacteriological research aimed at the preparation of germ weapons.'

"The action was unanimous by doctors representing the association's fifty-two nations—all of them outside the Iron Curtain. The proposal was made by Dr. Augusto Fernandez Conde of Cuba. It proposed that the medical association reject any use of bacteriological arms, prohibit doctors from helping develop such forms of warfare, and call for the formation of a commission to help outlaw germ warfare."

²⁶ *N.Y. Times*, Oct. 2, 1955.

²⁷ 1955, 2, p. 12.

I could find no mention of this resolution in the account of the Rome meeting in the *World Medical Journal*²⁷ or the *Journal of the American Medical Association*.²⁸

On May 28, 1954, the Board of Governors of the International Red Cross, meeting at Oslo, "adopted a resolution . . . calling for a ban on nuclear, chemical, and bacterial warfare," without opposition but with four Communist nations not voting.²⁹ Among the "Rules limiting the risks run by the civil population in times of war" adopted by the 19th International Conference of the Red Cross at New Delhi in the autumn of 1957, Article 14 "forbids, without prejudice to existing or future prohibitions of specific weapons, the use of weapons whose injurious effects—in particular those brought about by the spreading of incendiary, chemical, bacteriological, radioactive, or other agents—could spread in an unforeseeable manner or escape, in space or in time, the control of those using them and would thus endanger the civilian population" (Vitanyi, 1958).

²⁸ 1955, 156, pp. 1256, 1602, 1925.

²⁹ *N.Y. Times*, May 29, 1954.

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