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The Siren's Song of Avian Influenza

A Brief History of Future Pandemics

> I think there are two camps: "we're all going to die," and "there's nothing to worry about and we don't want to overreact," or "I've got my bird flu plan." But that didn't help with this outbreak. We were too H5 focused, so that when we got this shift, we were uncertain about where to go.
>
> An epidemiologist working in a local Department of Public Health in California

Gene Segment HA. Biological function*: The hemagglutinin gene segment encodes for a surface protein on the influenza virus responsible for attaching it to the host cell. It recognizes the appropriate receptor proteins on the surface of cells and then effectively binds the virus to the host. Changes in the genetic makeup of this segment are closely monitored through surveillance, as any alteration has the potential to affect Influenza A's infectivity and virulence.* Pathographic function*: This chapter analyzes the various historical, biological, and social narratives that bind the 1997 H5N1 outbreak to the 1918 H1N1 pandemic to the 2009 H1N1 pandemic. The result of this merging of time/space—in which the H5N1 virus is transformed into the representative infectious disease agent at the heart of most pandemic planning—is the concept of "bird flu" itself. In effect, this chapter examines how history and biology combine to produce an infective trope of a deadly future influenza pandemic; a specter that is then used effectively by experts to ground further global research, surveillance, and planning programs.*

As late as the summer of 2012, experts involved in the 2009 H1N1 response—social scientists, virologists, epidemiologists, and public health officials alike—continued to share and gather tales of the pandemic. Throughout workshops and debriefings that I observed or guided in my role as a consultant, people rehashed events and decisions in order to comprehend something beyond any individual ken. Maybe if we pooled our resources, the collective logic seemed to go, we might be able to grasp at a larger truth about the effectiveness of and gaps in global public health systems and preparedness. In trying to reconstruct the global pandemic, in all the retellings of its smaller local or national events, we found ourselves grappling with notions of uncertainty and risk (for more on the role uncertainty played in 2009, see chapter 5), problems related to open access to "actionable" information (for more on the problem of the "data deluge," see chapter 6), and the constant, overhanging threat that we might all be eventually either lulled into a false sense of security or pushed into a heightened state of anxiety by listening to *too many* narratives about influenza. In this chapter, I will argue that viruses like influenza hold the promise of ultimate biological knowledge reminiscent of the Greek myth of the Sirens' song, and just as distracting.

Ironically, the Sirens are first depicted as half-human and half-bird—portrayed in early Greek art with the head of a woman and a bird's body and legs. Divine beings who lived on an island in the sea, their singing was so delicious to the ears of men that any who sailed past their island were certain to be lured to their deaths. At their clawed feet lay heaps of skeletal remains, human remnants of those who had heeded the Sirens' call and never returned. The Sirens make two main appearances in Greek mythology: once when Orpheus saves Jason and the Argonauts from sure destruction by playing his lyre to drown out their voices, allowing the Argonauts to safely sail past the island; and again in the *Odyssey*, when the cunning goddess Circe helps Ulysses to escape the Sirens' call by enjoining him to pack his crew's ears with wax. Circe tells Ulysses that he can listen to the song himself so long as he instructs his men to tie him firmly to the mast of their ship and to ignore all his pleas to be unfastened. As they sail past, Ulysses hears the Sirens singing. Edith Hamilton, in her seminal work, *Mythology*, tells us that it was the words of their song that were the most enticing and maddening. The Sirens' song promised

knowledge far beyond man's ken, "ripe wisdom and a quickening of the spirit" (Hamilton 1963, 214). Hamilton asserts that it was this promise of godlike knowledge that lured men to their deaths, not the sheer beauty of the song itself. With access to the Sirens' information, anyone would be able not only to see into the future but to know all things. In other words, all who heard the song would be consummately prepared to act to their best advantage. No wonder, then, that two thousand years after first heard their invitation, the concept of the Sirens' song remains so compelling.

