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July 2014

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A History of Biological Warfare (1)

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* Chemical weapons were the first weapon of mass destruction to be invented. After World War I, however, weapons makers realized that nature herself could provide potentially even deadlier "weapons of mass destruction (WMDs)", in the form of pathogens and biotoxins that could be cultured, stockpiled, and used to kill on a massive scale. Japan, Britain, and the US all built up stocks of biological weapons during World War II; the race to build up biological weapons continued in the Cold War era, though in a more inconsistent fashion.

[3.1] 1932-1942: THE ORIGINS OF BIOLOGICAL WARFARE / UNIT 731

* The use of disease as a weapon is nothing new. Centuries ago, armies would occasionally catapult the bodies of people who had died of plagues into cities under siege in hopes of spreading disease, a tactic that often proved successful. English colonists in the New World on occasion gave blankets and other items that had belonged to people who had died of smallpox to local native tribes, and the results could be devastating since the natives had little resistance to the disease.

These were purely opportunistic schemes. Methodical development of pathogens and potent biological toxins as weapons of mass destruction had to wait until the development of modern medical theory and the discovery of pathogens, in the last part of the 19th century.

Despite the fact that the knowledge to manufacture biological weapons or "bioweapons" was available in the First World War, there is no strong evidence that anyone did, although rumors of biological warfare (BW) were widespread at the time. The possibility of BW was certainly evident, and the Geneva Protocol of 1925 included clauses forbidding it. Development of bioweapons did not actually begin in earnest until the 1930s, with Japan taking the lead. The effort was directed by a single domineering figure, an Imperial Japanese Army officer and medical doctor named Shirou Ishii.

Ishii returned from a European tour in 1932, bringing with him a conviction that BW was the way of the future. Ironically, the fact that the Geneva Protocol had banned BW helped draw his attention to it, since the ban implied that people found such weapons unusually dangerous and frightening.

The Japanese invaded the Chinese province of Manchuria in 1932, and set it up as the Japanese puppet state of "Manchukuo". In 1935, Ishii managed to convince his superiors of the potential usefulness of BW; they set him up in a hospital in Harbin, Manchuria, to conduct small-scale experiments with dangerous pathogens. By 1937, Ishii's work had proved promising enough for the Japanese War Ministry to approve the construction of a full-scale BW research and development complex, at a small town named Pingfan, about 65 kilometers (40 miles) south of Harbin.

The Imperial Japanese Army had attacked China proper in that year. The Japanese were able to win almost every battle they fought, but they were completely outnumbered by the Chinese. The Japanese turned to BW as a potential equalizer; it is also possible that some Japanese hoped to exterminate Chinese in areas Japan intended to colonize.

The Pingfan Institute went into operation in 1939. Ishii, now a general, was in charge of the research organization, which was given the cover designation "Water Purification Unit 731". The Pingfan complex covered over three square kilometers (1.16 square miles) and included an airfield, barracks, and laboratories. Japanese recruits arriving there found it an odd place. For example, none of the vehicles carried any identifying marks. They quickly found out that it had other strange and much more unpleasant features. One Japanese veteran who was a technician at the Pingfan site recalled there were many doctors and professors there, giving it something of the air of a university medical research facility, but noted that it was in fact the opposite: "Here, they were trying to find ways to kill people."

There was a certain scientific challenge in this effort. The understanding of pathogens and their actions in causing disease and epidemics was crude and there was, still is, much to learn. There were also the practical problems of developing bioweapons, such as selecting the appropriate pathogen, determining the lethal dosage, and engineering the right techniques for production, storage, transport, and dispersal. Unit 731 also worked on defensive measures, primarily the large-scale production of vaccines.

Unit 731 studied almost every major known pathogen for its utility as a BW agent or "bioagent" -- . as with chemical agents and chemical weapons, a "bioagent" only refers to a pathogen or toxin itself, while a "bioweapon" is a delivery system loaded with bioagents. Some of the more significant bioagents researched by the Japanese included:

- "Anthrax", a highly lethal disease of livestock and humans. Anthrax is a bacterial infection that can be acquired by contact with infected victims, eating of tainted meat, or by inhalation of anthrax spores. When anthrax is acquired by contact, it can create hideous sores that may lead to death by blood poisoning, though the mortality is relatively low, no more than about 20%. The sores tend to be shiny black with dried blood, which gives the disease its name, since the word "anthracis" is Greek for "coal". Mortality is about 50% if the bacteria are

ingested by eating tainted meat, though this form of anthrax is very rare. However, when inhaled, it leads to a lung infection that is over 90% lethal, killing in a few days.

The action of inhalation anthrax is dangerously deceptive, since the victim suffers an initial bout of what feels like the flu, which then seems to fade out. In fact, all that has happened is that the anthrax spores have been scavenged up by the body's lymphatic system, where they then proceed to multiply, bringing on a second and murderous bout of the disease. The bacteria actually kill by secreting a deadly toxin that results in toxic shock. The purified toxin itself can in principle be used as a deadly bioagent.

