Weeks 9 & 10: Biological Warfare

Bacterial pathogens are bad; intentionally developed and released artificial ones could be worse. Most Americans today have heard about the *threat* of bioterrorism. What few Americans know about is the *actual* history of biological warfare (BW). Through most of the 20th century, nations were attempting to develop effective BW agents almost as aggressively as they had developed nuclear weapons. The most notorious BW program was run by the Japanese in the 1930's after they invaded China. A wide range of microbial pathogens were studied on human prisoners, and other pathogens were released on entire Chinese cities in field tests of BW weapons. The reprehensible crimes against humanity committed by "Unit 731" in Manchuria match or exceed those of the Nazi "doctors"; yet, while you may know the name Dr. Josef Mengele, you likely have never heard of Dr. Shiro Ishii. In a shameful example of Cold War calculation, the victorious Americans did not bring the responsible Japanese to justice (no Nuremberg-style war crimes trial, though some captured Japanese war criminals were tried by the Soviets). On the contrary, the events at Pingfan were intentionally hushed up (even the fact that American POWs had been experimented upon!) in exchange for information from the Japanese "doctors" in order to get a head start on *our* BW program—ahead of the Soviets.

Below you will find excerpts from a variety of online sources piecing together a very short story of Unit 731, of the U.S. offensive BW program and its termination in the 1970's, and the Sverdlovsk incident in 1979 when an accident at a Soviet BW facility released airborne anthrax over a city, killing hundreds (*after* the USSR had signed the global Biological Weapons Convention renouncing the development of offensive BW).

For further reading: The preeminent book on Japan's Unit 731 was written by a (deceased) CSU professor, Sheldon Harris, titled Factories of Death. I HIGHLY RECOMMEND: Anthrax: Investigation of a Deadly Outbreak by J. Guillemin, which tells the scientific detective story of the Western epidemiologists who were allowed to study the 1979 Sverdlovsk outbreak (in 1992, after the collapse of the Soviet state).

Source: http://www.fas.org/nuke/guide/japan/bw/

Japanese Biological Weapons Program

Between 1932 and 1945 Japan experiments included testing biological weapons on humans, and attacked 11 Chinese cities with biological weapons. The Japanese, as the US learned at the end of World War II, had been making significant progress learning about traditional biological warfare agents like botulism and anthrax. The US Army sent several investigators to Japan after the war to interrogate captured Japanese scientists. Leading the team was Dr. Norbert Fell and Lt. Col. Arvo Thompson. Working with Gen. Douglas MacArthur's intelligence team at Supreme Commander Allied Powers (SCAP), Dr. Fell and Thompson learned the full extent of the Japanese program headed by Lt. Gen. Shiro Ishii.

From 1938-1945 Ishii carried on experiments against POW's, including US forces at the Mukden POW Camp in northeast China. He directed Unit 731, the secret Japanese unit engaged in human experimentation. Ishii was initially given command of the "Togo Unit" of 300 men, which rapidly grew and acquired additional "cover" identities. Open air testing on prisoners was conducted at the officially named "Water Purification Unit 731" at Pingfan near Harbin, a remote, desolate area on the Manchurian Peninsula. Pingfan's 6 square kilometers housed more than 150 buildings, including administrative buildings, laboratories, workers dormitories, and barracks. By 1945, the Japanese program had stockpiled 400 kilograms of anthrax to be used in a specially designed fragmentation bomb. Studies continued there until 1945, when the Unit 731 complex was leveled by burning it (at Ishii's command).

Slightly less than **1,000 human autopsies apparently were carried out at Unit 731, most on victims exposed to aerosolized anthrax.** Many more prisoners and Chinese nationals may have died in this facility - some have estimated up to 3,000 human deaths. In 1940, a bubonic plague epidemic in China and Manchuria followed reported overflights by Japanese planes dropping plague-infected fleas (and grain to attract local rats to act as carriers). **The Japanese attacked hundreds of heavily populated communities and remote regions with germ bombs.** There appears to have been a massive germ war campaign in Yunnan Province bordering Burma. Planes dropped plague-infected fleas over Ningbo in eastern China and over Changde in north-central China, Japanese troops also dropped cholera and typhoid cultures in wells and ponds. In all, tens of thousands, and perhaps as many 200,000, Chinese died of bubonic plague, cholera, anthrax and other diseases.

