transmissible to humans. An expert in coronaviruses, she served on the World Health Organization study of the SARS coronavirus.

What we know about livestock behavior and its use in preventing cruelty and promoting humane treatment, especially during slaughter, has been created by animal scientist Temple Grandin. Born of a wealthy Boston family, she used her autism to understand the animal’s response to pain. Named one of 2010’s one hundred most influential people in the world by *Time* magazine, and elected to the American Academy of Arts and Sciences and National Women’s Hall of Fame, Grandin has changed the way commercial livestock are handled and processed.

Hannah Carey, professor in the School of Veterinary Medicine at the University of Wisconsin and an expert on the gut microbiome during mammalian hibernation, was elected to the presidencies of the American Physiological Society and FASEB—the Federation of American Societies for Experimental Biology—a conglomerate of twenty-nine scientific groups with 130,000 members worldwide.

Nutritionist Catherine Woteki had worked at the Universities of Maryland and Nebraska and was dean of Agriculture and Life Sciences at Iowa State from 2002 to 2005, when she left to be the chief scientist for the U.S. Department of Agriculture from 2010 to 2015, with responsibilities for the Research, Education and Economics unit, which administered the Agricultural Research Service, National Institute of Food and Agriculture, the Economic Research Service, and the National Agricultural Statistics Service, as well as the National Agricultural Library and the National Arboretum. She was elected to the Institute of Medicine and was a major force in nutrition, food safety, and agricultural risk policy for two decades. Woteki was fired by President Trump, who nominated a radio talk show host as her replacement as chief scientist.

38. BIOPOLITICS

The Biological Weapons Convention of 1972—its official title was The Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons and on Their Destruction—was designed as a supplement to the 1925 Geneva Convention, which prohibited the use but not possession or development of the weapons
of biowarfare. Submitted by the British, the Biological Weapons Convention treaty was eventually ratified in 1975 by 22 governments and later signed by 103 nations, including the U.S. and the Soviet Union. The Nixon government ratified the Biological Weapons Convention and was an honorable force behind the disassembly of the offensive wing for germ warfare at Fort Detrick.

The U.S. biological warfare lab at Fort Detrick had already been disenfranchised in 1969 by President Nixon’s resolution that “the U.S. shall renounce the use of lethal biological agents and weapons, and all other methods of biological warfare.” Pathogens causing anthrax, botulism, and plague, as well as those of wheat stem rust, rye stem rust, and rice blast, were destroyed. Nations that signed the treaty were to do likewise, including the Soviet Union. Many of the buildings at Fort Detrick that were vacated after the Biological Weapons Convention was ratified were transformed into the new Frederick Cancer Center. The defensive Walter Reed biowarfare unit that remained was reconstituted as the U.S. Army Medical Research Institute of Infectious Diseases—USAMRIID—and it assumed control of some of the empty buildings.

In the mid-1980s, articles had begun appearing in the Soviet veterinary journals reporting an anthrax outbreak among livestock. In the spring of 1979 there had been a deadly anthrax outbreak during which large numbers of sheep and cattle had died in clusters around Sverdlovsk, a city of 1.2 million people east of Moscow. Information gleaned by Western scientists from the medical reports and from seminars given by Soviet physicians indicated that humans had also died of anthrax: 79 people had developed gastrointestinal anthrax, with 64 deaths; 17 had developed cutaneous anthrax with no deaths.

The Soviet government-controlled press reports included information that patients had developed intestinal anthrax after eating contaminated meat and cutaneous anthrax after contact with diseased farm animals. The reports did not tell the reader that the geographic areas affected were close to a Soviet military base in Sverdlovsk. Experts in North America and Europe suspected that a major cover-up of the anthrax outbreak might have been orchestrated through destruction of reports by veterinarians and physicians, and that the public explanation from the Soviet government that meat from anthrax-infected animals had been sold privately and was the source of anthrax was a hoax. Debates appeared in the Western press about whether these cases were natural or accidental and, if the latter, they had resulted from activities prohibited by the Biological Weapons Convention of 1972.
To the scientific community on the outside, the real cause was both clear and ominous: *Bacillus anthracis* had been released accidentally by Military Compound 19, the Soviet germ warfare lab in Sverdlovsk, which was suspected to be secretly and illicitly involved in research on agents of biological warfare. The covert research exposed by this event placed in jeopardy any agreement to destroy weapons for biological warfare.

