THE HISTORY OF AMERICA'S SECRET GERM WARFARE PROJECT

THE BIOLOGY OF DOOM

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Prologue

DUGWAY PROVING GROUND, UTAH
BW GRID NO. 4
TUESDAY, JULY 12, 1955
SUNSET

The test subjects are arrayed in a single straight line that stretches for more than half a mile across the desert floor. The file resembles a battle line from the old days of trench warfare, but this is only a field trial.

In a normal field trial, packs of caged mice, rats, guinea pigs, rabbits, or sheep inside wooden crates would be waiting patiently for the cloud of airborne infectious agent to wash over them. Sometime afterward—hours, days, weeks—most of the animals would show symptoms of the disease, and many of them would have died from it. Those that survived would be killed nevertheless, and all the test subjects would be autopsied to determine the precise medical effects of the biological agent used in the experiment.

But tonight's event will not be of the usual sort. Tonight, for the first time in the short history of the U.S. Army germ warfare program, a field trial using live infectious agents will include human beings as test subjects.

The thirty humans have been set out on the biological warfare test grid exactly as if they were animals, and in fact next to each small group of three human beings there is a cage of seven rhesus monkeys and a second cage of guinea pigs. The test line is thus a tidy biological cross section, fair and democratic, with no trace of species chauvinism anywhere in evidence.

Across from the line, in the middle distance, the last orange sun rays illuminate the top of Granite Peak, a 7,068-foot prominence. The air has cooled from the day's high of 97°F, and by the time of the experiment, which will occur after dark, the subjects will have been chilled by the dry breeze coming down from the mountains.

There are no human habitations within a radius of eighteen miles. From the nearest vantage point, Simpson Springs, an abandoned Pony Express station on a high bluff some ten miles to the east, the string of subjects is invisible to the naked eye. But no one is watching.

The sky overhead is clear and cloudless, a deep silent blue.

Soon it will hold a fine mist that will be carried along on the moving air toward the long line of humans and animals. The cloud will filter through their ranks like a fog, the mist produced by five type-C generators, spray nozzles that the Army germ warfare researchers have adapted from the Navy's E-4 marine mine.

The E-4 mine was one of the Navy's cleverer inventions. It was designed to be fired from a submarine's torpedo tube, but instead of speeding toward an enemy ship it would remain motionless under water for a specified period of up to two hours. Then it would rise to the surface. At that point, the mine's C generators would poke out above the waves and disseminate into the prevailing wind some forty-five quarts of a biological agent, a particular strain of virus or bacteria that would waft toward the enemy ship, and, depending on the species of microbe used, would either kill or incapacitate the crew. The mine would then scuttle itself and sink to the bottom forevermore.

On the theory that a spray device that worked well on the open ocean ought not to freeze up in the cold air of the high desert, the Army's germ warfare researchers have chosen the C generator for use tonight. Accordingly, five of them are arranged in an arc that focuses in toward the test subjects stationed 3,200 feet away. Once the nozzles start spewing out their supplies of live pathogen, it will take approximately four minutes for the aerosol cloud to cross the distance.

Earlier in the year, the Army had staged three dry runs of tonight's test, using guinea pigs as experimental subjects. In those trials, the researchers

had learned how to calibrate the generators and aim the pathogen cloud at the center of the line, where the animals were bunched closely together in a section called the "dense sampling array." All the guinea pigs used in those trials, whether they were in the dense sampling array or not, had long since been sacrificed and incinerated, and from the postmortem examinations it was clear that many of them had been successfully infected with tonight's disease of choice, Q fever.

The "Q" in "Q fever" stood for Queensland, Australia, where the microorganism first appeared in 1935 as an epidemic among slaughterhouse workers. The men presented the typical symptoms of a flulike illness—fever, chills, headache, and so on—but blood tests failed to turn up a typical flu pathogen. Two researchers, MacFarlane Burnet, an Australian, and H. R. Cox, an American, independently discovered the microbe responsible. It proved to be an unusual type of rickettsia, and the organism was named after its two discoverers: *Coxiella burnetii.*

In the years since its discovery, *C. burnetii* had become known as a biological curiosity, a pathogen that produced no symptoms whatsoever in the vast majority of animal species that carried it. Among those it did affect, including sheep, goats, cattle, and guinea pigs, it caused spontaneous abortions in pregnant females about to give birth, but otherwise generally had little effect.

The disease was far worse in humans, among whom it produced fever, chills, and shivering; headaches that were severe and throbbing; eye pain, chest pain, cough, sore throat, weight loss, nausea, and vomiting; and a range of neurological problems including visual and auditory hallucinations. The symptoms could last for as little as a week or for as long as two to three months. A human victim was unlikely to die from Q fever, but deaths were not unknown, and about four percent of those who contracted the disease died from it. One out of thirty human cases died, on average, and there were thirty humans in the test tonight.

