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The Pandemic Century

A History of Global Contagion from the Spanish Flu to Covid-19

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About the Author

Mark Honigsbaum is a medical historian, journalist, and author of five books including *The Pandemic Century: One Hundred Years of Panic, Hysteria, and Hubris* and *The Fever Trail: In Search of the Cure for Malaria*. He hosts the podcast series, ‘Going Viral: The Mother of all Pandemics’, marking the centenary of the 1918 influenza pandemic. His TED-ED animation, ‘How Pandemics Spread’, has been viewed more than 2.75 million times. He is a former chief reporter of the Observer and holds a PhD in medical history. He is currently a lecturer at City University, London.

For Mary-Lee

“Everyone knows that pestilences have a way of recurring in the world; yet somehow we find it hard to believe in ones that crash down on our heads from a blue sky. There have been as many plagues as wars in history; yet always plagues and wars take people equally by surprise.”
Albert Camus, *The Plague*, 1947.

PROLOGUE

Sharks and Other Predators

Sharks never attack bathers in the temperate waters of the North Atlantic. Nor can a shark sever a swimmer's leg with a single bite. That's what most shark experts thought in the blisteringly hot summer of 1916 as New Yorkers and Philadelphians flocked to the beaches of northern New Jersey in search of relief from the sweltering inland temperatures. That same summer the East Coast had been gripped by a polio epidemic, leading to the posting of warnings about the risk of catching "infantile paralysis" at municipal pools. The Jersey shore was considered a predator-free zone, however.

"The danger of being attacked by a shark," declared Frederic Lucas, director of the American Museum of Natural History, in July 1916, "is infinitely less than that of being struck by lightning and … there is practically *no* danger of an attack from a shark about our coasts." As proof, Lucas pointed to the reward of $500 that had been offered by the millionaire banker Hermann Oerlichs "for an authenticated case of a man having being attacked by a shark in temperate waters [in the United States, north of Cape Hatteras, North Carolina]"—a sum that had gone unclaimed since Oerlichs had posted the challenge in the *New York Sun* in 1891.[1]

But Oerlichs and Lucas were wrong, and so were Dr Henry Fowler and Dr Henry Skinner, the curators of Philadelphia's Academy of Natural Science who had categorically stated, also in 1916, that a shark lacked the power to sever a man's leg. The first exception to these *known* facts had come on the evening of 1 July 1916, when Charles Epting Vansant, a wealthy young broker holidaying in New Jersey with his wife and family, decided to go for a pre-dinner swim near his hotel at Beach Haven. A graduate of the University of Pennsylvania's class of 1914, Vansant, or "Van" to his chums, was a scion of one of the oldest families in the country—Dutch immigrants who had settled in the United States in 1647—and famed for his athleticism. If he had

any concerns about entering the cool Atlantic waters that evening, they would have been offset by the familiar sight of the beach lifeguard, Alexander Ott, a member of the American Olympic swimming team, and a friendly Chesapeake Bay retriever that ran up to him as he slid into the surf. In the fashion of young Edwardian men of the time, Vansant swam straight out beyond the lifelines, before turning to tread water and call to the dog. By now his father, Dr Vansant, and his sister, Louise, had arrived on the beach and were admiring his form from the lifeguard station. Much to their amusement, the hound refused to follow. Moments later, the reason became apparent—a black fin appeared in the water, bearing down on Vansant from the east. Frantically, his father waved for his son to swim to shore, but Vansant spotted the danger too late and when he was fifty yards from the beach he felt a sudden tug and an agonizing pain. As the sea around him turned the colour of wine, Vansant reached down to discover that his left leg was gone, severed neatly at the thigh bone.

By now Ott was at his side and dragging him through the water to the safety of the Engelside Hotel where his father desperately tried to stem the bleeding. But it was no use—the wound was too deep—and to his father and young wife's horror Vansant died then and there, the first known victim of a shark attack in the North Atlantic. From that moment on, neither would be able to look at Jersey's Atlantic seaboard without imagining the jaws lurking beneath the surface.