One group of American scientists, headed by Harvard professor Matthew Meselson, approached the problem indirectly by collecting information on disease incidence, geographic topography, temperature, wind patterns, particle size, and military bases. Epidemiologists noted that during the first week of April 1979, livestock, mostly sheep and swine, had died of anthrax in villages located along a narrow zone that extended from the military microbiology compound in the northern end to the end of the city limits two and a half miles to the south. The wind patterns and ambient temperatures told the story. The scientists concluded that the outbreak in sheep was an aerosol of anthrax bacilli that began in Compound 19, that prevailing wind patterns had blown it in a narrow zone, and that the outbreak had occurred on April 2. Similarly, of the seventy-seven tabulated human patients, most had lived and worked in the southern area of the city and some at Compound 32, an army base in the affected area.

In a 1989 scientific meeting in France, Russian microbiologist Vladimir Pasechik defected to the British embassy in Paris. Angered that he had been forced to work at Biopreparat on weaponization and missile aerosols of plague bacteria, Pasechik spilled the beans to British intelligence officials on the Soviet biowarfare program.

Mikhail Gorbachev, as head of state of the Soviet Union from 1988 to 1991, added two new words to workaday English: *perestroika* (restructuring) and *glasnost* (openness). The changes he made led both to freedom and the end of the Cold War and to dissolution of the Soviet Union. They also led to food shortages, rationing, and the awakening of long-suppressed nationalism. Glasnost also confirmed an astounding story of biological weapons research that had been revealed to U.S. Intelligence by Russian veterinarians and medical pathologists.

In May 1992 after the Soviet collapse, Gorbachev’s successor, Boris Yeltsin, when asked about the anthrax event was quoted as saying, “The KGB admitted that our military developments were the cause.” Sverdlovsk is now known by its prerevolutionary name of Ekaterinburg, the area where, years before, Czar Nicholas and his family were brutally murdered by the Soviets. Compound 19
was a military microbiology facility on the outskirts of the city. The Soviet government announcement in 1979 that it had been developing an improved vaccine against anthrax but knew of no escape of *Bacillus anthracis* was a lie. Local public health records of the epidemic had been confiscated by the KGB.

Colonel Kanatzhan Alibekov, the former physician and first director of Biopreparat who had overseen the Soviets’ biowarfare program, emigrated to the United States in 1992. Becoming a U.S. citizen and taking the new name Ken Alibek, he confirmed all suspicions about the Sverdlovsk incident. Alibek worked as a biodefense contractor, testifying later that the Iraqi weapons of mass destruction had probably not been completely destroyed, testimony that would play a key role in President Bush’s decision to invade Iraq.15

The 1990s also opened communication with two Russian pathologists, Faina Abramova and Lev Grinberg, who had carried the heavy workload of autopsies during the Sverdlovsk anthrax epidemic and who had first concluded that all their cases had died of inhalational anthrax. Before they could be published, the autopsy reports had been confiscated by Soviet government officials and further efforts on reporting had been suppressed. But Drs. Abramova and Grinberg hid their personal notes, photographs, and microscopic slides among ancient papers and debris. After the collapse of the Soviet Union, when a team of American scientists came to their city, their materials were retrieved, reviewed by the Americans, and reported in the Russian medical literature.16

**THE USAMRIID AT FORT DETRICK** was one of the few places in the world that could handle BL4 agents—the lethally dangerous human pathogens that are highly infectious with a high fatality rate and for which there is no vaccine, therapy, or cure. USAMRIID’s contributions to national and global protection have been enormous. Its vaccine to protect against Venezuelan equine encephalitis quelled an outbreak in Texas in 1971 that affected animals and humans. When Rift Valley fever broke out in Egypt in 1977, the USAMRIID vaccine was used to protect people at high risk, including soldiers of the United Nations Peacekeeping Force, laboratory workers, and research workers at risk of the disease they work with such as vaccines for Ebola hemorrhagic fever.

