PANDORA'S GAMBLE

LAB LEAKS, PANDEMICS, AND A WORLD AT RISK

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CHAPTER 1

Martyrs to Science

U.S. Army Biological Laboratories
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At first, Sherwood Davis[1] tried to ignore the headaches. He could not afford to be sick, especially not with a baby on the way.

Each morning, well before dawn, he would quietly climb out of bed to get ready for work, trying not to wake his wife, Geraldine, who was seven months pregnant. She would need to be up soon enough to get to her own job.

The couple lived in a two-story frame house in Bartonsville, Maryland, a historically Black community where Davis grew up. He was the son of a sharecropper and from a young age had learned the importance of hard work.

Their neighborhood was just three miles southeast of downtown Frederick, Maryland. It still had a rural feel, even though the community was only about an hour from the nation's capital. The Monocacy River flowed just a few blocks away from their house.

Landing a job as a dishwasher a few years earlier at the U.S. Army's Camp Detrick on Frederick's northwest side had been a huge opportunity for Davis. The hours were early and long, starting at 5:30 a.m., but the pay was better than he could hope to get anywhere else.[2]

Of course, that was because of the risk.

Davis wasn't washing dishes in the base's cafeteria. He was cleaning and disinfecting specimen plates, beakers, tubes, and other glassware inside Camp Detrick's high-security biological research laboratories. In addition to studying germs, the scientists there were leading the U.S. government's

efforts in an international biological arms race that escalated during World War II.

By 1950, most everyone in the Frederick area had some idea of what went on at Camp Detrick, even if the residents didn't know the specifics of the secret work. Detrick was home to the U.S. Army Biological Laboratories, and at the end of World War II the U.S. government had disclosed publicly that the army had been developing biological weapons, a revelation that generated significant news coverage.[3]

In 1943 the military had converted a small airport[4] on the outskirts of Frederick into a sprawling base for scientific research. The base brought an influx of workers—not just military officers and troops, but also numerous civilian scientists who arrived with their families.

Until 1969, when President Richard M. Nixon ordered the end of the United States' offensive biological weapons program and only allowed research considered to be defensive, Camp Detrick's civilian and military workforce was creating batches of toxins, anthrax, and other bacteria and figuring out ways to turn them into bombs and other weapons. The goal was to counter what the U.S. saw as threats posed by enemy states[5] like Germany, Japan, and later the Soviet Union.

But it took a lot more people than just the scientists in their white coats to operate these laboratories.

The high-tech equipment and buildings required ongoing maintenance and repair. Reports on experiments had to be typed. Floors needed to be mopped. Lab animals had to be fed, their cages cleaned, and their spent carcasses disposed.

So the labs also employed scores of support staff like Davis. And their jobs were far riskier than most knew.

Until now, Davis had avoided becoming infected with any of the dreaded diseases that were the focus of the base's work. But recently he wasn't feeling well.

Maybe he just had a cold or the flu? It was November, after all.

The headaches had started about a week earlier, a few days after Davis celebrated his forty-fifth birthday.

It didn't seem like a big deal at first.

As the days went by, though, he started having chills and muscle aches. Then the fevers began.

By the time he felt sick enough to go to the station hospital at Camp Detrick, an infection had been taking hold inside his body for what had probably been weeks. As teams of doctors drew blood and tried to determine whether he had been sickened by one of the base's deadly microbes, his fever spiked to 104°F.[6]

The report of Sherwood Davis's hospital admission on November 20, 1950, recorded under his full given name of William S. Davis, joined a growing pile of similar reports being investigated by the Safety Division of the U.S. Army Biological Laboratories.

He would soon become one of more than 145 Detrick lab workers[7] with confirmed lab-acquired infections during 1943–1950. In these first several years, there were no recorded deaths.

While some of the lab-acquired infections were minor, many caused serious illnesses that resulted in workers being hospitalized for days or weeks at a time. The fortunate ones eventually recovered completely. Others, however, ended up with chronic infections or on permanent disability.

The mounting human toll weighed heavily on Dr. Arnold Wedum, the safety division's director, who would later be hailed as the father of modern biological safety.[8,9]

Wedum arrived at Camp Detrick in 1946.[10] He and his safety team had methodically documented and studied the extraordinary number of ways that bacteria and viruses could get out of their laboratories and spread infection among those who never knew they were at risk. Wedum's team also pioneered many of the cornerstone biosafety practices still used today to contain microbes in laboratories throughout the world.