The only good thing about anthrax is that it is not contagious as such -- though since a victim's corpse is full of spores, cremation is usually advised. The lack of contagiousness is actually an advantage when using it for BW, since it helps ensure that only those directly attacked will contract the disease. In fact, anthrax would become the lethal bioagent of choice for future BW development programs. Its spores are very hardy and easy to store for long periods of time, and can be conveniently packed into munitions. Anthrax spores are so hardy that they will persist in an area over which they have been spread for decades, though they are sensitive to bright sunlight.

- "Plague", the "Black Death" of Medieval times, is caused by infection from a bacterium named *Yersinia Pestis*. It has three forms: "bubonic plague", when spread by fleas or other parasites; "pneumonic plague", when spread by inhaling the bacteria; and "septicemic plague", when spread by contact. Pneumonic plague has a lethality of 95% or more. Although bubonic plague is somewhat less lethal, its spreads more easily and is more useful for BW. However, bubonic plague still isn't all that good a bioagent, since it requires the accumulation, storage, and distribution of live fleas.

- "Gas gangrene", a condition caused by the infection of wounds by the *Clostridium perfringens* bacterium, characterized by stinking putrefaction of the flesh.

- "Brucellosis", a bacterial disease caused by various pathogens of the genus *Brucella* that infects livestock and humans. It isn't very lethal, but it is highly contagious and can incapacitate a victim for a week or more.

- "Tularemia", a bacterial disease caused by the bacterium *Francisella tularensis* that infects rabbits as well as humans, and so is known as "rabbit fever". Like brucellosis, tularemia is rarely fatal in humans but can make a victim wretchedly sick for a time.

- "Glanders", a disease of horses and humans that eats away the mucous linings of nose and respiratory tract, and attacks the lymphatic system. It is caused by the bacterium *Pseudomonas mallei*. It is unclear if the Japanese were interested in glanders for killing horses and mules, or humans, or -- most likely -- both.

- Bacteria related to food poisoning, including the *Salmonella* and *Clostridium botulinum* bacteria, which secrete extremely deadly biotoxins. The toxins were potential

bioagents in themselves, particularly botulism toxin. The lethal dose of botulism toxin is very small, and the toxin is easily produced in quantity and stored for long periods of time.

Other pathogens investigated included typhus, typhoid, cholera, tetanus, smallpox, and tuberculosis, but these agents proved difficult to "weaponize". The Japanese also experimented with exotic biotoxins, such as blowfish poison. They were traditionally familiar with this toxin, since blowfish is regarded as a delicacy in Japan but has to be prepared by a specially-qualified chef so that it may be eaten without fatal results.

* The Japanese had to produce pathogens in quantity for tests and, if they proved worthy, production. Unit 731 researchers devised a scheme using trays of meat and broth as cultures. The trays were kept in incubators and the scum of bacteria produced was skimmed off every few days. The stink of rotten meat was almost overpowering. Eventually, Pingfan was believed to have been capable of producing tonnes of pathogens every month.

Having obtained pathogens, the next step was to determine their effectiveness. There were plenty of Chinese available for use as involuntary test subjects. The Japanese would put up posters warning the Chinese that epidemics of the appropriate diseases had broken out, and then a squad of soldiers would go out and dump pathogens discreetly into the well of a village. Three or four days later, they would return to inspect the ill. The soldiers would anesthetize them, cut them open and take samples, and sew them back up again. "Then we threw the bodies down the well," as a veteran of the program recalled. The soldiers torched the village and left.

The tests were very successful. Ishii then decided to perform more controlled tests in deep secrecy on Chinese prisoners taken to the compound at Pingfan. Many of these people were simply rounded up off the streets of Harbin to meet quotas set by Unit 731 officers. At least 3,000 were taken to the installation and few, if any, ever came back. Another cover story for the compound was that it was a lumberyard, and so Unit 731 personnel referred to the prisoners as "maruta (logs)". Prisoners were assigned serial numbers 1 through 200. Once that block had all been killed, the serial number count started over again through the next 200, and so on. Japanese veterans of Unit 731 recollect the place as a kind of hell on Earth, but the Imperial Japanese Army demanded absolute and unquestioning obedience. Soldiers were routinely beaten by their NCOs, and insubordination of any sort was not tolerated, resulting in immediate and severe punishment.

Chinese prisoners were tied to poles out in the open and forced to look into the sky as airplanes flew over and sprayed bacteria on them. The prisoners were carefully observed and their condition recorded with colored drawings as they sickened and died. Others were tied to stakes or panels and arranged around fragmentation bombs containing *Clostridium perfringens* bacteria. The bomb was detonated, and the test subjects were studied as they developed gas gangrene from their wounds. When test subjects died, their corpses were burned in a crematorium.