In *The Dialectic of Enlightenment*, Max Horkheimer and Theodor Adorno use the Sirens' song as an allegory for man's desire to triumph over brute nature using scientific reason. For Horkheimer and Adorno, the Sirens' song is representative of an alluring past that threatens to return Ulysses back to a primitive state (2002, 26). The tale of Ulysses and the Sirens, then, is ultimately about the triumph of the mind over art, reason over nature, objectivity over subjectivity, the future over the past. But if Hamilton's view is accurate, the Sirens' song does not just contain all past knowledge, as Horkheimer and Adorno suggest, but all future knowledge as well. The song, then, is enticing because it is *pure knowledge*. It promises a knowledge that allows a perfect rationality; to hear the song is to be able to choose the perfect course of *action*. That is why the myth of the Sirens' song is so perfectly suited to unpacking the various narratives—expert, scientific, personal, cultural, and political—surrounding influenza. Influenza captures the attention of scientists, epidemiologists, public health policy planners, politicians, journalists, and ordinary citizens alike. Its call beckons us into an uncertain future but promises that the knowledge it contains might save us. And yet, as much as the Sirens promise Ulysses "to sing of 'everything,'" in reexamining Homer's original narrative one notices that the Sirens ultimately "sing of nothing other than the fact that they are to sing: a song about itself" (Comay 2000, 36). The Sirens' song, then, is about all future songs; it is the promise of knowledge without the knowledge itself, the choice not necessarily to act but to gather better information to inform future actions.

The promise of ultimate knowledge that the mythological song contains is a ripe allegory for analyzing the modern-day search for scientific knowledge and the promises which such knowledge seems to contain. The various scientific narratives spun about influenza ultimately reflect the larger epidemiological quest for actionable knowledge *before* any

infectious disease pandemic gets under way, flu or not. If we could stop or predict a deadly novel influenza strain before it truly begins, then we might understand enough about all viruses to stop other deadly infectious disease outbreaks. In fact, many experts argue that this is the only way to prevent another deadly pandemic such as the infamous one caused by an H1N1 Influenza A virus in 1918, estimated to have killed up to forty million people,[1] and whose specter continues to haunt (and to taunt) public health. The influenza virus, then, holds out an almost mythlike promise to epidemiologists and virologists everywhere. This chapter, then, is an attempt to unravel the song from its promise, to examine the ways in which the lure of scientific knowledge about deadly strains of influenza steered the ship of public health slightly off course.

The metaphor of the Sirens' song echoes in my analysis below of the different, but overlapping, narratives about influenza, in particular "bird flu." Until the outbreak of H7N9 in 2013, H5N1 was the subtype of Influenza A most commonly referenced as "bird flu" by both the media and experts. The generally accepted stories about the origins of H5N1 from a scientific perspective mirror the more recent cultural, institutional, and political narratives concerning pandemic influenza (or "pan flu") and preparedness told from a macroscopic perspective. Narratives about pan flu are always threefold: biological, historical, and social. Retold in juxtaposition or in close relationship to each other, these layered narratives about H5N1 craft a modern mythical tale about a deadly scourge that never was but soon will be. Stories about pan flu form the basis for a greater understanding of the political ramifications of the global 2009–10 H1N1 pandemic response (as will be discussed in more detail throughout the following two chapters).

In 2009, these narratives mattered more than ever; they aided both experts and "laypeople" in attempts to understand events that never seemed to have a clear-cut beginning or ending. At different locations and times throughout the pandemic, stories I heard and read about influenza seemed to all lack a certain "narrative coherence" (Liu 2002, 102). It was not that the epidemiologists and scientists I talked with did not recollect what actually occurred during the early days and weeks of 2009 or could not tell me "the story," but rather that they often had difficulty narrating smaller instances or moments of decision-making in any kind of "meaningful temporal sequence" (Liu 2002, 102). Their oral retellings of events often jumped back and forth in time and space, with moments and information

all linked together like some kind of aural hypertext (or, to loop back to the last chapter, a type of postcolonial temporality). To understand what was happening as it unfolded in 2009, public health experts often shared stories of their experience with past outbreaks of influenza or SARS in an effort to place uncertain epidemiological information back into some context or relationship to known facts. The stories that people told me were often filled with details that were meant to recreate for me the anxiety, excitement, and frenetic energy of the first few weeks of the pandemic. They were also, as I would come to understand much later, representative of each individual's attempts to better understand and analyze events and actions. Even in 2013, as this book was being revised, stories about the 2009 H1N1 pandemic were, at least from the perspective of a traditional narrative arc, still unfinished.

The unfinished epidemiological narratives about H5N1, H7N9, and H1N1 explored in this chapter are ultimately a type of "technology" (Wald 2008, 19) that crafts and binds together entire populations through the trope of susceptibility. Seen through this lens, tales of a future H5N1 pandemic have helped to construct a truly "global" public health, one in which we see "communicability configuring community" (Wald 2008, 12) on a global scale. Throughout the 2009 H1N1 pandemic, discussions about bird flu's relationship to the circulating virus (both in print and in speech) were at least partially constitutive of the events themselves.[2] Ultimately, I argue that over a decade of prior research, focus on the Influenza A subtype known as H5N1 was as important to the collective understanding of the 2009 pandemic as the H1N1 virus itself.