Wedum had a PhD in bacteriology and also a medical degree from Northwestern University, a background that allowed him to understand both how biological research was conducted in the lab and the serious health impacts of laboratory-acquired infections.

In the four and a half years since he left a career in academia as an

assistant professor of bacteriology, Wedum had been on a crusade at Camp Detrick to eliminate lab accidents and infections.

He knew from personal experience the life-changing impact of occupational illnesses.

His wife, Bernice, a physician and medical researcher, had contracted tuberculosis from a patient during her medical training while the couple lived in Cincinnati. It had been a crushing setback after she had become one of only two women[11] to receive medical degrees in her class of seventy-seven graduates from the University of Cincinnati College of Medicine in June 1941.

Nearly a decade later, she was still battling the disease and eventually needed surgery to remove part of one lung.[12] It was one more hurdle for her as a woman in science trying to pursue her own research into rheumatic heart disease while helping raise the couple's two young children.

In his new job at Camp Detrick, Arnold Wedum made it his mission to search for clues about how each person had become infected in the hope of finding ways to prevent other lab workers from being exposed in the future.

Much of what is known today about how biological research laboratories should safely work with dangerous microbes can be traced to the work of Wedum and his colleagues. They did groundbreaking studies to determine who at Camp Detrick—and at labs across the United States and abroad—was getting sick and why.

Their work revealed the kinds of activities that were most likely to allow deadly microbes to escape the laboratories where they were being studied, infecting people who had no idea they were being placed at risk. And by the 1950s, they had helped create futuristic devices and safety concepts that are still considered best practices today.

Along the way, Wedum also learned that keeping workers safe in biological research laboratories was far more difficult than protecting the safety of workers in chemistry, radiological, or engineering labs.

"Medical personnel as a rule tend to be more reluctant than, for instance, engineers or chemists to enter into a professionally planned safety program that involves critical scrutiny of the entire research process," Wedum would later tell a group[13] of occupational safety experts in 1964.

Part of the challenge was the invisible threat from bacteria and viruses.

The microbes couldn't be seen with the naked eye and signs of their attack might not appear for days or weeks. Even then, infections were often difficult to prove as having been occupationally acquired, especially if symptoms were flu-like and mild.

But there was another, even bigger challenge, he found. It was the pervasive culture of self-sacrifice and resistance to safety measures among many of the researchers drawn to work with dangerous microbes.

They didn't want safety getting in the way of their science.

Arnold Wedum inherited safety oversight of a research program that had been quickly launched in 1943, during World War II, amid the growing threat of biological warfare by Germany and Japan.

It was a concern fueled in part by the use of biological agents[14]—including cholera, dysentery, and anthrax—by the Japanese military. (At the end of World War II, an investigation revealed that Japan's biowarfare program had also conducted deadly experiments[15] on prisoners of war, many of them Chinese nationals, including exposures to aerosolized anthrax.)

The possibility of a biological attack on the U.S. seemed urgent and real for those working at Detrick's secret, high-security labs.

In 1942 a committee of experts, convened by the National Academy of Sciences at the request of Secretary of War Henry L. Stimson, said their review found[16] that the use of bacterial weapons was "entirely possible, even probable," and that the country must take actions to develop both offensive and defensive measures.

The United States had already faced some biowarfare plots during World War I, including an effort[17] by German agents in 1915 to infect horses and cattle with deadly bacteria, including anthrax, as the animals were about to be shipped from U.S. ports to battlefields in Europe.

With recent advances in microbiology, the experts warned about the potential for larger scale attacks on U.S. civilians that could range from contaminating water and food supplies to spreading organisms from airplanes, bombs, or missiles.

Dozens of organisms showed potential to be used by enemies, the experts warned. They included the bacteria that cause typhoid, dysentery,

brucellosis, plague, and cholera, and viruses that cause various types of encephalitis, smallpox, yellow fever, and psittacosis.

These lists of pathogens contributed to the research agenda for Camp Detrick's secret labs.

Fortunately, the deadly organisms studied during the base's early history generally only caused infection via direct contact with the microbes—such as by inhaling bacteria-laden dust or drinking contaminated water. They weren't capable of easily spreading from person to person and causing a chain-reaction pandemic.