The Imperial Japanese Army was attempting to produce biological weapons that could be transported by balloon to the United States. (The Khabarovsk trials also revealed plans to use germ warfare in Russia, but the Soviet Union did not join the Pacific War until after the atomic bomb was dropped in August 1945.) **Japan succeeded in lofting hundreds of incendiary balloons, swept eastward by the jet stream to the U.S. West Coast**. These killed seven people, ignited forest fires and crashed in Medford, Oregon, and Billings, Montana. But the logistics of sending infected rats or fleas across the Pacific apparently proved overwhelming. Late in the war, the Japanese devised Operation Cherry Blossoms at Night, a plan to send

kamikaze pilots to bomb San Diego with plague-infected fleas. But with the U.S.' atomic attacks on Hiroshima and Nagasaki, the plan was never carried out.

Most of the Unit 731 war criminals went on to respectable careers in Japan. Lt.-Col. Ryoichi Naito, a military physician, became the founder of the Japan Blood Bank, the predecessor of Green Cross. Gen. Ishii Shiro (who had escaped the Soviet forces and was never tried) lived in peace until his death from throat cancer in 1959.

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http://www.gulfwarvets.com/biowar.htm **1979 Sverdlovsk anthrax outbreak**

In late April, 1979, the city of Sverdlovsk {in western Russia} experienced a loud explosion that was identified as originating from Military Compound 19. Several days later, residents downwind from this compound developed high fever and difficult breathing. Over the next several days, more cases were reported and fatalities rose sharply to around 40. Autopsies revealed severe pulmonary edema in addition to symptoms of serious toxemia. Local doctors announced an outbreak of pulmonary anthrax. On the other hand, government officials reported that the outbreak was caused by the illegal sale of contaminated meat from a cow suffering from the disease. **Case fatalities did not display the symptoms of the usual gastric or skin anthrax, which would be more likely if contaminated beef had been handled or eaten**. A nine story hospital was taken over by the military to handle exclusively the victims of the explosion. Vaccination and antibiotics were provided to patients and residents alike. The final death toll was estimated between 200 and 1,000. The victims were buried with special sanitary precautions, and relatives were not allowed to attend the funerals. Some western scientists accepted the explanation provided by the Soviet Ministry of Health. The Sverdlovsk incident remained unproven; yet all evidence available to the U.S. Government indicated that a massive accident had occurred at a BW production facility. Believers and non-believers of the Soviet explanation remained in a status quo situation until President Boris Yeltsin acknowledged in a press conference, prior to meeting with President Bush in the summer of 1992, Washington, D.C., that the Sverdlovsk incident was in fact a massive BW accident involving an aerosol of anthrax spores.

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http://www.nybooks.com/articles/14971

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Bioterror: What Can Be Done?

By Matthew Meselson

Germs: Biological Weapons and America's Secret War
by Judith Miller, Steven Engelberg, and William Broad Simon and Schuster, 382 pp., $27.00

Virtually every major technology has been exploited not only for peaceful purposes but also for hostile ones. Must this also happen with biotechnology, which is rapidly becoming a dominant technology of our age? This is a question that comes to mind when reading *Germs: Biological Weapons and America's Secret War*, a clear and informative account of biological weapons here and abroad by the *New York Times* reporters Judith Miller, Steven Engelberg, and William Broad.

Germs begins by describing the deliberate contamination in 1984 of salad bars in the small town of The Dalles, Oregon, with *Salmonella typhimurium*, a common bacterium that attacks the stomach lining and causes cramps and diarrhea. The bacteria were spread by members of a religious cult, who were apparently testing a plan to gain control of local government by keeping other citizens from voting in a coming election. Although they caused no deaths, their criminal actions caused sickness in some 750 people and illustrated a community's vulnerability to even a relatively minor biological attack. A year passed before federal and state investigators established that the outbreak was not natural, and they were able to do so only because the cult leader himself called for a government investigation. The leader's personal secretary and the cult's medical care supervisor were sentenced to the maximum prison penalty of twenty years; they served less than four years and then left the country. Federal law enacted in 1994 raised the maximum penalty for such nonlethal biocrimes to life.