They were not alone. Within fourteen days, four more bathers would also be attacked on the Jersey shore and three would be killed, sparking an obsessive fear of "man-eating" sharks[fn1] that persists to this day.[2] It makes little difference that sightings of great whites and other large sharks in the North Atlantic are rare and attacks on swimmers rarer still. Beachgoers now *know* better than to swim too far from shore, and should they become blasé about the risks and dismissive of the menace, there is always a rerun of *Jaws* or an episode of the Discovery channel's *Shark Week* to set them straight. The result is that many children and a fair number of adults are now terrified of playing in the surf, and even those brave enough to venture beyond the breakers *know* to keep a wary eye on the horizon for the tell-tale sight of a dorsal fin.

* * *

At first glance, the New Jersey shark attacks would seem to have little to do with the Ebola epidemic that engulfed West Africa in 2014 or the Zika epidemic that broke out in Brazil the following year, but they do, for just as in the summer of 1916 most naturalists could not conceive of a shark attack in the cool waters of the North Atlantic, so in the summer of 2014 most infectious disease experts could not imagine that Ebola, a virus previously confined to remote forested regions of Central Africa, might spark an epidemic in a major city in Sierra Leone or Liberia, much less cross the Atlantic to threaten citizens of Europe or the United States. But that is precisely what happened when, shortly before January 2014, Ebola emerged from an unknown animal reservoir and infected a two-year-old boy in the village of Meliandou, in south-eastern Guinea, from whence the virus travelled by road to Conakry, Freetown, and Monrovia, and onward by air to Brussels, London, Madrid, New York and Dallas.

And something very similar happened in 1997 when a hitherto obscure strain of avian influenza, known as H5N1, which had previously circulated in ducks and other wild waterfowl, suddenly began killing large numbers of poultry in Hong Kong, triggering a worldwide panic about bird flu. The great bird flu scare, of course, was followed by the panic about Severe Acute Respiratory Syndrome (SARS) in 2003, which was followed, in turn, by the 2009 swine flu—an outbreak that began in Mexico and set off an alarm about the threat of a global influenza pandemic that saw the drawdown of stockpiles of antiviral drugs and the production of billions of dollars' worth of vaccines.

Swine flu did not turn into a man-eater—the pandemic killed fewer people globally than common or garden strains of flu have in the United States and the United Kingdom most years—but in the spring of 2009 no one knew that would be the case. Indeed, with disease experts focused on the re-emergence of bird flu in Southeast Asia, no one had anticipated the emergence of a novel swine flu virus in Mexico, let alone one with a genetic profile similar to that of the virus of the 1918 "Spanish flu"—a pandemic that is estimated to have killed at least 50 million people worldwide and is considered a byword for viral Armageddon.[fn2]

* * *

In the nineteenth century, medical experts thought that better knowledge of the social and environmental conditions that bred infectious disease would enable them to predict epidemics and, as the Victorian epidemiologist and sanitarian William Farr put it in 1847, “banish panic.” But as advances in bacteriology led to the development of vaccines against typhoid, cholera, and plague, and fear of the great epidemic scourges of the past gradually receded, so other diseases became more visible and new fears developed. A good example is polio. The month before sharks began attacking bathers on the Jersey shore, a polio epidemic had broken out near the waterfront in South Brooklyn. Investigators from New York’s Board of Health immediately blamed the outbreak on recent Italian immigrants from Naples living in crowded, unsanitary tenements in a district known as “Pigtown.” As cases of polio multiplied and the papers filled with heart-breaking accounts of dead or paralyzed infants, the publicity prompted hysteria and the flight of wealthy residents (many New Yorkers headed for the Jersey shore). Within weeks, the panic had spread to neighbouring states along the eastern seaboard, leading to quarantines, travel bans, and enforced hospitalizations.[3] These hysterical responses partly reflected the then-prevalent medical conviction that polio was a respiratory disease spread by coughs and sneezes and by flies breeding in rubbish.[fn3]