From the beginning, Detrick's labs had a safety program. It was established by Order No. 1[18] on May 17, 1943. But initially much of the research that focused on growing and testing dangerous microbes was done on open benchtops.[19] In those days, microbiology labs looked a lot like chemistry labs—even though the hazards were different.

As a result, Detrick's lab workers during World War II fell ill at alarming rates.

Depending on the organism being studied, 13 percent to 48 percent of the lab workers ended up becoming infected, Major Harold V. Ellingson, the post surgeon[20] at Camp Detrick's hospital, estimated in one internal army report.[21]

What he didn't point out is that many of them were women.

The labor shortage during World War II had created job opportunities for millions of women, including in Camp Detrick's laboratories, where they worked in both civilian and military roles, such as through the Women's Army Corps and the Navy's WAVES program.

One of the first Detrick workers to be stricken with a documented lab infection was Dr. Elizabeth M. Smadel, who became ill in April 1944, the safety division's case records show.[22,23,24]

Smadel, a pathologist, was hospitalized for six days with what the records say was a mild case of a disease called tularemia, one of several being explored as a biological weapon.

She was among seventy workers infected during 1944 and 1945[25] with a wide range of organisms, including those causing anthrax, glanders, valley fever, brucellosis, and psittacosis. These were microbes that in nature

primarily sickened livestock and other animals but that also could cause disabling or deadly disease in people.

The tularemia labs had the highest number of workers with documented infections during the war years: twenty-five. And at least twelve were women.[26]

Tularemia, with a long connection to warfare, was an obvious pathogen for Camp Detrick to study. The bacterium *Francisella tularensis* causes disease in many kinds of animals, especially rabbits, muskrats, prairie dogs, and other rodents.

Sometimes an accident in the tularemia lab preceded an infection, such as when Eleanor G. Chapman in 1945 accidentally spilled a specimen of the bacterium two weeks before she developed a fever and other symptoms. Chapman had to be hospitalized twice and needed five months to recover.

Most of the time, however, there was no obvious cause of the infections, which left workers battling extreme fatigue, fevers, and other symptoms, often for weeks or months.

Ruth Doiron, a young army recruit working as a lab tech, was hospitalized with tularemia for ten days in 1944. Years later, Doiron, under her married name Ruth D. Herring, would be credited[27] with assisting Henry T. Eigelsbach with critical research at Camp Detrick that led to the development of a live tularemia vaccine.

Lab tech Ruth A. Penfield, who had enlisted[28] in the Women's Army Corps in 1942, needed to be hospitalized for about three weeks because of her tularemia infection, as did lab techs Alice H. Klauber and Alice L. Devine.

Mary P. Clapp, a 35-year-old scientist, suffered a severe tularemia infection that invaded her lungs, making it impossible for her to work for three months. Jeanne R. Smith,[29] a 24-year-old bacteriologist, had such a severe case, possibly from exposure to aerosolized bacteria, that it took nine months for her to recover.

The work in Detrick's labs was "as dangerous and important as actual combat,"[30] said Cornelia "Cora" M. Downs, who took a leave from her position as a professor of bacteriology at the University of Kansas to help lead Detrick's tularemia research.

Downs had been studying tularemia since 1929, an expertise that

started when a Kansas doctor sought her help identifying the source of an infection in a man who developed lesions after killing rabbits for food.[31]

She went to Camp Detrick in the summer of 1943 and was there during many of the war years.[32] "We worked on all diseases we thought might be used against us," Downs said.

The research resulted in significant scientific advances, but it came at a cost.

"In spite of preventive measures a high percentage of the workers became infected but none of them died," Downs said in a 1946 news article.[33]

Infections didn't have to be fatal to be devastating for Detrick's lab workers.

That was especially true for those infected with *Brucella* bacteria, which in nature tended to sicken people who drank contaminated raw milk[34] from infected cattle or goats.

Of seventeen Detrick lab workers infected with *Brucella* during the war, at least nine became permanently disabled or required medical discharge,[35] the safety division's records show.

In one dramatic case, the navy had to send an emergency flight to Mexico City to evacuate[36] a lab tech who had gone there to visit her father in September 1945. Lupe M. Zarraga, a navy WAVE stationed at Camp Detrick's labs, began feeling ill during the visit. In the weeks before her trip, a mishap with a syringe had resulted in her face being sprayed with infectious fluid[37] containing *Brucella* bacteria.

Zarraga ultimately required months of hospitalization.