* By 1940, Unit 731 had developed a ceramic anthrax bomb and built 4,000 of them. They were also considering ways of delivering bubonic plague. Researchers at Pingfan bred plague-infested rats in quantity and then gathered the fleas from the rats. The fleas could then be distributed as a bioagent vector, using tubular baskets strapped to the bomb pylons of aircraft.

In October 1940, a Japanese aircraft flew low over the city of Ningpo, which was still held by the Nationalist Chinese, and dispersed a spray containing plague-infested fleas. The results were appalling. Roughly 500 people died and the city was panic-stricken. It is thought that more attacks may have taken place in China, but records of such activities were destroyed by the Japanese at the end of the war and nobody knows for sure.

The researchers at Unit 731 went on to even more imaginative BW studies. They decided to use Chinese prisoners not merely to test pathogens, but to actually act as production incubators to breed them. The researchers believed that pathogens that managed to overcome the body's defenses were likely more virulent. The prisoners were injected with pathogens. When the victims reached their limit, the prisoners were chloroformed and all the blood was drained from their bodies. When the blood flow from a prisoner slowed down, a soldier would jump on the man's chest to force out the last drops. One Japanese veteran recollected: "They did not leave even one drop of blood in the body!"

With such extensive handling of pathogens there were likely to be accidents, and it is believed that hundreds of Japanese staff of Unit 731 died from the pathogens they handled. Despite this problem, Ishii's BW research empire spread, establishing 18 satellite stations in China and in other locations ranging from Hokkaido, the northernmost of the main Japanese islands, to the Dutch East Indies.

The Japanese BW researchers not only investigated pathogens to attack people, they also studied chemical herbicides and pathogens to destroy crops. The most intensively studied plant pathogens were "fungal smuts" and "nematode worms" intended to attack Soviet and North American wheat fields. Smuts in particular were potentially highly effective bioagents. The head of a wheat plant infected by wheat smut turns into a blackened mass of spores that are released into the air to infect other wheat plants downwind. The Japanese developed a production facility that could yield about 90 kilograms (200 pounds) of smuts annually.

[3.2] 1942-1945: BW DEVELOPMENT IN THE WEST (1)

* By mid-1942, word of Japanese BW development was leaking out to the Allies, and in July 1942 Winston Churchill placed the issue on the top level of priority for discussion by Allied leadership. It was not completely a new topic to him, since the British had been thinking about BW since 1934. The prime mover was a Whitehall bureaucrat named Sir Maurice Hankey, who, like Shirou Ishii, had been inspired to investigate BW by the fact that the Geneva Protocol tried to ban it.

In the prewar period, British BW efforts were minimal, consisting of a few committees issuing reports and, as war approached, funding for limited defensive measures. When war broke out in 1939, considerations for offensive biowarfare rose in importance, and the British government established a small laboratory at Porton Down, run by a medical researcher named Paul Fildes.

Fildes began to conduct small-scale experiments to evaluate pathogens and biotoxins for use as bioagents, and in late 1941 recommended the production of millions of anthrax-laced linseed cattle cakes that would be dropped by air over Germany. The goal was to destroy German livestock, not kill German civilians, though obviously some civilians would contract anthrax by eating tainted

meat. Production of the cattle cakes was approved, and a large stockpile of them was stored at Porton Down until the end of the war, when they were all incinerated.

Biotoxins had a particular appeal for clandestine operations in occupied Europe, setting a precedent for later interest by intelligence services in such agents. Porton Down is known to have produced botulism toxin under the designation "BTX". Some sources claim, though not with strong support in the facts, that a BTX-laced grenade was used in 1942 to assassinate SS General Reinhard Heydrich, a senior and highly competent Nazi officer, considered a possible heir to Hitler's throne, who was then the ruler of occupied Czechoslovakia.

The intelligence information leaking out about Japanese BW experiments only increased the priority of Allied efforts to build their own BW capability. In the summer of 1942, the British conducted their first large-scale BW experiment on Gruinard Island, off the coast of Scotland. A film was made of the experiment and remained classified until 1997. Sheep were taken to an open field, secured in wooden frames, and exposed to a bomb that scattered anthrax spores. The sheep started dying three days later. They were examined and then burned. Other tests involved dropping anthrax bombs from a Vickers Wellington bomber.

Safety precautions were unbelievably slipshod, and it's a wonder there were no calamities among the personnel involved or innocent bystanders. One worker in the program recalled helping a medical researcher pour a thick soup of anthrax agent into a bomb, without use of protective clothing or any other safety measures. Despite attempts to disinfect Gruinard Island, the anthrax spores left there by the experiments kept the island in quarantine for five decades. The final report on the Gruinard Island experiments suggested that anthrax could be used to render whole cities uninhabitable "for generations". Biological weapons were potentially orders of magnitude more effective than chemical weapons.

