# Biological Warfare and the Extinction of Man

*A Nobel Prize-winning geneticist calls a ban of biological weapons only a first step in measures needed to assure man's life and health on earth.*

by JOSHUA LEDERBERG, Ph.D.

AS A SCIENTIST I am profoundly concerned about the continued involvement of the United States and other nations in the development of biological warfare. This process puts the very future of human life on earth in serious peril.

It is all the more tragic because the great powers who should be hastening to institute international controls have very little to gain and much to lose in relation to the present balance of nuclear deterrence. Except for incidental contagion, chemical warfare presents many similar issues; but I cannot speak to them with the same immediacy of personal expert knowledge.

Our ratification of the Geneva Protocol would represent only the first small step toward the negotiation of international controls. However, so long as we have isolated ourselves as the only major power to refuse to enter into its commitment, this stands as an immediate distraction to further negotiation. It leaves on the record a very low and unconvincing reading, indeed, about our earnestness as a nation in seeking a world order for the management of this problem.

My own research career has centered on the genetics of bacteria. With Dr. E. L. Tatum, then at Yale, I had the thrill of discovering genetic recombination in bacteria. Later at the University of Wisconsin with my then graduate student Norton Zinder (like E. L. Tatum now a professor at Rockefeller University) I was again privileged to help unearth genetic transduction (the use of viruses to convey information from cell to cell). I have also studied bacterial mutation, for example, to resistance against the action of antibiotic drugs, in work that complemented the pioneering studies of Drs. S. E. Luria and Max Delbrueck (named for the 1969 Nobel prize in medicine).

Basic scientists who have worked in the genetics of bacteria and viruses believe that these discoveries have ever growing importance for the prevention and healing of serious human diseases. We live, in the present era, in an incompletely justified optimism about having "conquered infectious bacterial disease" as the fruit of the development of the antibiotics. However, viruses are in general still beyond the reach of antibiotic therapy. Even bacteria, believed to be under firm control with antibiotics, are continuing their own evolution and continue their assaults upon human health with renewed vigor. In the long run, only our continued vigilance over bacterial evolution can justify our hope of maintaining a decisive lead in this life and death race.

However, whatever pride I might wish to take in the eventual human benefits that may arise from my own research is turned into ashes by the application of this kind of scientific insight for the engineering of biological warfare agents. In this respect we are in somewhat the same position as the nuclear physicist who foresaw the development of atomic weapons, with one crucial difference. Nuclear weaponry depends on the most advanced industrial technology. It has then been monopolized by the great powers long enough to sustain a de facto balance of deterrence and to build a security system based on non-proliferation. Nuclear power has thus, ironically, become a stabilizing factor tending to reinforce the status quo in parallel with established levels of economic and industrial development. Germ power will work just the other way.

The United Nations Study Report on chemical and biological weaponry has summarized some infectious agents that have served as points of departure for the development of biological weapons. Any knowledgeable virologist could suggest many more. I will not repeat these technical details, nor will I bludgeon you with the horrible diseases that some of these agents provoke. I will also leave to your own conscience the burden of moral judgments about using these kinds of weapons. Most Americans would be repelled by the thought, but perhaps no less by exposure to the human realities of any other form of warfare. Overriding such comparisons should be the grave moral issue in a policy that risks the lives of a world of innocent bystanders. Fortunately, these concerns actually converge with our self-interest in calling for a halt to bacterial warfare before it becomes established in the arms-traffic of the world.

MY MAIN FEARS ABOUT BW have to do with the side-effects of its proliferation 1) as a technique of aggression by smaller nations and insurgent groups