USAMRIID became the reference laboratory for the World Health Organization and a collaborator with the Communicable Disease Center in Atlanta to deal with global diseases; the complex in Frederick, Maryland, houses a sixteen-bed research ward and isolation facilities to deal with extremely dangerous human pathogens. A veterinarian, Colonel David L. Huxsoll, was commander of the institute from 1983 to 1986. Huxsoll had graduated from veterinary school at the University of Illinois and had a PhD in microbiology from Notre Dame. A career military officer, he commanded a staff of six hundred, including twenty-six veterinarians, twenty physicians, and nearly one hundred research scientists. A national asset, USAMRIID acts as an authority in the panic that develops in any incident of biowarfare. A major goal of any biowarfare attack is the public panic that follows. Wild statements by those involved, multiple hypotheses by the press, and quotes from incompetent “experts” all required that the authoritative source of USAMRIID be available.17
Nancy Jaax, a veterinary pathologist, was the chief of the Pathology Division at USAMRIID from 1989 to 2000, where she began investigating Ebola virus. Ebola virus and its cousin, Marburg virus, are classed as lethal BL4 agents. In October of 1989, when monkeys began dying at a primate quarantine facility in Reston, Virginia, it was Nancy Jaax who identified the causal agent as a unique relative of the highly dangerous Ebola virus. Turns out that this new “Reston virus” was nonlethal to humans, but the furor it created was memorialized by Richard Preston, author of the 1992 *New Yorker* article “Crisis in the Hot Zones” and the 1994 best seller *The Hot Zone*. The book was the basis for a movie, *The Hot Zone: A Terrifying True Story*, and a National Geographic series by the same name.

In 1991, expert inspection teams were sent to investigate Iraq’s capacity to produce weapons of mass destruction. The choice to lead the biological warfare inspection team of thirteen members going to Iraq was the Army’s expert on biological warfare defense in the Veterinary Corps, Colonel Huxsoll. The Iraqis readily admitted to the inspection team that they had operated a biological weapons research center at Salman Pak, twenty-two miles southeast of Baghdad, with units working on anthrax, botulism, and *Clostridium* bacteria but had shut it down. They had been afraid that it would be bombed. During its two-week stay, the team inspected ten sites, including vaccine production facilities, pharmaceutical plants, R&D labs with fermentation capabilities, and units designed to allow work with agents hazardous for animals and humans. No evidence of biological weapons production was uncovered.

In early August 1999, Tracey McNamara, veterinary pathologist at the Bronx Zoo, began noticing dead crows on the zoo’s grounds—unusual because crows are roadkill consumers and resistant to many avian diseases. Sending samples to the New York State Department of Environmental Conservation, she waits several weeks before being told there was only evidence of “metabolic bone disease.” Turns out, NYSDEC had been receiving an unusually high number of dead crows since early June. Its “wildlife pathologist,” concerned about pesticides, was able to determine that the birds were not dying from any of several common problems but could not identify a clear cause—political speak for unable to make a diagnosis. Perhaps this was because NYSDEC lacked expertise: its “pathologist” was not adequately trained in either veterinary medicine or pathology.
On Monday, August 23, the chief of infectious diseases at Flushing Hospital in Queens called the New York City Department of Health to report an unusual number of patients dying of encephalitis, most with an unusual complaint of muscle weakness. A week later, samples of brain tissue and blood are sent to the CDC’s Division of Vector-Borne Infectious Diseases in Fort Collins, Colorado; on September 8, the CDC announced the cause of deaths in New York City as St. Louis encephalitis virus, the most common mosquito-borne disease in the nation. The CDC had been unable to isolate a virus from the tissue samples, but there were anti-flavivirus antibodies in the blood serum, and slides of brain tissue had reacted positively in immunolabeling tests. The diagnosis, although incorrect, led officials at the New York City Department of Health to begin mosquito control efforts.

In the Bronx Zoo, flamingos, cormorants, and other species were being found dead in their cages. Doing autopsies, McNamara found hemorrhages in the brain and dead Purkinje cells—neurons in the cerebellum that control movement and balance—and there were areas of damage in the heart, kidney, liver, and intestine. The dead necrotic areas in the organs were typical of viral-induced damage, and no bacteria were found in histologic sections of the damaged areas. She ran through the viral diseases that killed birds quickly. Newcastle disease and influenza were at the top of the list, but those were respiratory diseases, and there were no signs of damage to the lungs; the Bronx Zoo had flocks of chickens and turkeys in its petting zoo and they were not dying. The virus was killing only new-world birds—from North and South America. Eastern equine encephalitis was also at the top of McNamara’s list, but the zoo’s old-world emus, exquisitely sensitive to EEE, were healthy. So, what was it?

Thinking her dead birds might be dying of a zoonotic disease, McNamara sends samples to the U.S. Geological Survey’s National Wildlife Health Center in Madison, Wisconsin, and telephones the wildlife pathologist at the New York State Department of Environmental Health. She also contacts the CDC’s Division of Vector-Borne Infectious Diseases in Colorado, telling them of her concerns that the virus killing her birds is related to the same agents causing encephalitis in humans; she was told that they had identified the New York City human outbreak as St. Louis encephalitis virus and did not have time to work on a “veterinary disease.”