PANDEMIC!!! The Continually Reemergent Story

Tracking the beginnings—or origins—of our modern fascination with and fear of influenza is, at best, difficult to do. Influenza is an old disease. So, too, our fears about it. Looking specifically at how bird flu came to be at the center of our imaginings about the future shape and scale of pandemics requires that we have flexible concepts of time and space. This is not a linear story that I'm about to tell; past and future collide together in the space of the present. The 1918 swine flu and the future possibility of a bird flu pandemic both played an equal part in how the 2009 H1N1 virus was

conceptualized. In order to track back and forth from 1918 to the future to 2009 and back again, I borrow philosopher Mikhail Bakhtin's concept of the "chronotope" or "time space." In the chronotope, time is "thickened" and space is "responsive to the movements of time" (Bakhtin 1981, 84). To examine how the specter of a global bird flu pandemic influenced preparedness planning in public health and inflected the 2009 H1N1 response, I turn first to an analysis of how our conception of bird flu was shaped by the influenza pandemic of 1918.

Ultimately, and following historian William Cronon, I suggest here that "to recover the narratives people tell themselves . . . is to learn a great deal about their past actions and about the way they understand those actions. Stripped of the story, we lose track of understanding itself" (Cronon 1992, 1369). Without examining the various narratives that people continuously tell about the influenzas of 1918 and 1997, we risk losing a critical part of our understanding of the actions public health experts took during the 2009 H1N1 outbreak. The ultimate effect of the rhetorical entanglement of past influenzas with present-day strains was to erase differences between very distinct influenza viruses, different eras, and discrete places. In essence, public health experts used familiar narratives about 1918 and 1997 to help them make decisions in 2009.

In what follows, I explore how the 1918 H1N1 became linked to the 1997 H5N1 which then became the basis not only for pandemic influenza plans but for fears about the circulating H1N1 subtype in 2009. This past-present-past-future-past looping created a chronotope wherein an influenza pandemic is ever-emergent and ever-present. The 1918 H1N1 Influenza A strain was often discursively entwined with the 1997 H5N1 and the 2009 H1N1 influenza A strains in three overlapping, yet distinct, narratives: biological, historical, and what I will label as "prophetic past-future." And yet, as epidemiologist Stephen S. Morse writes in the preface to the 1993 volume *Emerging Viruses*: "Despite our wish to anticipate emerging diseases, we cannot foretell the future. What we can do is to draw the best inferences possible from past experience; for this, history can be a valuable guide" (viii).

It is the history of the 1918 pandemic that I turn to next, paying particular attention to how the 1918 virus has been used to construct a future H5N1 pandemic. The history of the 1918 virus not only bleeds into our conceptualization of avian influenza but also contaminates our thinking

about possible future pandemics. Since 1997, the historical narrative of 1918 has transformed into the unfinished story of H5N1.

The History/Narrative of 1918

In March 1918, when influenza first broke out among US Army troops stationed in Kansas, World War I had already been raging for three and a half long years. The outbreak of flu, while noted, went largely unremarked until the so-called second wave of the pandemic hit the United States in the fall of that same year. Influenza seems to have been brought back to the country via returning troops aboard a naval vessel that docked in New York City. A newspaper story from October 6, 1918, chronicles one day in the fight against influenza. The *New York Times*'s headline reports sixty-one deaths the day before—an increase over the day before that—and details a new work hours timetable with a listing of shop and school closures. The city requisitioned hospitals in preparation for a large increase in influenza cases and yet the overall tone of the article is confident, not panicked or overly anxious. A spokesperson for the city Health Department is quoted as stating: "I believe the epidemic can be handled without its alarming spread" (*New York Times* 1918). Yet spread it did. In the United States, the "Spanish flu" caused widespread illness and an alarming rate of death in young people (defined as between the ages of twenty and forty). By the end of the third wave of the pandemic, an estimated forty million people worldwide would be dead from influenza and its complications (Taubenberger and Morens 2006, 15).