Americans have now experienced a far more sinister form of biological attack: seventeen cases of inhalation and cutaneous anthrax with four people dead and the person or persons responsible still at large. Yet the scale of the recent anthrax attacks was minuscule in comparison with the scale of preparations for continent-wide biological warfare conducted by major countries—notably the United States before **President Richard Nixon categorically renounced biological weapons in 1969**, and the Soviet Union, which even expanded its program after it was made illegal by the Biological Weapons Convention in 1975.

The advent of industrial-scale microbiology and therefore of industrial-scale biological weaponry was made possible by the proof of the germ theory of disease and the development of methods for growing pure bacterial cultures in the nineteenth century. These are accomplishments for which Robert Koch and Louis Pasteur are celebrated and which underpin the studies of tuberculosis for which Koch was awarded the 1905 Nobel Prize in Medicine. It was Koch who in 1876 described with great clarity the life cycle of the bacterium *Bacillus anthracis* and completed the proof that it causes the disease that is known in German as *Milzbrand* (fiery spleen), in French as *charbon* (because of the blackened scab it makes on the skin), in Russian as *Siberskaya yasva* (Siberian ulcer), and in English as anthrax (from the Greek for coal).

Anthrax is primarily an affliction of grazing animals. When multiplying in an infected animal, the bacteria are rod-shaped. But anthrax bacteria from the dead or dying animal, upon exposure to oxygen, form within themselves a tough-shelled ovoid spore that can remain dormant and infectious in the environment for years. The disease took a heavy toll among herds in Europe, Asia, and Australia until the introduction of effective veterinary vaccines, first one developed by Pasteur and then a safer and more effective vaccine developed in the 1930s by Max Sterne, a South African veterinary microbiologist. Sporadic natural outbreaks continue to occur throughout the world and have caused animal deaths and nonfatal human cutaneous cases in Minnesota, the Dakotas, and Texas this year.

The disease in human beings takes three principal forms, depending on what part of the body the spores enter and therefore on how the body responds. Most common and most easily curable with penicillin and other antibiotics is the cutaneous form, observed among people who come into contact with contaminated hides, hair, or bonemeal or who butcher infected animals. The gastrointestinal form, contracted by eating contaminated meat, is not uncommon in some poor countries and has not been much studied. Highly fatal in some outbreaks, it is less so in others. **The inhalational form**, mainly associated with occupational exposure to contaminated hides or animal hair, **is usually fatal** unless treated with antibiotics before or immediately after symptoms develop. It is this form of anthrax that has attracted the attention of those who seek to make biological weapons and those concerned to defend against them. **Anthrax spores can be dispersed by bombs**, aircraft spray tanks, or missiles as an aerosol sufficiently fine to remain suspended in the air and, if inhaled, to reach the depths of the lungs. Such weapons may be capable of rivaling nuclear ones in their power to kill people over large areas.

Crude anthrax bombs were produced by **Unit 731 of the Japanese Imperial Army, which attacked villages in Manchuria with anthrax, plague, and typhoid during the Sino-Japanese war in the 1930s and 1940s. Under its creator and leader, General Shiro Ishii, the unit conducted vivisection and other lethal experiments on humans. After the Japanese surrender, he and several of his associates were granted immunity from war crimes trials by American officials in exchange for data from the Japanese biological weapons program.**

The US biological weapons program, as the authors of *Germs* write, began in 1942, first directed by George W. Merck, then president of the chemical and pharmaceutical company founded by his father. Research, development, and pilot-scale production of biological weapons were conducted at Camp (subsequently Fort) Detrick, in Maryland. By the end of the war it had some 250 buildings and employed approximately 3,500 people, engaged in both offensive and defensive work. **Large-scale production of anthrax spores and of botulinum toxin was planned to take place** in a plant at Vigo, Indiana, near Terre Haute, built in 1944. The plant was equipped with twelve 20,000-gallon fermentors for culturing bacteria and with production lines for filling bombs. Its production capacity was estimated to be 1,000,000 to 1,500,000 British-designed four-pound anthrax bombs per month, requiring some 320 to 480 tons of a concentrated liquid suspension of anthrax spores. As noted in Brian Balmer's deeply researched examination of British biological-warfare policy-making,[1] Winston Churchill, in placing an initial order with the US for 500,000 anthrax bombs in March 1944, wrote that it should be regarded only as a first installment. Although the Vigo plant was ready to begin weapons production by the summer of 1945, the war ended without its having done so.