Other than its potential lethal effects, the worst part of Q fever was its long incubation period, which in humans ranged from ten to forty days. This meant that it could take a month or more for the first symptoms to show up, a month of watching and waiting, of oversensitivity to every stray pain.

Earlier in the evening, the Dugway technicians had filled each of the C generators with five ounces of infective slurry, the liquid that would shortly be streaming out of the spray nozzles. The microbes had been cultivated in a one-story yellow brick laboratory building at Camp Detrick, the Army's

biological warfare research center in Frederick, Maryland, about fifty miles west of Washington, D.C. Laboratory technicians working in Building 434, the Virus Pilot Plant, had raised 3.5 liters of the *C. burnetii* microbe in embryonated chicken eggs. Then they extracted the liquid and purified it, transferred it into vials, placed the vials on dry ice, and shipped them by air to Dugway.

Now, finally, about an hour after sunset, the generators have been loaded and pressurized, and the air sampling devices on platforms next to the men are ready to sniff the aerosol as it comes wafting past. The samplers are powered by small vacuum pumps, and when the motors start running it means the test has begun.

After some initial erratic winds, the breeze is blowing steadily and from the right direction, from the generator arc toward the test line. Colonel William Tigertt, the Army medic in charge of the operation, walks along the line of men telling them in a calm voice, "When you hear the motors, just breathe normally. Remember to just breathe normally." No holding your breath, no gulping the air, no deep breathing exercises. This has to be a realistic test, approximating wartime conditions, when the enemy is not expecting an infectious puff of *C. burnetii* to float along on the night air. So when the time comes, *breathe normally.*

Tigertt now disappears into the control van, located well upwind and out of range, back behind the rank of C generators. The control van lights are dimly visible to the men, but otherwise the terrain is black.

And then, finally, the men hear the sound of the vacuum pump motors, a thin low drone.

The infective slurry is forced from the nozzles under the pressure of 250 pounds per square inch of carbon dioxide, and it billows out in a fine mist, like paint from a spray can. The particles are precisely sized, not so large that they'll fall to the ground like water from a hose, not so small that the subjects will exhale them back out again like cigarette smoke. When the men breathe them in, some of the particles will remain behind in the lung.

The spray nozzles are five feet above the ground, the same height as the human nose. The individual lines of spray are caught by the moving air; they travel downwind and merge, now forming a coherent cloud. It drifts toward the center of the test line, toward the dense sampling array, the bunched groups of guinea pigs, monkeys, and men.

Here it comes! . . . Here it is! . . . You can feel it on your face!

A fog. A vapor. A soft wet mist.

part one

1

Twenty years earlier, the U.S. Army would have laughed at the idea of making war upon the enemy by spraying germs out of a can. The Army's official position, in those days, was that biological warfare was science fiction.

That position had been formulated, argued, and loudly proclaimed by one Leon A. Fox, M.D., a major in the U.S. Army Medical Corps. Fox viewed himself as a great debunker of popular delusions, and in 1932 he had written an article for the Army journal *Military Surgeon* in which he took a dim view of the entire germ war fantasy.

"Bacterial warfare is one of the recent scare-heads that we are being served by the pseudo-scientists who contribute to the flaming pages of the Sunday annexes syndicated over the nation's press," he wrote. "I consider that it is highly questionable if biologic agents are suited for warfare. Certainly at the present time practically insurmountable difficulties prevent the use of biologic agents as effective weapons."

For one thing, most of the world's microbes were highly perishable: they were destroyed by heat, cold, and even by sunlight. Placing germs inside weapons and firing them off like cannonballs pretty much guaranteed that the organisms would be dead on arrival.

"Shells can be used to project missiles and chemicals on to an enemy many miles distant," he said, "but bacteria cannot be used in this way. No living organism will withstand the temperature generated by an exploding military shell."

You could spread bacteria from an airplane, he conceded, just as a crop duster sprayed insecticide over farmland. Still, "their effect would be quite local and probably less dangerous and less certain than high explosives used in the same way."

And in any case there was the boomerang effect to consider. Unless you've immunized your own army against the specific biological agent you're going to use on the enemy, that agent could come back and kill you as easily as them. If, on the other hand, you've immunized your own forces against certain bacteria, then the other side could do so as well, making the entire biological assault an exercise in futility.

But if you wanted to wage war with germs even in spite of all these obstacles, exactly which diseases would you try to inflict upon the adversary?