Scholars who study the 1918 influenza are often puzzled by the relative lack of attention paid to the pandemic—both at the time and for decades afterward. Historian Alfred Crosby refers to it as the "forgotten pandemic" in the title of his recent book on the subject (2003). And yet, as journalism professor Debra Blakely has shown in her recent analysis of over eight hundred *New York Times* articles written about and during the 1918, 1957, and 1968 influenza pandemics, the 1918 pandemic was not—as has been suggested elsewhere—"forgotten" or "ignored" (2003). The newspaper's coverage of the pandemic, according to Blakely, "changed daily," relied heavily on war metaphors to describe public health measures being taken to stave off spread, and depicted officials as "not in control" of the situation. Stories put the blame for influenza equally on health and

government officials. Once deaths from influenza disappeared, so did the news stories. Interestingly, the 1918 pandemic was only labeled as such post hoc—long after deaths had subsided. Before that, throughout the outbreaks and despite reports of influenza worldwide, events during 1918 were referred to as an epidemic. During subsequent pandemics, newspaper articles directly referred to that of 1918 as "the cause for alarm and risk." (Blakely 2003, 889, 893.) So if, as it appears from Blakely's analysis, the 1918 pandemic was reported upon and was never forgotten, what are we to make of its resurgence in the 1970s as a subject for serious academic research and in the 2000s as a topic able to garner both public and expert attention?

Public health scholar Philip Alcabes, in his book *Dread*, discusses how the "Spanish flu" of 1918 was all but forgotten by researchers and nonfiction writers alike (though not by novelists such as Katherine Anne Porter) until the 1970s, when it was resurrected by epidemiologists and virus specialists "who were interested in promoting their theory that devastating flu outbreaks occur every decade or so." Going further, Alcabes argues: "Today, all discussions of flu involve some retrospection on the Spanish Flu epidemic, the rationale for 'pandemic preparedness.' There is an imagined epidemic that carries meanings not self-evident in the original event" (Alcabes 2009, 6). To put it another way, the story of 1918 has been decontextualized from its original meaning and recontextualized (Bauman and Briggs 1990) within present narratives about H5N1 (or, more recently, H7N9) to create an imagined pandemic. It is to this partially reimagined history and wholly imagined future, then, that I turn to next and which will undergird much of the rationale and rethinking for public health response to the 2009 H1N1 pandemic.

The Legacy of 1918

As historian of public health Charles Rosenberg once argued, we are prepared to fear what we have been prepared to see (Rosenberg and Golden 1992, 186). The history of the 1918 pandemic prepared scientists to see—and to fear—the H5N1 outbreak in 1997. It is impossible to say how public health experts might have assessed the threat in the absence of 1918. That is an unworkable conjecture; 1918 has totally saturated the ways in which we conceive of pandemic influenza. So much so that influenza experts

conceive of the 1918 virus as the "mother of all pandemics" (Taubenberger and Morens 2006).

Washington Post journalist Alan Sipress links 1918 to H5N1 in the preface to his book on avian influenza, ultimately arguing that "today we remain closer than we've ever been to a repeat of the Great Influenza of 1918." Sipress reconstructs a conversation he had with Keiji Fukuda, the WHO's Director of Influenza, who explains his own experience during the early outbreaks of H5N1, telling Sipress that "it really brought us back to 1918." (Sipress 2009, 6, 68.) The language used by Fukuda here is especially interesting in that it transports us in time and space. The past here is compressed into the present and stretched out into the future. Indeed, 1918 is often discursively linked to the threat of a future avian influenza pandemic through the specter of H5N1.

However, the 1918 influenza pandemic has not always been of immediate concern to either the public or public health officials (the exception, as highlighted in the section above, being the successive influenza pandemics in 1957 and 1968). The 1918 pandemic was, as it were, rediscovered as a focal point for both anxiety and intensive scientific research. It reemerged along with our fears about calamitous future influenza outbreaks. Pete Davies discusses the lack of funding for influenza prior to 2000 and how experts at the CDC lament that influenza isn't as exciting or fund-worthy as something like HIV (2000). Davies's book is about the search for the 1918 virus in frozen bodies buried deep in the tundra near the Arctic Circle. The 1918 virus is the ultimate Siren in this narrative; it is hoped that by understanding the H1N1 strain that killed millions, scientists might learn something about H5N1. In a book on H5N1, Mike Davis reports that interest in 1918 amped up in 1974, only a few years before the 1976 swine flu pandemic. Davis suggests that pre-1918, flu was "not considered a serious killer" and argues that the memory of 1918 was "repressed" because it was a failure of science. (Davis 2005, 24, 32, 33.) But was the memory of 1918 repressed or was the event itself just forgotten until it was revived by epidemiologists working on influenza in the latter half of the twentieth century?