In his history of poliomyelitis, the epidemiologist John R. Paul describes the epidemic of 1916 as “the high-water mark in attempts at enforcement of isolation and quarantine measures.” By the time the epidemic petered out with the cooler weather in December 1916, 27,000 cases and 6,000 deaths had been recorded in twenty-six states, making it the world’s then-largest polio outbreak. In New York alone there had been 8,900 cases and 2,400 deaths, a mortality rate of around one child in four.[4]

The scale of the outbreak made polio appear a peculiarly American problem. But what most Americans did not realize is that a similarly devastating outbreak had visited Sweden five years earlier. During that outbreak, Swedish scientists had repeatedly recovered polio virus from the small intestine of victims—an important step in explicating the true aetiology and pathology of the disease. The Swedes also succeeded in culturing the virus in monkeys who had been exposed to secretions from asymptomatic human cases, fuelling suspicion about the role of “healthy carriers” in the preservation of the virus between epidemics. However, these insights were ignored by leading polio experts. The result is that it was not until 1938 that

researchers at Yale University would take up the Swedish studies and confirm that asymptomatic carriers frequently excreted the polio virus in their stools and that the virus could survive for up to ten weeks in untreated sewage.

Today, it is recognized that in an era before polio vaccines, the best hope of avoiding the crippling effects of the virus was to contract an immunizing infection in early childhood when polio is less likely to cause severe complications. In this respect, dirt was a mother's friend and exposing babies to water and food contaminated with polio could be considered a rational strategy. By the turn of the nineteenth century, most children from poor immigrant neighbourhoods had become immunized in exactly this way. It was children from pristine, middle-class homes that were at the greatest risk of developing the paralytic form of the disease—people like Franklin Delano Roosevelt, the thirty-second president of the United States, who escaped polio as a teen only to contract the disease in 1921 at the age of thirty-nine while holidaying at Campobello Island, New Brunswick.

* * *

This is a book about the way that advances in the scientific knowledge of viruses and other infectious pathogens can blind medical researchers to these ecological and immunological insights and the epidemic lurking just around the corner. Ever since the German bacteriologist Robert Koch and his French counterpart, Louis Pasteur, inaugurated the "germ theory" of disease in the 1880s by showing that tuberculosis was a bacterial infection and manufacturing vaccines against anthrax, cholera and rabies, scientists—and the public health officials who depend on their technologies—have dreamed of defeating the microbes of infectious disease. However, while medical microbiology and the allied sciences of epidemiology, parasitology, zoology, and, more recently, molecular biology, provide new ways of understanding the transmission and spread of novel pathogens and making them visible to clinicians, all too often these sciences and technologies have been found wanting. This is not simply because, as is sometimes argued, microbes are constantly mutating and evolving, outstripping our ability to keep pace with their shifting genetics and transmission patterns. It is also because of the tendency of medical researchers to become prisoners of particular paradigms

and theories of disease causation, blinding them to the threats posed by pathogens both known and unknown.

Take influenza, the subject of the first chapter. When the so-called "Spanish flu" emerged in the summer of 1918, during the closing stages of World War I, most physicians assumed it would behave in a similar way to previous flu epidemics and dismissed it as a nuisance. Few thought the pathogen might pose a mortal threat to young adults, much less to soldiers en route to the Allied lines in northern France. This was partly because they had been informed by no less an authority than Koch's protégé, Richard Pfeiffer, that flu was transmitted by a tiny Gram-negative bacterium, and that it would only be a matter of time before bacteriologists trained in German laboratory methods had manufactured a vaccine against the influenza bacillus, just as they had against cholera, diphtheria, and typhoid. But Pfeiffer and those who put their faith in his experimental methods were wrong: influenza is not a bacterium but a virus that is too small to be seen through the lens of an ordinary optical microscope. Moreover, the virus passed straight through the porcelain filters then used to isolate bacteria commonly found in the nose and throat of influenza sufferers. Although some British and American researchers had begun to suspect that flu might be a "filter-passer," it would be many years before Pfeiffer's misconception would be corrected and influenza's viral aetiology divined. In the meantime, many research hours were wasted and millions of young people perished.

