

A Brief History of Anthrax

Anthrax is a zoonotic disease (one shared by animals and humans) whose causative organism is *Bacillus anthracis*. Primarily a disease of herbivorous animals, anthrax appears in humans in several different forms: cutaneous anthrax, pulmonary anthrax, and intestinal anthrax with meningial anthrax being a complication of inhalation, gastrointestinal or cutaneous anthrax. Gastrointestinal and meningial anthrax are extremely rare and have never been documented in the United States. Although anthrax has been known since antiquity, it was not always clearly distinguished from other diseases with similar manifestations. Scholars have characterized the fifth and sixth biblical plagues as well as the “burning plague” described in Homer’s *Iliad* as anthrax. However, it was Virgil (70-19 BC) who provided one of the earliest and most detailed descriptions of an anthrax epidemic in his *Georgics*. Virgil also noted that the disease could spread to humans.

Over the next fifteen hundred years, Europe witnessed sporadic outbreaks of anthrax, with the most acute outbreaks occurring in fourteenth-century Germany and seventeenth-century Russia and central Europe. Despite the threat these outbreaks posed to livestock, it was only in 1769 that Jean Fournier classified the disease as anthrax or *charbon malin*, a name undoubtedly derived from the black lesions characteristic of cutaneous anthrax. Fournier also noted a link between those who worked with raw animal hair or wool and susceptibility to anthrax.

In 1850, Pierre-Francoise Olive Rayer and Casimir-Joseph Davaine reported the presence of “small filiform bodies” in the blood of anthrax-infected sheep. Five years later, Franz Aloys Antoine Pollender confirmed this discovery and speculated that these bodies might cause anthrax. In 1858, Freidrich August Brauell noted that these “small filiform bodies” never appeared in healthy animals or in animals infected with diseases other than anthrax. Brauell also noted that pregnant sheep who were infected with anthrax did not transmit the disease to their fetuses.

By the mid 1870s, most researchers believed that anthrax was an infectious disease but there was still disagreement as to its specific cause. In 1876, Robert Koch, a Prussian physician, isolated the anthrax bacillus and pointed out that the bacillus could form spores which remained viable, even in hostile environments. According to Koch, “this remove[d] all doubt that *Bacillus anthracis* is the actual cause and contagium of anthrax.” Shortly after this, John Bell linked anthrax with “wool sorter disease” and developed a procedure to disinfect wool.

William Greenfield was the first to immunize livestock successfully against anthrax in 1880. However, credit for the use of a live vaccine against anthrax is usually given to Louis Pasteur who tested a heat-cured vaccine on sheep in 1881. Celebrated in the contemporary French press, Pasteur’s vaccine solidified his status as one of France’s greatest scientists. By the late twentieth century, extensive animal vaccination programs led to an overall decline in anthrax although the disease still occurred in poor and unstable regions (between 1978 and 1980, for example, a civil war in Zimbabwe caused a breakdown in veterinary care which then resulted in an anthrax epidemic which spread from animals to humans).

Without the vaccine, animals are highly vulnerable to this disease, which makes it an extremely effective form of biological warfare. During World War I, German agents were sent to five neutral countries (Romania, Spain, Norway, the United States and Argentina) with instructions to infect animal shipments sent to the Allies. Targeted animals included sheep, cattle, horses, mules, and, in Norway, reindeer. Animals were infected either by having anthrax injected directly into their blood or by being fed sugar laced with anthrax.

In the inter-war period, attention shifted to human anthrax and its potential as a biological weapon. Although the Geneva Protocol of 1925 prohibited biological weapons, several nations, including the United States, experimented with anthrax during the 1930s and 1940s. In the late 1930s, the Japanese Imperial Army performed covert experiments on anthrax and began deploying biological weapons in Manchuria. During World War II, American, British and Canadian laboratories began developing biological weapons, especially anthrax. By 1944, the Allies had developed thousands of anthrax bombs. Hitler had forbidden biological weapons research; however, the Nazis did conduct anthrax and biological weapons research at a small secret facility in Poland. Following World War II, the Americans and British continued to research anthrax and its potential for biological warfare, with the American program being centered at Fort Detrick, Maryland. In 1969, Richard Nixon limited biological weapons research to defensive purposes, saying “mankind already carries in its own hands too many of the seeds of its own destruction.”