In 1947, the Indiana plant was demilitarized and leased and subsequently sold to Charles Pfizer and Company for the production of animal feed and veterinary antibiotics. It was replaced by a more modern biological weapons production facility constructed at Pine Bluff Arsenal, in Arkansas, which began production late in 1954 and operated until 1969.

A sizable effort of the 1950s, discussed in *Germs*, was the development and testing of anthrax bombs for possible attack on Soviet cities. The weapons to be used were cluster bombs holding 536 biological bomblets, each containing a liquid suspension

of anthrax spores and an explosive charge fused to detonate upon impact with the ground, thereby producing an infectious aerosol to be inhaled by persons downwind. In order to determine the area effectively covered by the aerosol from a single bomblet and therefore the number of bombs required, **173 releases of noninfectious aerosols were secretly conducted in Minneapolis, St. Louis, and Winnipeg** —cities chosen to have the approximate range of conditions of urban and industrial development, climate, and topography that would be encountered in the major cities of the USSR.

A problem with this project, which had the code name St. Jo, was uncertainty about the average number of inhaled spores needed to give a high probability of killing. Experiments at Fort Detrick involving 1,236 monkeys indicated that the ID50, the dose that would infect half the monkeys inhaling it, was 4,100 spores. Other experiments, carried out under different conditions, gave monkey ID50 values ranging from 2,500 to 45,000 spores. The army estimated that the ID50 for people might be between 8,000 and 10,000 spores, with lower doses expected to cause a correspondingly lower percentage of infections. But even leaving aside the variable results with monkeys, one could not know for sure if data derived from experiments with monkeys were at all applicable to people.

Inability to establish reliable munitions requirements **and the possibility of creating long-lasting contamination eventually led the US Air Force to abandon plans to use anthrax as a lethal biological agent. It was replaced by *Francisella tularensis*, the bacterium that causes tularemia**, a disease that inflames the lymph nodes and causes lesions in many organs of the body and can be fatal. Inhalatory tularemia can be dependably cured by prompt administration of antibiotics, and this made it **possible to measure its infectiousness in human volunteers**—Seventh-Day Adventist conscientious objectors in the 1950s. Inhalation of approximately twenty-five bacteria was found to be sufficient to give a 50 percent chance of infection. Untreated, the death rate of inhalational tularemia was thought to be up to 60 percent, depending on the strain employed.

Other agents were introduced into the **US biological arsenal**, including the bacteria of brucellosis and Q-fever and the virus of Venezuelan equine encephalomyelitis—all three of them incapacitating but much less often lethal than anthrax or tularemia—**as well as fungi for the destruction of wheat and rice crops**. The US arsenal also contained improved biological bombs for high-altitude delivery by strategic bombers and spray tanks for dissemination of biological agents by low-flying aircraft. These developments culminated in a major series of field tests of biological weapons using various animals as targets and conducted at sea in the South Pacific in 1968.

Soon after becoming president in 1969, Richard Nixon ordered a comprehensive review of US biological and chemical weapons programs and policies, the first full study of the biological warfare program in more than fifteen years. Each relevant department and agency was instructed to evaluate several matters: the threat of biological weapons to the US and ways of meeting it; the utility of the weapons to the US; and issues raised by the possible distinction between weapons intended to be lethal and those meant only to incapacitate.

Six months later, **on November 25, 1969, with the full support of the Departments of Defense and State, the President issued National Security Decision Memorandum 35, declaring that the United States would renounce all methods of biological warfare and that US biological programs would be confined to research and development for defensive purposes**. In doing so he said that "mankind already carries in its hands too many of the seeds of its own destruction." Three months later, after further interagency review, he similarly renounced the use of toxins (poisonous substances from living organisms), whether produced biologically or by chemical synthesis.