However, it would be a mistake to think that simply knowing the identity of a pathogen and the aetiology of a disease is sufficient to bring an epidemic under control, for though the presence of an infectious microbe may be a necessary condition for ill health, it is rarely sufficient. Microbes interact with our immune systems in various ways, and a pathogen that causes disease in one person may leave another unaffected or only mildly inconvenienced. Indeed, many bacterial and viral infections can lie dormant in tissue and cells for decades before being reactivated by some extrinsic event or process, whether it be coinfection with another microbe, a sudden shock to the system due to an external stress, or the waning of immunity with old age. More importantly, by taking specific microbial predators as our focus we risk missing the bigger picture. For instance, the Ebola virus may be one of the deadliest pathogens known to humankind, but it is only when tropical rain forests are degraded by clear-cutting, dislodging from their roosts the bats in which the virus is presumed to reside between epidemics, or when people

hunt chimpanzees infected with the virus and butcher them for the table, that Ebola risks spilling over into humans. And it is only when the blood-borne infection is amplified by poor hospital hygiene practices that it is likely to spread to the wider community and have a chance of reaching urban areas. In such circumstances, it is worth keeping in mind the view expressed by George Bernard Shaw in *The Doctor's Dilemma*, namely that "The characteristic microbe of a disease might be a symptom instead of a cause." Indeed, updating Shaw's axiom for the present day, we might say that infectious diseases nearly always have wider environmental and social causes. Unless and until we take account of the ecological, immunological, and behavioural factors that govern the emergence and spread of novel pathogens, our knowledge of such microbes and their connection to disease is bound to be partial and incomplete.

In fairness, there have always been medical researchers prepared to take a more nuanced view of our complex interactions with microbes. For instance, in 1959 at the height of the antibiotics revolution, the Rockefeller researcher René Dubos railed against short-term technological fixes for medical problems. At a time when most of his colleagues took the conquest of infectious disease for granted and assumed that the eradication of the common bacterial causes of infections was just around the corner, Dubos, who had isolated the first commercial antibiotic in 1939 and knew what he was talking about, sounded a note of caution against the prevailing medical hubris. Comparing man to the "sorcerer's apprentice," he argued that medical science had set in motion "potentially destructive forces" that might one day usurp the dreams of a medical utopia. "Modern man believes that he has achieved almost completely mastery over the natural forces which molded his evolution in the past and that he can now control his own biological and cultural destiny," wrote Dubos. "But this may be an illusion. Like all other living things, he is part of an immensely complex ecological system and is bound to all its components by innumerable links." Instead, Dubos argued that complete freedom from disease was a "mirage" and that "at some unpredictable time and in some unforeseeable manner nature will strike back."[5]

Yet for all that Dubos's writings were hugely popular with the American public in the 1960s, his warnings of a coming disease Armageddon were largely ignored by his scientific colleagues. The result was that when, shortly after Dubos's death in 1982, the Centers for Disease Control and Prevention

(CDC) coined the acronym AIDS, to describe an unusual autoimmune condition that had suddenly appeared in the homosexual community in Los Angeles and was now spreading to other segments of the population, it took the medical world by surprise. But really the CDC shouldn't have been surprised because something very similar had happened just eight years earlier when an outbreak of atypical pneumonia among a group of war veterans who had attended an American Legion convention at a luxury hotel in Philadelphia sparked widespread hysteria as epidemiologists scrambled to identify the "Philly Killer" (the outbreak initially flummoxed the CDC's disease detectives and it took a microbiologist to identify the pathogen, *Legionella pneumophila*, a tiny bacterium that thrives in aquatic environments, including the cooling towers of hotels). That year, 1976, saw not only a panic over Legionnaires' disease, but a panic over the sudden emergence of a new strain of swine flu at a US Army base in New Jersey—an emergence event for which the CDC and public health officials were likewise unprepared and that would eventually result in the needless vaccination of millions of Americans. And something very similar happened again in 2003 when an elderly Chinese professor of nephrology checked into the Metropole Hotel in Hong Kong, igniting cross-border outbreaks of a severe respiratory illness that was initially blamed on the H5N1 avian influenza virus but which we now know to have been due to a novel coronavirus[fn4] associated with SARS. In that case, a pandemic was averted by some nifty microbiological detective work and unprecedented cooperation between networks of scientists sharing information, but it was a close call, and since then we have seen several more unanticipated—and initially misdiagnosed—emergence events.