* In the meantime, the British had been working with the Canadian government to set up a BW test range at Suffield, in the province of Alberta. The area was empty and isolated, and experiments could be performed with greater safety than any location available in the British Isles.

The entry of America into the war in late 1941 added more momentum to the Allied BW effort. The US had considered BW, with government reports being written and distributed to detail defensive and offensive measures. With a real war on, the American Chemical Warfare Service, with British assistance, built up BW research facilities, including test stations near Dugway and near Pascagoula, Mississippi; a potential production facility at Vigo, near Terra Haute, Indiana; and the master research and development center at Camp Detrick, Maryland.

The British work on anthrax, or "N" as it was codenamed, as a bioagent led in 1943 to the design of an "N" bomb suitable for mass production by the Americans. This munition weighed 1.8 kilograms (4 pounds). 106 of these "bomblets" were to be packed into a 225 kilogram (500 pound) cluster-bomb canister and dropped over enemy population centers. The whole effort was protected by the highest level of secrecy, TOP SECRET:GUARD, which the Americans jokingly described as DESTROY BEFORE READING. An initial pilot batch of 5,000 N bombs was produced at Camp

Detrick in May 1944, and medium-scale production at a rate of about 50,000 bomblets a month followed. The bomblets were turned over to the British, who stockpiled them.

The plant at Vigo, Indiana, was designed for production of 500,000 anthrax bombs per month. The plant was never put into operation, partly because of extreme safety concerns. By the end of the war, it had been converted to antibiotic production, though it could have easily been converted back to bioagent manufacture if the need had arisen.

* The drastic nature of anthrax was not lost on the Americans, and so they searched for a bioagent that could incapacitate instead of kill. They found brucellosis promising: the infectious dose was much smaller than that of anthrax, meaning a single bomber could attack a much larger area with the same weight of bombs, and a city that had been attacked with brucellosis would be safe to enter a week or so after the attack. Brucellosis was, on the other hand, wildly infectious, and many of the people who worked with it in the weapons development program came down with it. However, other than a few days of nasty chills, pains, fever, and headaches, it rarely did much harm. Brucellosis weapons were in an advanced state of development at the end of the war.

The Americans also investigated anti-crop bioagents, including "potato blights" and "wheat rusts"; "sclerotium rot", which can attack soybeans, sugar beets, sweet potatoes, and cotton; and "blast diseases" to attack rice. There is some suspicion that crop bioagents might have been used by the Allies. In the fall of 1944, the German potato crop was infested by a huge plague of Colorado beetles, and in 1945 the Japanese rice crop was badly afflicted by rice blast. However, in the absence of any evidence supporting such suspicions, there is no reason to believe these incidents were due to anything but natural causes.

[3.3] 1928-1945: BW DEVELOPMENT IN THE USSR (1)

* The Soviet BW program during World War II remains somewhat mysterious, and considering the fact that many records were destroyed later, will probably always remain so. Ken Alibek (originally Kanatjan Alibekov), a senior official of the Soviet "Biopreparat" BW organization in the late 1980s and early 1990s, emigrated to the United States in 1992 and provided a history of the Soviet BW program. While Soviet expatriates have been known to tell exaggerated stories for self-serving reasons, Alibek's comments sound entirely plausible.

According to Alibek, the Soviet BW effort began in 1928, three years after the USSR signed the Geneva Procotols. The initial focus was to "weaponize" typhus, with the work supervised by the state security apparatus, the "GPU", which would eventually evolve into the KGB. The effort then expanded, with new facilities built in the network of GPU prison camps. The prime testing ground was at Solovetsky Island, in the Arctic, north of Leningrad in the White Sea.

Prisoners may have been used in tests of bioagents. Certainly there were many casualties among researchers and workers as well, whose lives were made even more miserable during the purges of the 1930s by the influence of Trofim Lysenko, a quack biologist who managed to get Stalin's ear. Those biologists who differed with Lysenko were sent to prison camps or worse, and Lysenko did much to hobble the Soviet BW effort.

When the Soviet Union was invaded by Hitler's forces in the summer of 1941, BW facilities in the west were relocated by train to the east, in the Ural mountains. A train carrying pathogens and other materials was passing though the city of Gorky when the Germans decided to bomb the place, panicking supervisors on the train, who ordered the train to keep on rolling through the city. The town of Kirov became the main BW facility after the move. The Soviets also found a new testing ground, at Rebirth Island in the Aral Sea.

During the summer of 1942, when the Germans were pushing through the USSR towards the Caucasus and Stalingrad, there was an outbreak of tularemia of unprecedented magnitude among both German and Soviet troops. Alibek felt certain the outbreak had been a BW attack that had gone wrong, and "old-timers" in the Biopreparat organization told him stories that reinforced his suspicions.