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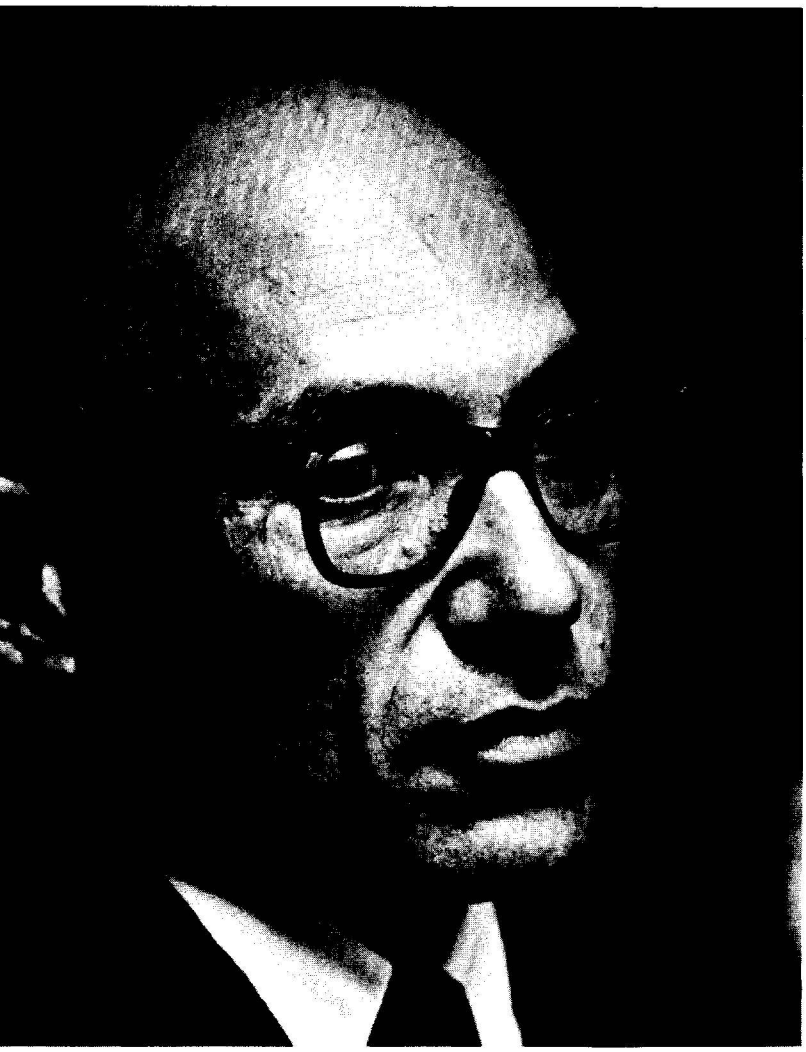

JOSHUA LEDERBERG, *a Nobel Prize winner, is Joseph D. Grant professor of genetics and biology, and chairman of the Department of Genetics of the Stanford University School of Medicine. Dr. Lederberg also writes a syndicated column titled "Science and Man" in the* Washington Post, *and several other newspapers in the U.S. and abroad. Dr. Lederberg's article was written just before President Nixon's announcement pledging not to make use of bacteriological weapons. It was presented December 2 before the Subcommittee on National Security Policy and Scientific Development of the House Committee on Foreign Affairs. "I am confident," Dr. Lederberg said after the President's announcement, "that the Senate will now promptly ratify the Geneva Protocol as a basis for the further measures needed to assure man's life and health on this planet."*

and 2) by the inadvertent spread of disease. If the great powers could actually protect the secrecy of their bacterial warfare work, I would be much less alarmed. The chance of BW ever being used in a major strategic attack is essentially negligible in the face of the nuclear deterrent. The suggestion that we need BW or CW weapons for specific retaliatory purposes in order to deter their use aims at a ridiculous kind of precision. Will our deterrent missiles have to follow the same trajectories as those that might potentially attack us? Will they have to be launched at the same time of day? Will they have to have the same mix of explosive energy and radioactive fallout? If we are attacked with anthrax strain B27, must we reply with anthrax B27?

On the other hand, if I were a Machiavellian adviser to a would-be Hitler, I might indeed advocate a considerable investment in biological weaponry as a desperate approach to the cheap acquisition of great power even if at a very great risk. And, of course, the first thing I would do would be to plant my intelligence agents in the existing bacterial warfare establishments of the high-budget powers in order to get the necessary scientific information at the lowest possible cost.

However, if I were patient I would not bother to do even that. No security system, no counter-intelligence system in the world, expects more than a delay of 5 to 10 years in the leakage of vital information. We do not have, and I presume do not contemplate, a security reservation like wartime Los Alamos for the containment of BW research. If a high level activity is to be maintained, there will be frequent turnover of personnel. It is unreasonable to expect a tighter security barrier here than has prevailed in any other area, given the problems of reconciling security with a free society. Besides these channels for diffusion of information, there are also bound to be Pueblo-like incidents, and finally calculated leaks in the budget competition of the services. The American people might be the last to know. But we can hardly rely on more than a 10-year delay between many important discoveries in BW research laboratories and their availability to hostile and irresponsible forces outside.

As a matter of prudent self-protection, bacterial warfare research laboratories in the U.S. and the U.K. have pioneered in the technology of containing dangerous microbes. I have great respect for the technical capabilities of the senior civilian management of these laboratories. They should be credited with the utmost diligence in protecting both their personnel and the surrounding community. They have also published a great deal of their work in the engineering of such protective facilities and this experience is unquestionably of great value in public health work. For example, the British laboratories, at Porton, were acclaimed for the safe handling of the very dangerous Marburg virus upon its first outbreak in Europe two years ago.