This is a book about these events and processes, and the reasons why, despite our best efforts to predict and prepare for them, they continue to take us by surprise. Some of these epidemic histories, such as the panic over the 2014–16 Ebola epidemic or the hysteria over AIDS in the 1980s, will be familiar to readers; others, such as the pneumonic plague outbreak that erupted in the Mexican quarter of Los Angeles in 1924, or the great "parrot fever" panic that swept the United States a few months after the Wall Street Crash, less so. Whether familiar or not, however, each of these epidemics illustrates how quickly the received medical wisdom can be overturned by the emergence of new pathogens and how, in the absence of laboratory knowledge and effective vaccines and treatment drugs, such epidemics have an unusual power to provoke panic, hysteria, and dread.

Far from banishing panic, better medical knowledge and surveillance of infectious disease can also sow new fears, making people hyperaware of epidemic threats of which they had previously been ignorant. The result is that just as lifeguards now scan the sea for dorsal fins in the hope of forewarning bathers, so the World Health Organization (WHO) routinely scans the internet for reports of unusual disease outbreaks and tests for mutations that might signal the emergence of the next pandemic virus. To some extent this hypervigilance makes sense. But the price we pay is a permanent state of anxiety about the next Big One. It's not a question of *if* the Apocalypse will occur, we're repeatedly told, but *when*. In this febrile atmosphere it is not surprising that public health experts sometimes get it wrong and press the panic button when, in reality, no panic is warranted. Or, as in the case of the West African Ebola epidemic, misread the threat entirely.

To be sure, the media plays its part in these processes—after all, nothing sells like fear—but while 24/7 cable news channels and social media help to fuel the panic, hysteria, and stigma associated with infectious disease outbreaks, journalists and bloggers are, for the most part, merely messengers. I argue that by alerting us to new sources of infection and framing particular behaviours as "risky," it is medical science—and the science of epidemiology in particular—that is the ultimate source of these irrational and often prejudicial judgments. No one would wish to deny that better knowledge of the epidemiology and causes of infectious diseases has led to huge advances in preparedness for epidemics, or that technological advances in medicine have brought about immense improvements in health and well-being; nevertheless, we should recognize that this knowledge is constantly giving birth to new fears and anxieties.

Each epidemic canvassed in this book illustrates a different aspect of this process, showing how in each case the outbreak undermined confidence in the dominant medical and scientific paradigm, highlighting the dangers of overreliance on particular technologies at the expense of wider ecological insights into disease causation. Drawing on sociological and philosophical insights into the construction of scientific knowledge, I argue that what was "known" before the emergence event—that water towers and air conditioning systems *don't* present a risk to hotel guests and the occupants of hospitals, that Ebola *doesn't* circulate in West Africa and *can't* reach a major city, that Zika is a relatively harmless mosquito-borne illness—was shown to be false; and I explain how, in each case, the epidemics would spark much

retrospective soul-searching about “known knowns” and “unknown unknowns”[fn5] and what scientists and public health experts should do to avoid such epistemological blind spots in the future.[6]