In her influential book, *The Coming Plague*, journalist Laurie Garrett highlights how the historical influenza pandemic of 1918 influenced decision-making during the 1976 swine flu outbreak. As she argues, public health officials believed that the consequences of being wrong about the

severity of the 1976 virus would be devastating. Although pandemic predictions, as one top epidemiologist explained it, were like "weather forecasts" and "hazardous business," public health experts ultimately decided to err on the side of caution (Garrett 1994, 159–60). The resultant vaccines produced in 1976 caused several cases of Guillain–Barré Syndrome[3] and cost millions of dollars. Ultimately, the scandal caused by the so-called overreaction to the 1976 swine flu would continue to be balanced by fears about a repeat performance of 1918. By 2009, public health officials had become trapped in a need to triangulate between 1918, 1976, and 2003 (the year of the SARS outbreak); it would not be easy to see 2009's influenza outbreak clearly or objectively.

In his book about the 1918 virus, Davies begins the story of the infamous pandemic with a chapter on the 1997 H5N1 outbreak in Hong Kong. In it, the influenza virus is described as a "terrorist." Robert Webster is quoted as being convinced that the H5N1 viral outbreak in Hong Kong in 1997 was like the 1918 H1N1. Keiji Fukuda was also concerned that the situation with H5N1 was similar—too similar—to H1N1. (Davies 2000, 9, 35, 36.) The linking of the two viruses is not accidental, nor is it necessarily evidentiary. The viruses were two different subtypes of the same class of Influenza A viruses, but they were not the same virus. And yet, putting them in juxtaposition caused H5N1 to take on the rhetorical casting of the "new" 1918 H1N1. This was the "same" or a similar threat in a new guise. This type of thinking makes a stronger response to the threat of H5N1 (or any other novel influenza) all the more likely.

The Institute of Medicine utilizes influenza as a case study in how the US system is unprepared for large outbreaks or pandemics. In a pull-out box in *Microbial Threats to Health: Emergence, Detection, and Response*, the specific case of the 1918 influenza pandemic is used to highlight the threat of future pandemics and the need to remake the virus using reverse genetics technology in order to learn more about viral pathogenicity. The institute stresses that a future pandemic is "inevitable" and "overdue," but that—despite pandemic planning—we "remain poorly prepared." (1992, 136–38.) Scholar Gerald Callahan's book on infections (2006) also links the story of 1918 to the threat of a future H5N1 pandemic in a chapter named after influenza's nickname, "The Slate Wiper." The name refers to influenza's ability to "wipe out" millions of humans in one wave, thus "cleaning the slate."

Books targeted at a general audience also seem to tap into this modern fear of bird flu as a "disaster" waiting to happen. In the early 2000s, one medical doctor was so concerned with news reports of avian influenza that he decided to self-publish three separate books on the topic. He argues that we are "in denial" about the threat of bird flu and suggests his books are an attempt to spur action. Woodson avowedly wants to frighten people into preparing for what is, in his opinion, a certain catastrophe (Woodson and Jodrey 2005, 4, 10). The books also rhetorically and scientifically connect the 1918 H1N1 virus to the H5N1 virus, pushing readers to see H5N1 as akin to the worst known pandemic influenza in history. Other authors writing for a general audience take great pains not only to map out what "will" happen during a pandemic, but how to prepare for societal collapse and panic (Fonte 2006, Greene 2006). A slightly more tongue-in-cheek book entitled *The Little Book of Pandemics: 50 of the World's Most Virulent Plagues and Infectious Diseases* (Moore 2007), lists influenza and H5N1 bird flu as plagues number one and two, respectively.

Published in the wake of outbreaks of H5N1 in 2005, such fear-mongering books all capitalize on our collective anxiety about another 1918-sized pandemic by purporting to prepare or educate us for the next "big one." While some are more scientific and scholarly than others, all of these popular accounts of influenza resonate with apprehension on the part of actual scientists and officials about future influenza outbreaks. Things might work out, but then again, they might not. H5N1 could just disappear or become a nonissue; or bird flu could become more deadly and capable of person-to-person transmission and kill up to 30 percent of the global population. Caught between the poles of 1918 and 1997, these authors all suggest that their readers must collectively decide what the real threat or risk posed by H5N1 is. The H5N1 virus is a symbol here of the potential for influenza to decimate the human population. It prepares us to fear, as Rosenberg suggests, what we have been prepared to see.

By the end of journalist Sipress's book on avian influenza, the more recent 2009 H1N1 pandemic has officially begun. After years of chasing after the Siren song of bird flu, it should come as no surprise when officials like the WHO's general director Margaret Chan make specific recourse to the H5N1 threat in their calls to action in 2009 (Sipress 2009, 327). As Sipress's account highlights—and the last section of this chapter will show—the echo of two decade's worth of fears about H5N1 reverberated throughout

the early days of the 2009 H1N1 response. The next section examines how the 1918 and avian influenza strains are interwoven with the 2009 H1N1 virus not only in historical terms, but in biological ones. Biological narratives here link the viral past to the viral future through a viral present.