There was also an outbreak of "Q fever" among German troops on leave in the Crimea in 1943. Alibek never investigated the matter in detail, but believed it might very well have been a BW attack or test. Q fever was originally "Query fever" because nobody could figure out what caused it. The pathogen was eventually identified as *Coxiella burnetii*, a species of "rickettsiae", a type of very small and primitive bacteria that, like viruses, can only reproduce in living cells. The typhus pathogen is another member of the rickettsiae.

Q fever is a disease of sheep, goats, and cows carried by ticks. Animals can be infected by breathing dried tick feces, and humans in proximity to the animals can be infected as well. It forms hardy spores, with an effective dose as small as one spore, and so makes a fairly good bioagent. Q fever causes a sudden fever, aches, and general ill health, but it is much less dangerous than its relative typhus. Q fever only lasts a few weeks, rarely leads to complications except for pneumonia, and is rarely fatal. Outbreaks of Q fever were unheard of in the Soviet Union before that time, and it was heavily investigated as a bioagent by Soviet researchers later. However, wars do tend to be accompanied by a breakdown in public health systems and outbreaks of diseases, sometimes unusual ones, so there's not much there to put any weight on.

[3.4] 1945-1969: BW DEVELOPMENT IN THE WEST (2)

* When Germany surrendered in May 1945, the Allies got a nasty surprise from Nazi nerve gases. There was no such shock from Nazi BW research. The Germans had never gone beyond preliminary investigations, though some brutal experiments had been performed on concentration camp prisoners.

The German disinterest in BW was partially due to the fact that Germany was situated in the middle of Europe, and the countries that would be logical targets for BW attacks were right on Germany's borders. Since pathogens are poor respecters of borders, the Germans had strong reasons to not develop biological weapons. England, separated from potential enemies by the English Channel, was in a better position to conduct BW, and the Americans were in an even safer position, with their enemies oceans away. Similarly, as an island nation, Japan had a degree of separation from China that made BW attractive to the Japanese.

General Ishii's BW research staff at Pingfan kept up their efforts until the very end of the war. In fact, the Japanese developed a technology that could have allowed them to conduct BW attacks on the United States, in the form of balloons that were released into the jet stream to float across the Pacific to North America. The "fusen bakudan (balloon bombs)" carried incendiary bombs that were dropped automatically when a timer ran out. Hundreds were launched beginning in the fall of 1944 and into early 1945, and a good number of them reached the US and Canada. They did no real damage, but there was the prospect that the Japanese could use them for BW attacks, which could have potentially made them more dangerous.

The Americans developed a weapon of mass destruction that outdid anything the Japanese had. The US dropped two atomic bombs on Japan in August 1945, and the USSR declared war on Japan at the same time and invaded Manchuria. Japan surrendered. The Pingfan complex was demolished ahead of the advancing Soviets, and Unit 731's most incriminating records were destroyed. Ishii and his men did make sure they saved a significant set of documents relating to observations made at Pingfan, and set them aside in a safe place.

* The Americans, now Japan's masters, only knew vague rumors about the activities of Unit 731. They interrogated Ishii, who had returned to Japan, and he simply told them that he had conducted research on defensive BW. There was no evidence to dispute this claim until the Soviets began to sort out what they had captured at Pingfan and elsewhere in Manchuria. The Soviets then asked the Americans to turn Ishii and his officers over to them. The Americans were halfway inclined to go along with the request until Ishii, justifiably panicked by the idea of being handed over to Stalin's highly experienced interrogators, confessed that Unit 731 had in fact been involved in offensive BW research, and had conducted field trials against Chinese civilians.

There was some uncertainty among the Americans that even these confessions provided enough evidence to make a case against Ishii and his assistants that would stand up in court. In the meantime, American BW researchers from Camp Detrick interviewed Ishii and his colleagues. The details of Unit 731's activities became more ghastly the more the Americans probed, but the interviewers also became more fascinated. In the light of the data Ishii's people could provide, the Camp Detrick group produced a report recommending that charges against Ishii and his men be dropped, in recognition of the potential value of what they could teach the Americans.

The recommendation was accepted. Ishii and his colleagues went free, and the activities of Unit 731 were kept quiet. At the time, the Americans had the Bomb and the Soviets did not. Many American officials believed the USSR would never be able to build the Bomb, and so would likely seek equalizers in the form of chemical and biological weapons, which it appears was the case. The Americans needed to counter such a move.

Shirou Ishii died of cancer at his home in 1959. He was never arraigned for any war crimes. The data provided by the Japanese proved less valuable than expected; they had neither mastered the efficient production of BW agents nor devised effective delivery systems. Ishii had got the better part of his deal with the Americans.