McNamara sent tissue samples of the dying birds to the USDA’s National Veterinary Services Laboratory in Ames, Iowa. She requested that any suspect
virus be examined by electron microscopy—finding viral particles of 40 nm diameter would strengthen the link between the bird and human outbreaks (since eastern equine encephalitis is 60 nm). Within a few days, a poultry virologist had isolated a virus from the suspect tissues. On September 15 he calls McNamara, telling her that the virus was a 40 nm flavivirus that did not cross-react in tests for any of the viruses in the group that caused disease in animals in the U.S. He recommended that since they did not have test antigens for viruses that affected only humans, she should pursue efforts to find precisely what flavivirus this might be.

It was a serious matter: the dangerous members of the flavivirus group included the viruses that caused yellow fever, dengue fever, Japanese encephalitis, West Nile fever, and several other rare flaviviruses of African origins—many of them capable of causing catastrophic illness in humans. McNamara was frightened, reasoning that one could not be sure that this rapidly spreading virus might infect humans (including technicians in her laboratory), or worse, that it had been weaponized as part of some scary bioterror program.

With the National Veterinary Services Laboratory information at hand, McNamara called Colorado and was again rebuffed; a technician tells her in a condescending tone that they had no interest in her birds or her samples and that they had “little faith” in the quality of work done in a veterinary laboratory, and suggested that the NVSL had isolated a contaminant virus. McNamara begged him to reconsider, with explanations that birds in her zoo, known to be susceptible to St. Louis encephalitis virus, were not dying, that serum from flavivirus patients are notoriously cross-reactive with related viruses in the flavivirus group, and that this disease had the potential for incredible human death loss. A second rebuff.

Frustrated with disinterest from the CDC and the incompetence of the state’s “wildlife pathologist” laboratories, McNamara called the USAMRIID at Fort Detrick in Maryland. There, virologists ruled out both St. Louis encephalitis and eastern equine encephalitis and called the results in to CDC in Colorado. Retesting their samples, they found only West Nile virus, one they had never encountered in North America. West Nile virus had been first isolated from humans it had killed in Uganda in 1937 and had periodically spread to West Asia and the Middle East. Could West Nile virus be killing birds and humans in New York—an idea the CDC had rejected? But their diagnosis didn’t fit: St. Louis encephalitis virus did not kill birds. Perhaps West Nile was the culprit.
in both humans and birds. The virus isolated in Iowa was sent to the CDC in Colorado, where it was confirmed to be West Nile virus.

The discovery that the outbreak was West Nile fever had immediate responses from public health units. This was a disease that had never been reported in North America, and its spread would kill not only humans but horses. It also would infect dogs and cats, adding a new dimension of danger. The CDC requested new tissues from McNamara and from the NVSL in Iowa. They isolated West Nile virus.

Finally, the third week of September the puzzle pieces officially came together. On September 27, the CDC confirmed in a news release that a “West Nile-like” virus was responsible for the encephalitis outbreaks in New York City. In the end, thousands of birds had died and, in the sixty-two human cases of West Nile fever, there had been seven deaths. The CDC press release made no mention of the USDA’s National Veterinary Services Laboratory or the Army’s USAMRIID. An official government report compiled in Washington concluded that “better communication is needed” and that “links between public and animal health agencies are becoming more important.”

Again, more political speak: animal health and public health had been one health for a century.

The problem had been that too many governmental agencies did not understand the critical role of surveillance and the art of listening and communication it requires. The West Nile virus episode had been a master class in arrogance, ignorance, and scientific dysfunction of disease surveillance. But it was a minor event compared to what was coming. The same governmental failure to communicate and to meld all parties into a force for surveillance and rapid response was soon surpassed by a far greater debacle: the failure of federal agencies to communicate was greasing the skids for bioterror.

39. BIOTERROR, ANTHRAX, AND THE NATIONAL ANIMAL HEALTH NETWORKS

On September 11, 2001, television videos of the burning of the two towers of the World Trade Center in Lower Manhattan blocked television programs at 9 a.m. The north tower had been hit by American Airlines flight 11 and the south tower by United Airlines flight 175. By mid-afternoon the Pentagon had been attacked by American flight 77, and United flight 93 had crashed in a