Connecting Viruses in 1918, 1997, and 2009

Biologically speaking, all pandemic influenza strains are somewhat related to each other, simply in the sense that all pandemic strains "ultimately acquired some or all of their gene segments from the avian IAV gene pool" (Morens and Taubenberger 2010, 327). Chapter 1 examined scientific attempts to understand something more about the class of Influenza A viruses through the construction of genetic phylogeny trees. By comparing the genetic sequences of influenza viruses, virologists hope to unravel the secrets of how viruses work, what makes them more or less pathogenic, transmissible, and deadly to humans. As the evolutionary virologists in chapter 1 caution, while genetic information can tell you a lot about where a virus came from, it cannot tell you much about where it is headed. But that fact doesn't necessarily stop public health experts from trying to extrapolate meaning from such genetic information. In the case of the 2009 H1N1 pandemic, experts wanted to know if the circulating virus shared similar genetic components to other, more deadly, influenza strains. Such knowledge was seen as providing partial answers to questions about how the 2009 H1N1 pandemic might develop, giving decisionmakers access to more actionable information.

Because little was known about the 2009 H1N1 virus, researchers immediately began "looking to the past for clues about the seasonality and geography of pandemic flu, the relationship between the new viruses and existing ones, and the behavior of this new H1N1's parent viruses in swine" (Cohen and Enserink 2009b, 996). A *Science* article published in early May 2009 reported that the 2009 H1N1 strain was "highly similar to a recently reconstructed human 1918 A (H1N1) virus and likely share[s] a common ancestor" (Garten et al. 2009, 197). Another article published in the same journal in May showed that the 2009 virus, despite a lingering and "substantial uncertainty," appeared to have less clinical severity than "the 1918 influenza pandemic but comparable with that seen in the 1957 pandemic." The authors duly warn in their conclusion that the "future

evolution of the transmissibility, antigenicity, virulence, and antiviral resistance profile of this or any influenza virus is difficult to predict." (Fraser et al. 2009, 1557, 1561.) As CDC influenza expert Nancy Cox explained, these findings indicated that the 2009 virus ultimately did not seem to have the "markers of virulence that made the 1918 pandemic strain so deadly." Nevertheless, Cox went on to caution that there was "a great deal that we do not understand about the virulence of the 1918 virus or other viruses" (Silberner and Greenfieldboyce 2009).

One of the commonly discussed biological characteristics of influenza viruses is their ability to replicate much faster than other organisms. The evolutionary pace of H1N1 and H5N1—and, indeed, all Influenza A viruses—is impressively fast. The RNA of influenza is sometimes described as a "careless hack" whose copying mistakes lead to many errors in its millions of replications. These errors and the virus's high replication rate are the very reasons why flu evolves so rapidly. Because of this, influenza is often referred to as a "constantly emerging disease." (Davis 2005, 15, 11.) Influenza's rapid evolution is of concern to public health experts not only because a virus may quickly become more severe or deadly, but because of influenza's attendant facility in hiding from the human immune system, with its ability to develop antiviral resistance. Researchers sequence influenza viruses, in part, to better understand how viruses evolve into deadlier strains. After the 1918 pandemic strain was recovered from the lung tissue of a victim buried in tundra, it was sequenced for one main purpose: to discover what made it particularly catastrophic. Its genetic sequence was—and continues to be—compared to other, present-day virus strains. Sipress reports that influenza experts fear that, since its initial outbreak in 1997, "bird flu has become more like the Spanish flu strain" as it has evolved (2009, 69). The 1918 H1N1 strain has since become the model or standard for deadly flu strains; avian influenza viruses and the 2009 H1N1 virus were compared to the 1918 strain.

And yet, as with the reconstructed 1918 virus, researchers are no closer to understanding the biology of deadly influenza viruses like H5N1. The comparisons are, in essence, unavoidable, despite the lack of biological evidence to link them. As 1918 H1N1 is the only known catastrophic flu strain, what other comparisons—other than to that strain—are even conceivable? Researchers constantly admit that they don't know enough, or don't know much, about what makes any particular Influenza A strain

highly pathogenic or easily transmissible. And as any evolutionary virologist will tell you, genetic markers that are associated with those traits are not necessarily the cause of them (see chapter 1). Correlation is not causation, despite the fact that the genetic makeup of influenza viruses seems to hold out an elusive key to better understanding of how viruses work or how they act "in the wild." As Sipress suggests: "Since the last pandemic in 1968, the revolutionary field of microbiology has indeed succeeded in breaking the genetic code of the microbes that menace us. But laboratory science has still failed to unlock the secrets of how this mercurial agent evolves and mutates, how it strikes its human prey and when" (2009, 239).