* As the Cold War intensified, American research into BW accelerated. In 1948, the US built a huge sealed spherical test chamber at Camp Detrick to test the aerosol dispersal of pathogens. This test chamber was known as the "Eight Ball". In 1953, Camp Detrick became Fort Detrick, and would continue to be a center of BW development into the late 1960s. Tests of BW technologies were performed through the 1950s at the Dugway Proving Grounds in Utah. Somewhat startling mock BW attacks were also performed by BW researchers in several US cities, using harmless bacteria.

Initial American BW production in the postwar period focused on the plant pathogens investigated during the war: smuts, blights, blasts, rusts, and rots. Feathers were found to be an excellent storage medium for plant pathogens, and cluster munitions were built that were packed full of turkey feathers dusted with pathogens. When the dispenser burst open at altitude, the feathers scattered in the wind over a wide area. Anti-crop biological munitions were put into production for the US Air Force in 1951. It was the first recorded instance of peacetime production of bioweapons.

The Americans also borrowed the *fusen bakudan* idea from the Japanese, and invented a balloon that could float over enemy territory to release canisters of bioagents after a preset period of time. The balloons were tested under the FLYING CLOUD program in 1954, but the program was judged a failure due to the inaccuracy of the balloons as a delivery system, and canceled. That didn't mean that the Americans had given up on BW, and eventually the US produced what is estimated at about 30 tonnes (33 tons) of wheat rusts, which would have been sufficient to destroy the entire Earth's wheat crop. The spores of the rust used, *Puccina graminus triciti,* could remain effective after being stored in cool places for two years, and the rust would propagate rapidly after dispersal. The main intended target was the wheat region of the Ukraine. The US also stockpiled roughly a tonne (1.1 tons) of rice blast disease, intended to attack the ricefields of China.

* American BW developers were not ignoring human pathogens. Anthrax remained the choice for a lethal bioagent. Many studies were performed with it, and anthrax weapons were produced.

Build such weapons was not a trivial task. Anthrax strains had to be selected for effectiveness, and determining the lethal dose was a problem. The conclusion was to use several times the maximum conceivable lethal dose. Then there were the manufacturing issues. Anthrax had to be cultured in bulk, refined from cultures, dried, and converted into a form that could be loaded into weapons. It had to be "milled" down to a fine powder that could be dispersed as an aerosol and inhaled by victims, then treated to eliminate static that might cause the spores to clump up and defeat the milling. Finally, there was the issue of delivery systems and military procedures. Simply putting anthrax in a bomb was ineffective, since the explosion killed most of the spores. Cluster munitions and aerosol sprayers were developed.

Since anthrax was such a drastic weapon, research also continued into less-lethal pathogens. Brucellosis remained an interesting bioagent, along with tularemia and Q fever. The Americans also considered "psittacosis" and "Venezuelan equine encephalitis (VEE)" as BW agents. Psittacosis is a nasty bacterial disease that primarily infects birds and is sometimes known as "parrot fever". In humans, psittacosis causes a high fever and can lead to pneumonia; about one in five human victims dies. VEE is a virus, one of the few evaluated by the US, normally transmitted

by mosquitoes. It causes brain inflammation, with headaches and fever, as well as vomiting and diarrhea in some cases. Its mortality rate is very low.`

Brucellosis and tularemia pathogens were actually put into production. Work was also conducted on botulism toxin, as well as "staphylococcus enterotoxin B (SEB)". SEB is produced by the staph bacteria*Staphylococcus aureus* and causes what is now known as "toxic shock syndrome". It can make a victim very ill for several weeks and is lethal in large doses. Other options were investigated, such as mass breeding of mosquitoes to carry yellow fever. Activity remained high at Fort Detrick into the 1960s. Defensive measures, including the development and production of vaccines, were pursued as well.

* The US Central Intelligence Agency (CIA) also studied a wide range of sometimes bizarre drugs and toxins for use in clandestine activities. For example, extremely lethal and fast-acting "saxitoxins" were used as an alternative to the relatively slow and painful cyanide pills carried by agents to allow them to commit suicide if captured. Saxitoxins are produced by marine microorganisms named "dinoflagellates" associated with toxic "red tides".

When a CIA Lockheed U-2 spy plane was shot down over Russia on 1 May 1960, the pilot, Francis Gary Powers, carried a silver dollar bored with a hole containing a needle coated with a saxitoxin. Powers did not use the needle and warned his captors to be careful in handling the silver dollar. The Russians pricked a dog with the needle and the dog died in ten seconds. The CIA also developed an electric dart gun that could fire a poison-tipped dart up to about 100 meters. The dart was so small that the victim might not even notice that he had been shot by it, and would then die quickly and mysteriously.

