Biological Weapons

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The idea of biological warfare, that is the use of living pathogens for hostile purposes, is not new. The earliest recorded use of biological warfare occurred in the 14th century —before microbes and had been discovered and people still believed that "demons" caused disease. In 1346, the Tartar Army catapulted plaque-ridded bodies over the walls of Kaffa (Ukraine). After the fall of Kaffa, survivors escaping the fallen city introduced plague into Europe. Thus began the plaque pandemic of 1348-1350.

In 1925, more than 100 countries agreed not to use biological warfare. Not long after that, however, bacterial bombs containing *Yersinia pestis* were used in attacks on China during the Sino-Japanese Water (1937-1945).

The U.S. Epidemic Intelligence Service (EIS) was formed in 1951, just after the start of the Korean War, as an early warning system against biological warfare. Since then, EIS officers ("disease detectives") have been important in combating epidemics and tracking outbreaks of disease.

During the 1940s through the 1960s, research on biological weapons was conducted in several countries including the United States and the United Kingdom. Countries that had a "no first use" policy developed weapons as a deterrent to potential aggressors and also did research on weapons to develop vaccines or treatments as defenses against the possible use of a biological weapon. To determine how a biological weapon would spread, in the 1950s, the U.S. army sprayed *Serratia marcescens* over San Francisco and Panama City and Key West, Florida. One outcome of this test was that 11 people became ill and one man died from *S. marcescens* infections.

In 1972, nearly 100 countries agreed to not even possess biological weapons. In 1979, *Bacillus anthracis* was being produced in Sverdlovsk (Soviet Union) when an explosion blew the *B. anthracis* into the air; this resulted in 1000 deaths in a two week period.

Historically, biological weapons have been associated with military action, but toward the end of the 20th century, biological agents were used against an unsuspecting civilian population. In 1984, a religious cult attacked the people of The Dalles, Oregon by intentionally contaminating food in restaurants and supermarkets with *Salmonella enterica*. And, in 2001 someone used the U.S. Postal Service to spread *Bacillus anthracis* in New York City and Washington, D.C. This gave rise to a new term, bioterrorism, to describe the use of a biological agent to intimidate or coerce a government or group.

One of the problems with bioweapons is that they are alive and so their impact is difficult to control or even predict. They could affect civilians, they could be transmitted to civilians in the attacking country by wind, by vectors, or by escaping refugees. They might cause an epidemic that would linger after hostilities, spread to neighboring countries as happened in Europe in 1346, and might damage livestock and other animals.

Some thought has also been given to the use of bioweapons that target food crops or livestock. Although the weapon might have the immediate effect of debilitating the target country, there are potentially devastating ecological consequences if such as pathogen escaped to wild, native plants or animals.

Clostridrium botulinum toxin, although a potent toxin, has limitations as a weapon: it must be delivered via food or water supplies, and it is not communicable. The ideal bioweapon should be disseminated by aerosol and spread efficiently from human to human, cause a debilitating disease, and it should not have a readily available treatment. Lists of potential biological weapons

usually contain the organisms shown in tables 1 and 2.

Early warning systems such as DNA chips or recombinant cells that fluoresce in the presence of a bioweapon are being developed. New vaccines are being developed and existing vaccines are being stockpiled for use where needed. When the use of biological agents is considered a possibility, military personnel are vaccinated if a vaccine exists.

The current plan to protect civilians in the effect of an attack with a microbe is illustrated by the smallpox preparedness plan. It is not practical to vaccinate everyone against smallpox. Smallpox vaccination was discontinued when the naturally occurring disease was eradicated because the vaccine does have a risk of complications, including death. Additionally, there are people who should not receive the vaccine (people with AIDS, some cancer patients, organ transplant recipients, and people with allergy-induced dermatitis). The government's current strategy against a smallpox outbreak is known as "ring containment." It consists of identifying people with the infection and vaccinating everyone whom has had contact with them. This procedure was used between 1966 and 1980 during the campaign to eradicate smallpox. People were vaccinated in villages where smallpox occurred, then people in neighboring villages, and so on.

Cultures of microbes have been relatively easy to obtain. The cultures used in your classes were probably purchased from the American Type Culture Collection (ATCC). However, weapons-grade cultures are special preparations and designed to withstand drying and ultraviolet radiation with uniform particles between 1 μm and 10 μm for easy distribution through the air. These preparations are usually available only in high-level security labs. It might not be possible to stop all wars, but the public health system was able to respond to the 2001 anthrax threat and is improving its ability to respond to bioweapons.

Table 1. Bacteria
Bacillus anthracis
Brucella spp.
Chlamydia psittaci
Clostridium botulinum toxin
Coxiella burnetii
Franciscella tularensis
Rickettsia prowazekii
Shigella spp.
Vibrio cholerae
Yersinia pestis

Table 2. Viruses
"Eradicated" polio and measles
Encephalitis viruses
Hemorrhagic fever viruses (Ebola, Marburg, Lassa)
Influenza A (1918 strain)
Monkeypox
Nipah
Smallpox
Yellow fever