In spite of these precautions, disease organisms have nevertheless escaped from time to time and inevitably will do so in the future. Such escapes already constitute a breach of security. They also compromise public health, which is further complicated by keeping civilian physicians in ignorance of potential agents that might fulminate into large scale epidemics. The intentional development of virulent strains resistant to conventional antibiotics obviously worsens the problem. We simply have no way of assuring ourselves that a bacterial warfare development activity will not eventually seed a catastrophic world-wide epidemic that ignores national boundaries.

On the immediate horizon are modern developments in molecular genetics. These undoubtedly point to the development of agents against which no reasonable defense can be mounted. Because of the uncertain danger of retroaction, such agents are hardly likely to be used in consequence of any rational military decision, but would obviously play into the hands of aggressive insurgents and blackmail. Finally, even the publication, albeit as a positive contribution to humanity, of the technology of safe containment insidiously helps solve a problem that might have hindered a potential insurgent from dabbling in bacterial warfare.

The problem of containing infectious agents being manufactured and stockpiled in large quantities, or tested in the open air, is a much more difficult technological challenge; and it is encumbered with even more official secrecy than the laboratory work. We have little better information than the Skull Valley incident to help judge the competence with which such matters are handled. The main effect of security has not been to deny information to an enemy but to protect an establishment from both destructive and constructive criticism at home. In this case, more open constructive criticism would be crucial for assurance that procedures for containing microbes are well conceived and correctly implemented.

BACTERIAL WARFARE AGENTS for use against man can be expected to be far more capricious than any other form of weapon. For any strategic purpose they are essentially untestable since large populations would have to be held to an uncertain risk. With nuclear weapons we can at least be confident of the laws of scaling. The destruction of targets can be calculated from simple physical measures like the energy released. Nothing comparable to this can possibly apply to bacterial warfare agents. For this reason again the United States and other nuclear powers have absolutely nothing to lose in disavowing their use in war. Our continued participation in BW development is akin to our arranging to make hydrogen bombs available at the supermarket.

Microbiological research must be expanded in programs of public health research for defense against our natural enemies. In fact, the public health bureaucracy has refused to give prudent thought to the recurrence of major pandemics of human disease, be they of spontaneous or human-intelligent origin. Perhaps this is simply a consequence of their sense of futility about mobilizing the necessary measures of global health needed to protect the species. If we add to the already urgent concerns, the spread of dangerous diseases from large foci of infection established by BW attack, the prospects become even gloomier.

Our self-interest both as Americans and human beings urgently calls for the institution of improved measures of world public health and of international controls on the development and use of bacterial warfare agents. Research related to the BW perhaps should continue; but it is of the first importance that this be fear-reducing rather than fear-generating, for the latter can only lead to mutual escalation of anti-human developments.

It is difficult at this stage to detail the texture of new agreements subsequent to our ratification of the Geneva Protocol. We cannot suddenly impose unilateral decisions on the international community; but no other issue can evoke such a unanimity of world opinion. New agreements probably should include:

- public legal commitments against secret bacterial warfare research.
- the establishment of central, international laboratories to monitor the occurrence of threatening organisms and to help develop generally available means of protection against them.
- a legal system to protect the freedom of information and communication of data on disease organisms to such central authorities.
- a general acceleration of research and health services to minimize the incidence of infectious disease, particularly in underdeveloped countries. No situation could be better designed for the evolution of serious new viruses than the existence of crowded, underfed human populations in which foci could develop and spread with a minimum of medical control.
- treaty commitments on bacterial warfare analogous to the nuclear non-proliferation treaty.
- pre-agreed sanctions by the civilized world against the release or development of BW agents, clearly invoking international law against such "offenses against mankind" as akin to war crimes.

Some of the expectations that I have outlined are speculations which I fervently hope will be proven false. Unfortunately, they already have a proven historical precedent. As many of you may already know, the Black Death—the epidemic of the Bubonic Plague in Europe between 1346 and 1350—was the immediate consequence of a primitive form of bacteriological warfare. Genoese colonists in the Crimea brought the plague back to Italy with them when they retreated from the fortress of Fyodosia after having been assaulted with the corpses from the attacking Tartar hordes who had been infested with the disease. This epidemic subsided only after killing approximately one-third of the population in Europe as well, presumably, as an equal toll in Asia and India. Unless we learn to apply our common energies against the common enemies of all mankind, we are foolish and arrogant to doubt that history will record "Black Death II," and more.