Although the CIA is now officially out of the poisons business -- and given the political liability and limited utility of such work, probably out of it unofficially as well -- investigations into new and better poisons have continued, including improved neurotoxins and "RNA" genetic material custom-designed to jam or activate specific genes in a victim. One of the dreams of those interested in poisons is a toxin that will only kill a specific target and is harmless to everyone else, but for the moment such an idea remains science fiction. In any case, such toxins are in general not appropriate for battleground or strategic use, and so amount to little more than a James Bond story in the history of the development of chemical and biological weapons of mass destruction.

* While the Americans stockpiled bioweapons, the British were winding down BW development efforts at Porton Down. By the 1960s, their BW research efforts were strictly defensive. In 1968, British delegates attending an international disarmament forum in Geneva suggested that proposals to limit chemical and biological weapons might be more effective if the two subjects were discussed separately. After all, chemical weapons had been used extensively in warfare while bioweapons had not. The British introduced a draft of a "Biological & Toxic Weapons Convention (BTWC)", sometimes referred to as the "BWC", that would require signatories to renounce BW. The Soviets objected heavily at first and the Americans were unenthusiastic.

However, US public opinion was strongly against BW, and even disregarding ethical concerns there was a practical reason to abandon biological weapons. America had the Bomb, the most

powerful deterrent available, and only the most advanced countries were capable of building nuclear weapons. As noted previously in the context of chemical weapons, anyone could build bioweapons, even in principle terrorist groups, and it was not in the advantage of the US to do anything to encourage BW.

The US military also had no enthusiasm for BW. Bioweapons were imprecise in their targeting, as well as delayed and unpredictable in their effects, making them clumsy weapons for warfighting. They were also difficult and dangerous to produce, store, handle, and use. In the early 1960s contingency plans were drawn up by Fort Detrick for use of nonlethal bioagents in Cuba and Southeast Asia, but the military brass rejected these plans after very little consideration. In fact, the US military had such a low opinion of BW that they had a somewhat short-sighted tendency to believe that their military counterparts on the "other side" had much the same viewpoint. That turned out to be dead wrong.

On 25 November 1969, President Nixon formally announced that the US would abandon offensive BW. The Eight Ball was shut down and hundreds of researchers taken off the program. Fort Detrick would remain in business, but only for research into defensive biowarfare. In hindsight, Nixon's decision, though largely forgotten, was one of the most significant and positive actions of his administration. The unilateral American decision broke the ice for other countries to give up BW as well. On 4 April 1972, the US and the USSR signed the BTWC, and eventually a total of over 141 countries signed up. The BTWC was a significant step forward in principle, though it suffered from weak verification and enforcement provisions. It would take almost two decades to find out just how weak it was in practice.

[3.5] 1945-1992: BW DEVELOPMENT IN THE USSR (2)

* The Soviets found the information on BW captured from the Japanese much more useful than did the Americans. The Soviets used Japanese plans to build a new and sophisticated BW plant in Sverdlosk in 1946. In the mid-1950s, responsibility for BW research and development was transferred from the KGB to the Red Army, and the program expanded dramatically. BW research facilities were built inside cities to help conceal their purpose. Even the Ministry of Agriculture was brought into the task, setting up a branch to develop bioagents to attack crops and livestock.

After signing the BTWC in 1972, the Soviets did not abandon their offensive BW effort. In fact, in 1973 Premier Leonid Brezhnev signed a decree ordering a comprehensive update and expansion of the entire Soviet BW apparatus, which had finally managed to shake off the debilitating influence of Trofim Lysenko -- whose authority had declined after the death of Stalin in 1953, but lingered up to his death in 1976.

The Soviets justified their secret BW effort, when they bothered to, with the belief that the Americans were also cheating on the BTWC. In fact, as noted, that was simply untrue: the US had no particular use for BW, having judged it more trouble than it was worth. The suspicious belief in American secret BW research also reflected the inability of Soviet leadership to understand that the US military is firmly under the control of their civilian masters, the politicians -- and that American

politicians may not be honest to a fault, but still have a direct and vested interest in being sensitive to the wishes of the people who voted them into office.

* Ken Alibek reported that after the USSR signed the BTWC, the country continued to produce and stockpile bioagents, such as anthrax and pneumonic plague with a vengeance. The Soviets ended up with production facilities able to produce *thousands* of tonnes of anthrax a year.

They produced tonnes of "weaponized" smallpox virus, which was felt to be a good BW agent because it was extinct in the wild and so defenses against it were poor, and experimented with the "Marburg" hemorrhagic fever virus, which causes massive hemorrhaging and has about 90% lethality. Weaponizing viruses is difficult and technically an impressive feat. Ironically, the USSR had also been a major backer of the UN worldwide immunization program that would eventually eliminate smallpox in the wild.

In addition, the Soviets weaponized incapacitating BW agents such as tularemia, Q fever, and VEE, and became very skilled at delivery systems. Missiles with BW warheads were tested and fielded. Apparently they developed their skills at aerosols to the point where they figured out how to use them to administer vaccines. Personnel to be vaccinated were simply put inside a closed room full of a vaccine in aerosol form and left there for a while.