Microbiologist Paul Ewald points out the differences between warranted and unwarranted fears about influenza in his 2000 book, *Plague Time*. Warranted fears are due to the fact that certain groups—such as the elderly and children—are more vulnerable to infection and complications. Unwarranted fears stem directly from any comparison to the 1918 pandemic virus. Ewald explains that the rationale for looking for strains with similar hemagglutinin (HA) and neuraminidase (NA)—the two protein molecules that are most visible to the human immune system—is that they provide an easy comparison for virologists. Using them helps to narrow down the search for potentially deadly new strains. But as Ewald argues, similar HA and NA markers between the 1976 H1N1 pandemic strain—a mild one that caused little increase in normal flu fatality rates—and the 1918 H1N1 pandemic strain did not equate to a similarity in severity. Evolutionary virology, he argues, is not the same as biochemical science. As he explains: "The H1N1 marker had been present on dangerous viruses, but there was no reason to think that it made the viruses dangerous—with its high mutation rate, the influenza virus can generate tremendous variation within a matter of weeks while still retaining the same H1N1 marker." Going even further, he argues that modern-day influenza researchers do not use the "evolutionary perspective" correctly and "confuse similarity of hemagglutinin and neuraminidase molecules among different virus strains with similarities in the virulence of these strains." (Ewald 2000, 23, 25.) Despite this, virologists and epidemiologists alike turn to genetic information about viruses to help them understand something more about influenza. The RNA of Influenza A viruses—in particular that of the 1918 virus and the various H5N1 viruses that have been sequenced or genetically modified[4] since 1997—hold a particular fascination for scientists.

These viruses have become the modern-day Sirens of influenza researchers. Experts such as Taubenberger and Morens, in addition to labeling the 1918 virus as the "mother of all pandemics," seek to understand something about the entire class of Influenza A viruses through careful study of the genetic makeup of the 1918 H1N1 virus and the evolution of its descendants. But, as we saw with the evolutionary virologists and their hesitation to use genetic markers to predict the future, knowing something about the past 1918 or current H5N1 or H7N9 viruses does not mean knowing something about their potential futures. But this fact has not prevented experts from wishing it were not so and redoubling research efforts. As Taubenberger and Morens lament, scientists were "not much closer to understanding pandemic emergence in 2006 than we were in understanding the risk of H1N1 'swine flu' emergence in 1976" (2006, 21). Despite not knowing which genetic factors influence virus severity (or cause high mortality), scientists have kept listening to the Siren song of 1918 and H5N1. In 2009, years of focusing on 1918 and worrying about bird flu would come to a head during the first few weeks of a new influenza outbreak.

The Siren Song of H5N1

During the summer and fall of 2009, I often talked to epidemiologists trying to make sense of what had happened during the early days of the Influenza A (H1N1) outbreak that March. Their narratives of events slid back and forth from the present day to their past experiences with other outbreaks, such as SARS in 2003 and H5N1 in the years leading up to the pandemic. As Wittgenstein once noted, if all knowledge is based in experience, then obviously it is our past experience that shapes our certainty about what we know in the present (1969, 35e). Science studies scholar Stephen Hilgartner suggests that events such as the 2009 H1N1 pandemic are not "objective occurrences" at all but rather actions that are constructed through the social dramas of the protagonists directly involved in them (2000, 148). Public health experts involved in the 2009 H1N1 response relied upon past experience to make decisions about the type of threat that the novel influenza virus posed. Knowledge of the 1918 pandemic and uncertainty about the threat of avian influenza impacted the ways in which public health experts could think about the 2009 influenza outbreak. It

is in this sense that the 1918 and 1997 strains of influenza resemble the Sirens; the echoing voices of 1918 and 1997 lured the ship of global public health off its all-hazard course and onto the rocky shores of a milder-than-expected Level 6 influenza pandemic.

An article in *Nature*, written in 2009 during the pandemic, suggested that public health systems were better prepared than they had been due to prior experience with SARS and pandemic planning for H5N1. But the article also admitted there had been "hiccups, due largely to the mismatch between pandemic scenarios envisaged and the one that has arrived." For one, the 2009 pandemic was much milder than the ones most countries had initially planned for, which made the plans less useful for directing action. For another, most non-Asian countries had in place flu plans that conceived of potential threats spreading out of Southeast Asia. When the 2009 pandemic seemed to be developing instead in the United States and Mexico, it had public health officials scrambling to retool their responses. As the *Nature* article suggested, "officials were initially confused about how to implement response plans." That being said, planning for SARS and H5N1 did have some positive effects on the 2009 pandemic: the H1N1 virus was sequenced in record time; information was shared more readily and quickly post-SARS; and vaccines were in production much faster (Hayden 2009 passim, 756 [quotes]).