Throughout the 1950s, the Communicable Disease Center (later re-named The Centers for Disease Control and Prevention) investigated outbreaks in Pennsylvania, Colorado, North Carolina, New Hampshire, and Louisiana. CDC’s goal was fivefold: first, to discover the cause of anthrax among workers in wool and animal hair industries; second, to determine the particle size of anthrax-contaminated aerosols in industry; third, to assess the effectiveness of an anthrax vaccine for humans; fourth, to study the epidemiology and epizootiology of anthrax in selected outbreaks and fifth, to collect and study different strains of *Bacillus anthracis*. These studies were concentrated in Pennsylvania.

Anthrax outbreaks occurred throughout the 1950s. In 1955, five human cases occurred within a three-month period at a mill in Monroe, North Carolina; the source of the disease was ultimately traced to a shipment of wool from Iran and Iraq. In 1957, nine human cases occurred at a mill in Manchester, New Hampshire; four workers ultimately died of inhalation anthrax (nine years later a worker at machine shop across from the mill died of inhalation anthrax). The New Hampshire mill was sealed in 1968 and ultimately decontaminated in 1971.

According to CDC, the last case of inhalation anthrax in the United States before 2001 occurred in 1976. A craftsman working with imported and infected yarn in California died as a result of the disease. Before 2001, the last case of cutaneous anthrax in the United States occurred in 2000. A 67 year old resident of North Dakota who participated in the disposal of five cows infected with anthrax contracted the cutaneous form of the disease. Upon being treated with antibiotics, the individual recovered.

Treatment for anthrax has varied. In 1903, a major breakthrough occurred when anthrax was successfully treated with serum therapy. But severe adverse reactions to this treatment were not uncommon, with the result that serum therapy was replaced by antibiotics in the 1940s. Since then, antibiotics have been the primary form of treatment.

In 1970, the Food and Drug Administration licensed an anthrax vaccine (the first human vaccine, a live spore vaccine, had been developed in the Soviet Union in 1943).

Two years after the development of the American vaccine, the Biological Weapons Convention (BWC) forbid development, production, stockpiling or retaining biological agents “that have no justification for prophylactic, protective or other peaceful purposes.” Ultimately 140 nations endorsed the BWC.

Several nations have, however, continued to research anthrax as a biological weapon. This was graphically demonstrated by the April 1979 anthrax outbreak in the Soviet city of Sverdlovsk (now Yekaterinburg). Soviet officials insisted that the outbreak was caused by tainted meat and that fatalities

were limited to sixty-four people. American intelligence sources claim the death toll reached a thousand and that the aerosolized anthrax originated in a military compound. Records from this outbreak were destroyed in 1990 but the consensus is that the outbreak *was* a result of biological weapons research. Recent evidence also indicates that Russian scientists may have been experimenting on an anthrax strain which would be resistant to antibiotics.

In the 1980s, Iraq bought anthrax from the American Type Culture Collection (Maryland). The 1995 defection and debriefing of a key Iraqi official provided western intelligence experts with evidence of Iraq's biological weapons program and its production of 8,500 liters of anthrax.

Since the Gulf War, American troops have been vaccinated against anthrax. Although only 0.007% of those vaccinated have suffered adverse reactions, there has been resistance to vaccination. The complex nature of the vaccine (six inoculations over 18 months with annual boosters) has made public health officials reluctant to endorse vaccinations for the general public.

Alexandra M. Lord, Ph.D.
Staff Historian
Office of the Public Health Service Historian
Prepared December 2001.

Suggested Sources:

Carter, K. Codell, "The Koch-Pasteur Dispute on Establishing the Cause of Anthrax," *Bulletin of the History of Medicine*, Spring, 1988, Vol. 62, No. 1, p. 42-57.

Cieslak, Theodore J. and Eitzen, Edward M., "Clinical and Epidemiologic Principles of Anthrax" *Emerging Infectious Diseases*, Vol. 5, No. 4, July-August, 1999, p. 553-555.

Guillemin, Jeanne, *Anthrax: The Investigation of a Deadly Outbreak* (University of California Press, Berkeley, 1999).

Knduson, Gregory B., "Treatment of Anthrax in Man: History and Current Concepts," *Military Medicine*, Vol. 151, February, 1986, p. 71-77.

Pile, James; Malone, John; Eitzen Edward and Friedlander, Arthur, "Anthrax as a Potential Biological Warfare Agent," *Archives of Internal Medicine*, Vol. 158, March 9, 1998, p. 429-434.

Wilkinson, Lise, "Anthrax" *The Cambridge World History of Human Disease* (Cambridge University Press, Cambridge, 1993), p. 582-584.