* Like the US, the Soviets performed various field tests, using aircraft to disperse harmless bacteria over civilian populations, as well as dispersal tests of harmless bacteria in the Moscow Metro. Not all the releases were so harmless. There are suspicions, unconfirmed and hotly debated, that a smallpox epidemic that occurred during August 1971 in the city of Aralsk, Kazakhstan, on the north short of the Aral Sea, may have been due to the unintentional infection of an ecological survey ship that strayed too close to Rebirth Island. Ten people came down with the disease and three of them died. The smallpox strain appeared to be unusually virulent, since several of those infected had been vaccinated against smallpox, and the symptoms were unusually severe.

In November 1979, a magazine published by Soviet emigres in West Germany printed an article based on reports by other Soviet emigres of a mass outbreak of anthrax in April 1979 in the city of Sverdlosk that killed at least a hundred people. The articles suggested the outbreak was due to a containment failure at a BW research facility outside the city, operating in clear violation of the USSR's commitment to the BTWC.

In 1980, the Soviets admitted that there had been an outbreak of anthrax as reported, but stated that it was due to tainted meat. This was plausible, since anthrax actually was a problem in parts of the Soviet Union. However, in 1993, after the fall of the USSR, the Russians admitted that the outbreak was in fact due to an accident at the major BW facility in Sverdlosk. Somebody had removed a clogged filter from an air-purification system, and other workers reactivated the system without noticing the filter was gone. The cover-up effort had involved destruction of evidence and records, and even the arrest and conviction of a few black-market meat dealers for selling tainted meat.

The party boss in Sverdlosk, the volatile Boris Yeltsin, had stormed over to the BW complex and demanded admission, but was refused. He was ordered to go along with the cover-up. The cover-up was so thorough that a group of American medical researchers who came to the USSR in the late 1980s went back home generally convinced that the anthrax outbreak had in fact been a natural occurrence. The American military was inclined to accept that because, again, they had a low opinion of the military utility of BW, and believed the Soviets did as well. The Soviets were spending a large amount of money and effort to conceal the truth, and were extremely skilled in general at secrecy and deception, with the matter kept tightly under wraps.

The American intelligence community was still suspicious, and the CIA was making out the vague shape of a very active Soviet offensive BW program. The 1989 defection of Vladimir Pasechnik, a senior Biopreparat official, did much to give weight to these vague suspicions; which were substantially reinforced later when Alibek came to the US; and confirmed in 1995 when a US diplomat got a chance to inspect a mostly derelict bioagent production plant in Stepnogorsk, Kazakhstan. The scale of the plant was astounding, and Western experts were shocked to learn of the quantities of pathogens produced, which were far greater than could have been put to any conceivable rational use. The diplomat also got the opportunity to inspect the now-abandoned test facility on Rebirth Island.

After Yeltsin became the first Russian president after the fall of the USSR, he ordered the complete destruction of all remaining bioweapons and shutdown of BW research and manufacturing facilities. In 1992, Russia signed an agreement with the US and Britain to obtain cooperation in converting or dismantling the Russian offensive BW apparatus. Some concrete measures were taken, such as the dismantling of the Stepnogorsk plant using American funding, and many Russian researchers who had worked on the BW program opened up and spoke freely to Western investigators. However, suspicions remain that the Russians never completely shut down their offensive BW facilities.

* The Soviets also tinkered with biotoxins for clandestine actions, using them in a number of occasions against defectors living in the West. The most significant of these incidents was the murder of a Bulgarian dissident living in London named Georgi Markov. On 7 September 1978, Markov was on the streets of London when he felt a sudden slight sting and turned around to see a man fumbling with an umbrella. Markov mentioned the incident to his wife. He then fell increasingly ill over the next few days, and finally died. Examination of his body uncovered a tiny pellet, the size of a pinhead and with four holes in it. The pellet had most likely contained a poison, but there wasn't enough trace of it to determine what kind of poison.

Another Bulgarian exile living in Paris named Vladimir Kostov read about Markov's death in the newspapers, and reported that about ten days before reading about the incident, somebody had stuck him in the back with something sharp, and he'd been ill for days. French doctors gave him a very thorough examination and found another pellet like that recovered from Markov. They forwarded the pellet to Scotland Yard, and British forensic pathologists found that the pellet contained traces of a poison named "ricin". Ricin is derived from the castor oil plant and is highly lethal. It was later determined that the pellets had been delivered by a compressed-air "gun" disguised as a pen.

Markov's murderer was never caught, but the killer was believed to have been an agent of the Bulgarian secret police. A Soviet emigre was also murdered with a ricin pellet in the US in 1980, apparently by KGB agents. As with the CIA experiments, such "cloak and dagger" activities were a sideline relative to the development of bioweapons of mass destruction by the USSR and its allies.