The epidemics canvassed in this book also underline the key role played by environmental, social, and cultural factors in changing patterns of disease prevalence and emergence. Recalling Dubos’s insights into the ecology of pathogens, I argue that most cases of disease emergence can be traced to the disturbance of ecological equilibriums or alterations to the environments in which pathogens habitually reside. This is especially true of animal origin or zoonotic viruses such as Ebola, but it is also true of commensal bacteria such as streptococci, the main cause of community-acquired pneumonias. The natural host of Ebola is thought to be a fruit bat. However, though antibodies to Ebola have been found in various species of bats indigenous to Africa, live virus has never been recovered from any of them. The reason, most likely, is that as with other viruses that are adapted to their hosts as a result of long evolutionary association, the Ebola virus is quickly cleared from the bloodstream by the bat’s immune system, but not before, presumably, it has been transmitted to another bat. The result is that the virus circulates continually in bat populations, without leading to the destruction of either. A similar process occurs with pathogens that have evolved so as to infect only humans, such as measles and polio, with a first infection in childhood usually resulting in a mild illness, after which the subject recovers and enjoys lifelong immunity. However, every now and again these states of immunological balance are disrupted. This may occur naturally if, for instance, sufficient numbers of children escape infection in childhood to cause herd immunity to wane, or if the virus suddenly mutates, as occurs frequently with influenza, leading to the circulation of a new strain against which people have little or no immunity. But it can also occur when we accidentally interpose ourselves between the virus and its natural host. This is presumably what happened with Ebola in 2014 when children in Meliandou began taunting long-tailed bats roosting in a tree stump in the middle of their village. And it is thought that something very similar may have prompted the spillover[fn6] of the HIV progenitor virus from chimpanzees to humans in the Congo in the 1950s. Tracing the precise genesis of these epidemics is the subject of ongoing research. In the case of AIDS, there is little doubt that the inauguration of steamship travel on the Congo River at the turn of the twentieth century and the construction of new roads and railways in the

colonial period were important contributing factors, as was the greed of loggers and timber companies. However, social and cultural factors also played a part: were it not for the practice of consuming bushmeat and widespread prostitution near the camps supplying labour to the rail and timber companies, the virus would probably not have spread so widely or been amplified so rapidly. Similarly, were it not for entrenched cultural beliefs and customs in West Africa—in particular, people's adherence to traditional burial rituals and their distrust of scientific medicine—it is unlikely that Ebola would have morphed into a major regional epidemic, let alone a global health crisis.

However, perhaps the most important insight medical history can bring is the long association between epidemics and war. Ever since Pericles ordered Athenians to sit out the Spartan siege of their harbour city in 430 BC, wars have been seen as progenitors of deadly outbreaks of infectious disease (this was certainly the case in West Africa in 2014, where decades of civil war and armed conflict had left Liberia and Sierra Leone with weak and under-resourced health systems). Though the pathogen responsible for the plague of Athens has never been identified and perhaps never will be (candidates include anthrax, smallpox, typhus, and malaria), there is little doubt that the decisive factor was the crowding of upwards of 300,000 Athenians and refugees from Attica behind the Long Walls of the Greek city. That confinement created the ideal conditions for the amplification of the virus—if virus it was—turning Athens into a charnel house (as Thucydides informs us, as there were no houses to receive the refugees from the countryside "they had to be lodged at the hot season of the year in stifling cabins, where the mortality raged without restraint"). The result was that by the third wave of the disease in 426 BC, Athens's population had been reduced by between one-quarter and one-third.[7]

In the case of the Athenian plague, for reasons that are unclear, the disease does not appear to have affected the Spartans, or spread far beyond the borders of Attica. But 2,000 years ago, towns and cities were more isolated and there was far less passage of people and pathogens between countries and continents. Unfortunately, this is not the case today. Thanks to global trade and travel, novel viruses and their vectors are continually crossing borders and international time zones, and in each place they encounter a different mix of ecological and immunological conditions. This was nowhere more true than during World War I, when the congregation of tens of thousands of

young American recruits in training camps on the eastern seaboard of the United States and their subsequent passage to and from Europe provided the ideal conditions for the deadliest outbreak of pandemic disease in history.