The US biological and toxin weapons stockpiles were destroyed and the facilities for developing and producing them were ordered dismantled or converted to peaceful uses. US biological stocks at the time were not very extensive, amounting to some 10,000 gallons of liquid incapacitating agents (the pathogens of Q-fever and Vene-zuelan equine encephalomyelitis), half a ton of dried lethal agents (anthrax and tularemia), some eighty tons of anti-wheat and anti-rice fungi, and about 100,000 munitions filled with various agents and simulated agents. Pine Bluff maintained a large standby production capacity for bacterial and viral antipersonnel agents, and a factory in Colorado was capable of supplying anti-crop fungi; there had, therefore, been no need to maintain large stocks.

Nixon announced support for a treaty proposed by the United Kingdom prohibiting the development, production, and possession of biological weapons, leading to the Biological Weapons Convention (BWC) of 1972.

These initiatives went far beyond the mere cancellation of a program. The US had categorically renounced the option to have biological and toxin weapons, whether intended to be lethal or only incapacitating. What was the underlying logic? First, it had become evident from the results of the US and British biological weapons programs that biological weapons, although subject

to substantial operational uncertainties, could kill people, livestock, and crops over large areas. Second, **US officials realized that the American biological weapons program was pioneering and legitimizing a technology that, once brought into existence, could be duplicated by others with relative ease, enabling a large number of states to acquire the ability to threaten or carry out destruction on a scale that could otherwise be matched by only a few major powers**. The US offensive program therefore risked creating additional threats to the nation with no compensating benefit and would undermine prospects for combating the proliferation of biological weapons. If the US offensive biological program had continued to the present day, legitimating the weapons and advancing the technology for making them, how much greater would the threat now be and how much less would be the prospect of containing or averting it?

While the United States renounced biological weapons and abided by the Biological Weapons Convention, **the Soviet Union secretly continued and intensified its preparations to be able to employ biological weapons on a vast scale**. An example described at length in *Germs* was the standby facility built in the early 1980s for the production of anthrax bombs at Stepnogorsk, in what is now the independent republic of Kazakhstan. Subsequently dismantled in cooperation with Kazakhstan under the US Defense Department's Cooperative Threat Reduction Program, it was equipped with ten 20,000-liter fermentors, apparatus for large-scale drying and milling of the spores to a fine powder, machines for putting it into bombs, and underground facilities for storage of filled munitions.

The first director of the Stepnogorsk facility, Kanatjan Alibekov, defected to the US in 1992 at the age of forty-two and simplified his name to Ken Alibek. In his account of the Soviet biological weapons program,[2] he describes the atmosphere of fear in which it flourished. Incorrectly believing that the US renunciation was a hoax and citing "the biggest American arms buildup our generation had seen," he found it easy to believe that the West would seize upon their moment of weakness to destroy them. The Stepnogorsk facility conducted dozens of developmental and test runs with anthrax so as to be ready to start full production should Moscow declare a "special period" for doing so. Moscow never did, and Stepnogorsk never produced a stockpile of weapons. Still, the purpose of the facility was to start production on short notice if it was ordered to do so. Other facilities at other locations were also established to produce infectious agents for war, not only the pathogens of noncontagious diseases such as anthrax and tularemia but also highly contagious ones, plague and smallpox. Alibek writes in his book, which is discussed in *Germs*, that **in the 1970s the Soviet military command ordered the creation of a smallpox stockpile** of twenty tons.

To this day, the Russian Federation has done little to convince other nations that the offensive core of the Soviet biological weapons program has been dismantled. Despite the opening to international scientific collaboration of several of the largest research and development centers of the old program, such as the bacteriological research establishment at Obolensk and the virus research center at Novosibirsk, the former Soviet research and production facilities at Ekaterinburg, Sergiyev Posad, and Kirov, now belonging to the Russian Ministry of Defense, remain entirely closed to foreigners. The discussions of the US and the UK with Russia during the 1990s achieved agreement on the principle of reciprocal visits to each other's military biological facilities as a means of resolving ambiguities, but they eventually ended in failure.

Nor has the Russian military seriously addressed remaining questions about the outbreak of inhalational anthrax in 1979 that killed at least sixty-four people in the Siberian city of Sverdlovsk (now restored to its former name of Ekaterinburg), despite the indisputable evidence described by Jeanne Guillemin in her authoritative book *Anthrax: The Investigation of a Deadly Outbreak*[3] that the spores emanated from the Sverdlovsk military biological facility. Resolving these and other questions and establishing conditions that will allow the two nations to cooperate on an equal footing in fostering global compliance with the Biological Weapons Convention will require that biological weapons be given high priority in the dialogue between the US and Russia. Making common cause against terrorism, including bioterrorism, may provide the needed motivation.