Not meningitis, for the organism was "so delicate that even on the most favorable culture media it rapidly dies when exposed for even a few hours to temperatures much below that of blood heat." Smallpox was out because soldiers were immunized against it as a matter of course. Influenza was a possibility, except for the fact that no one knew how to start a proper epidemic of the disease: the microbe was always skulking around in the environment somewhere, and it broke out sporadically and at random for unknown reasons. Handling the virus in a controlled manner and directing it upon the foe at will seemed entirely out of the question.

Plague was excluded by the boomerang argument. "The use of bubonic plague today against a field force, when the forces are actually in contact, is unthinkable for the simple reason that the epidemic could not be controlled. The torch once set off might destroy friend and foe alike, and would therefore prove of no value as a military weapon."

Botulinum toxin sounded like a good weapon, and indeed plenty of Sunday supplement writers seemed to get hysterical over it, claiming that an ounce or so of the substance would be enough to kill every man, woman, and child on earth. Mathematically that might be true, said Fox, but it was of no account if you couldn't physically parcel out a minute portion of that ounce to each of those persons one by one. A bare mathematical possibility, in other words, was not the same thing as a genuine material prospect. "There were over one hundred billion bullets manufactured during the

World War—enough to kill the entire world fifty times," Fox said. "But a few of us are still alive."

But for all the cold water he threw on the idea of biological warfare in general, even Leon Fox had to admit that there was one biological agent out there that approximated to a high degree what could be called the "perfect military pathogen." This was anthrax.

Anthrax was a spore-forming microbe, meaning that when the bacillus was thrust into unfavorable conditions it curled itself up in a tiny ball and built around its outer surface a capsule that amounted to a hard hide. Such spores were known to be remarkably stable and resistant to the destructive influences of light and heat, and they could remain that way, with no loss of virulence, for a period of many years.

"These spore-forming invaders are a real problem," said Leon Fox. "We cannot dismiss anthrax so readily."

He also made one other concession, concerning bubonic plague. Even though, because of the boomerang problem, it was of no use in close quarters on the battlefield, plague could still be used, he said, "to harass civil populations." This would be true especially if the attacker could leave the area right after introducing the microbe.

He even had an idea about how to do this: "It may be possible for airplanes flying low to drop recently infected rats."

Leon Fox's piece was published in the March 1933 issue of *Military Surgeon* under the title "Bacterial Warfare: The Use of Biologic Agents in Warfare." Shortly after it appeared in English, a Japanese translation was prepared in Tokyo, where it was read by one Shiro Ishii, a physician in the Imperial Japanese Army.

Ishii was about the same age as Fox, and was also a major in his country's Army Medical Corps. However, Ishii was not as skeptical about the idea of germ warfare as Fox was. In fact, he regarded Fox's piece as "fantastic" and "not based on scientific facts."

Ishii's own view was that germ warfare was a distinct possibility. Why had it been outlawed by the 1925 Geneva disarmament convention, he reasoned, unless it posed a realistic threat to modern armies? Organized states did not go to all the trouble of banning forms of warfare that had little or no chance of working, but on June 17, 1925, in Geneva, representatives of twenty-nine nations (including the United States) had signed a "Protocol

for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare."

Gas warfare, Ishii knew, had caused a million casualties in World War I. Although bacteria had never been used as weapons, it was obvious they could do a lot of damage. Every military physician understood that during all the wars of past history, more men had been killed by disease than by actual battle. Malaria, dysentery, cholera, typhus, bubonic plague, and other diseases had devastated countless armies. Why couldn't a field commander capitalize on that fact, turning nature's own prefabricated agents of destruction into controlled and directed offensive mechanisms?

Ishii had gotten some firsthand experience of the murderous potential of epidemic diseases when in 1924 he waded into an outbreak of an unknown pathogen on the Japanese island of Shikoku. Patients were losing weight, shaking with chills, and many became partially or totally paralyzed by the infection. Before long, 3,500 people had died of severe brain inflammation.

Much later, the cause was found to be Japanese B encephalitis virus, a microbe that was transmitted to humans by mosquitoes. The outbreak had natural causes and had not been artificially induced. Still, the epidemic was exactly what a germ warfare attack would look like: a strange disease appearing out of nowhere all at once, swamping the health care system and leading to many casualties. It was a formative experience for Shiro Ishii.

As a person, Ishii was overbearing and generally obnoxious. At Kyoto Imperial University, where he'd gotten his medical degree in 1920, he made a habit of coming into the lab late at night, running through a succession of test tubes, beakers, and other lab glassware, and then leaving the mess for others to clean up. Nevertheless, he ingratiated himself with his superiors, married the university president's daughter, and fathered a large brood. He spent his after-hours in bars and geisha houses, having a whale of a time. He had a mesmerizing effect on people, even strangers, and was said to have a hypnotic appearance.

In 1928, Shiro Ishii left Japan and toured the world, heading south to Singapore, then west to Ceylon, Egypt, Greece, Turkey, then moving systematically through Europe, hardly missing a single country. He crossed the Atlantic, visited the United States and Canada, and returned to Japan via Hawaii. A raft of legends soon sprang up about him. One dating from this period claims that he lived in Boston for a time and studied germ warfare at MIT, but MIT had no such program.

Two years later Ishii was back in Japan and working as professor of immunology at the Tokyo Army Medical College. While there he made his one positive contribution to military medicine, inventing a ceramic filter for water purification. The filter removed all kinds of impurities—bacterial, viral, or chemical—without boiling or any sort of chemical treatment.

Such a device, if it worked, would be a boon to modern armies, saving them from recurrent epidemics of waterborne diseases. Supposedly, Ishii performed live demonstrations of his device by urinating into the filter and drinking the output, and there was a legend that he repeated this display before Emperor Hirohito and invited him to sip the discharge. The filter was apparently a success because both the Japanese Army and Navy adopted it for field use, and a Tokyo firm manufactured it in various sizes, paying Ishii substantial royalties in the process.

By 1931, then, Ishii was a miracle man who strode into breaking epidemics, had circled the globe, invented an appliance that purged water of evil influences, and got rich on the proceeds. So when he gave impromptu lectures about the advantages of using germs as weapons, people paid attention. Indeed, his reasoning appeared to be unanswerable: microbes made people sick and killed them, and they did so reliably and according to the known laws of microbiology. Germs were invisible, cheap, and easy to grow in quantity. Why not utilize their offensive potential? And why not make him, Shiro Ishii, leader of the whole project?

In 1932 the Japanese Army gave Ishii a research laboratory at the Army Medical College in Tokyo, a bacterial production facility in Harbin, China, and a test site in the nearby rural village of Beiyinhe. Three separate institutions devoted to biological warfare research and all of them under the control of the same man, Shiro Ishii.

And all of it while Leon Fox insisted that germ warfare was a pipe dream.

In August 1933, a year after Shiro Ishii became the emperor of Japanese germ warfare, and the same year in which Leon Fox published his piece dismissing the notion, the Germans were staging a series of practical, hands-on biological warfare experiments in the ventilation shafts of the Paris Metro and in the tunnels of the London Underground—if an article that appeared in a staid British periodical *The Nineteenth Century and*

After could be believed. The piece, "Aerial Warfare: Secret German Plans," by the British journalist Wickham Steed, published in the July 1934 issue, told an amazing story.

Recently, by means he did not specify, Steed had received a cache of secret German documents. One was a memorandum allegedly written in Berlin in July 1932, by an unidentified official in the gas warfare division of the German War Office. The document described how bacteria then known as *Micrococcus prodigiosus* (later renamed *Serratia marcescens*) were commonly used in medical schools to demonstrate the airborne transmission of infectious diseases. The *Micrococcus prodigiosus* bacteria, thought to be harmless to humans, had a bright red hue—on culture plates they appeared as tiny red specks—and so to provide an object lesson in how bacteria could float through the air, a medical school lecturer would place a small quantity of the stuff in his mouth, mix it with his own saliva, and then proceed with the day's talk. At the end, the speaker would collect the culture plates that he'd earlier placed at various points around the room and incubate them overnight. Next day, lo and behold, fresh new colonies of the red bacteria had grown up on the culture plates. The conclusion was obvious for all to see: if the lecturer had been ill with tuberculosis or some other communicable disease, the causative agents would be flying around the room and infecting everyone within range.

The other lesson was that *Micrococcus prodigiosus* microbes made excellent biological tracers, and could be used to track air currents in places other than in medical school lecture halls. That gave the German gas warfare official an idea: Why not use that same bacillus to trace the airflow patterns into and throughout the subway tunnels of London and Paris? Then you'd know the probable results of spraying the subway air vents with chemical gases or pathogenic bacteria. The memo concluded, "If these bacilli could be successfully rained down from an aeroplane, with sufficient concentration, from various heights and in varying conditions of wind and weather, etc., and, as in the case of the medical demonstrative experiments just mentioned, could be caught by culture plates on the ground, then one could study at one stroke, aerodynamically and meteorologically, not only bacteriological but also chemical spraying."

The subways could be prime targets in a future war, especially if Londoners and Parisians flocked to the tunnels during air raids. With the intake air contaminated by anthrax or other bacteria, the underground refuge would be converted into an incubator of a mass epidemic.