One of the troubling implications of the anthrax bioterrorism since September 11 is that, even if the person or persons responsible for it desist or are caught, it may attract imitators. On the other hand, very few other lethal agents are as widely accessible and as stable in the environment as anthrax spores, and better means of prevention and better therapy for inhalatory anthrax are on the way. But there are thirty different bacteria, viruses, and fungi on the NATO list of biological weapons threats and there are additional agents on other lists. With sufficient effort, many of these could probably be modified so as to evade existing vaccines and antibiotics. It therefore seems reasonable also to consider more widely inclusive protections, not only those specific to a particular agent. **A neglected yet simple measure that could offer considerable protection against any major aerosol attack and would also contribute to the reduction of respiratory disease caused by air pollution is filtration of the air that enters and circulates within large buildings**.[4] The most generic measures of all, however, are

those that help to prevent and deter biological warfare and bioterrorism in the first place. Important among them is the Biological Weapons Convention.

The BWC serves the essential function of setting an international norm to guide the actions of states who see it in their interest to comply with the treaty, to dissuade states that may be tempted to violate it, and to facilitate joint international action against those found to be in violation. The convention obliges its members never in any circumstance to develop, produce, stockpile or otherwise acquire or retain:

(1) Microbial or other biological agents or toxins, whatever their origin or method of production, of types and in quantities that have no justification for prophylactic, protective or other peaceful purposes;
(2) Weapons, equipment or means of delivery designed to use such agents or toxins for hostile purposes or in armed conflict.

What about the question we began with? Will biotechnology, like earlier technologies, come to be extensively exploited for hostile purposes? That such an outcome is inevitable is assumed in "The Coming Explosion of Silent Weapons" by Commander Steven Rose,[5] an arresting article that won awards from the US Joint Chiefs of Staff and the Naval War College:

The outlook for biological weapons is grimly interesting. Weaponeers have only just begun to explore the potential of the biotechnological revolution. It is sobering to realize that far more development lies ahead than behind.

If this prediction is correct, biotechnology could profoundly alter not only the nature of weaponry but also the environment within which it is employed. As our ability to modify life processes continues its rapid advance, we will not only be able to devise additional ways to destroy life but will also become able to manipulate it—including the fundamental biological processes of cognition, development, reproduction, and inheritance. In these possibilities could lie unprecedented opportunities for violence, coercion, repression, or subjugation. Thinking about the distant future has not heretofore been necessary in the history of our species. Averting or at least containing the hostile use of biotechnology may be an exception.

Notes [1] *Britain and Biological Warfare* (Palgrave, 2001). [2] Ken Alibek, with Stephen Handelman, *Biohazard* (Random House, 1999). [3] University of California Press, 1999. [4] See the comments on such filters by Richard Garwin in his article "The Many Threats of Terror," *The New York Review*, November 1, 2001, and his reply to a letter from Stanley Crouch in the November 29 issue. [5] *Naval War College Review*, Summer 1989.

Questions.

1. In the 1930's and 1940's, which country actively pursued biological weapons research using human subjects in gruesome "medical" experiments? Which country did that country attack using biological weapons during that time?

2. Who was in charge of the Unit 731 "water purification unit"? Was he ever tried as a war criminal?

3. An accident at a Soviet biological weapons facility in 1979 caused an outbreak of the lethal pulmonary form of which disease?

4. What organism was used in a bizarre, low-key act of domestic bioterrorism in Oregon in 1984?

5. Which U.S. president ended the American offensive biological weapons program?

6. What potential biological warfare agent was tested for infectivity on human volunteers (who were then treated with antibiotics) in the U.S. in the 1950's?

7. Biological warfare plans have not been limited to organisms that kill people. Certain fungi were also stockpiled to attack what?

8. What enemy of the U.S. continued its buildup of biological weapons (including smallpox!) even after signing the Biological Warfare Convention renouncing such work?