Throughout the fall of 2009, when I worked inside the CDC, I continually asked people about the early weeks of the response to the pandemic. By their pauses and measured answers, I could tell that some experts felt the initial public health response was less than perfect. A woman who had worked in the Emergency Operations Center (EOC) explained that it was as if no one knew what to do, despite the fact that people inside the agency had been running exercises and drills on the basis of H5N1 for a solid year before H1N1 broke out.

"It was like they all forgot that there were guidelines, that they had practiced everything," she said. "Look, you've got a plan. You know what you're supposed to do."

Her colleague, who had also worked in the EOC during the initial outbreak of H1N1, agreed with her, nodding as she explained that things seemed less organized, less practiced, than at her former job in the military—where people quite literally "knew the drill." In the Air Force, responsibilities during an emergency were known in advance; no one had

to guess what their role would be or think about what to do—they just did it. That hadn't been the case with public health agencies. I told them that they were not alone, that several people from different organizations and agencies had expressed similar feelings and perspectives at debriefings on the pandemic I had attended. At one event, an expert from the WHO admitted she felt like everyone had "reinvented the wheel" when H1N1 happened.

The woman nodded and said, "Yes, that's it. But why? Why reinvent the wheel when you've got a plan right there? You should know what to do."

In point of fact, most public health agencies at the national and state levels not only had pandemic plans already in place, but had also extensively practiced for a future pandemic by running exercises based upon a fictional global outbreak caused by an infectious disease agent resembling H5N1 (a scenario itself partially modeled by using data on the 1918 H1N1 pandemic). Epidemiologists often saw these past exercises as having had positive and negative effects on the events of 2009. On one hand, prior pan flu drills had strengthened relationships among agencies and the individuals working in them; practicing responses to a pandemic had built greater trust between "partner" agencies. On the other hand, exercises and plans that had focused on an H5N1-type pandemic had left many experts feeling underprepared for actual events during the earliest weeks of the 2009 H1N1 outbreak. A flu expert working at the CDC remarked that "We had been preparing for many years for an H5 event, and we had a severity index in place for that, based on cases per death ratio. . . . So what was going on in Mexico, we really didn't have the denominator to calculate severity." A European vaccine research expert explained that before 2009 everyone was "sure" that bird flu would be the next pandemic, and much of the energy on vaccine development had been directed at preparing for H5N1 in particular. A communications expert at the US Department of Health and Human Services, presenting at a conference on H1N1, told the audience that, like everyone else, HHS had planned for the H5N1 virus, coming out of Asia, and thus had been surprised by an outbreak of H1N1 in Mexico. He joked to his (mostly expert) audience that viruses clearly didn't read flu plans. Events in 2009 underscored the need to retool plans based upon the H5N1 model. An expert working in Hong Kong expressed a hope that the lessons of 2009 would be packed back into global pandemic planning in order to strengthen future responses. By 2010, Hong Kong

had already begun to revise its own local plans, he told me, and "the WHO is now undergoing a similar process—they are revising their pandemic plans. Because the current system under the WHO was designed with something like H5N1 in mind, without a factor to account for severity. So I think a new system incorporating severity would be very useful."

When I asked experts if they thought that the lessons from the 2009 pandemic had been learned, most replied in the positive. One of my coworkers at the CDC, Rohit Chitale, explored how past experience could affect action in the present. One of his superiors had watched a good friend die in a hospital in Hong Kong during SARS. Rohit thought that this event had colored the way that this person subsequently performed his job, the way that he envisioned public health's obligations and responsibilities. As Rohit explained, "It's personal for him. You can tell that he responds emotionally. He's seen it up close. I mean, here in the office, we see the reports, and few things scare us—we've seen such a wide range of things. After you've seen what we've seen, you don't get easily disturbed because we put things into the larger context, not focusing on anecdotes or patient-level experience. That's part of why we reacted slowly to H1[5]—it just didn't seem all that bad in comparison. But for some people, it was different. Our boss—some of the other directors—they all thought this was 'the big one'—the global pandemic spread of H5."

At a meeting on influenza inside the CDC later that week, a flu expert maintained that if H1 had been H5, "We all would have been screwed." Someone else then joked that no one cared about H5 anymore. Another person across the room retorted, "It's waiting to bite us in the butt, though, don't worry." Then the entire room erupted in a brief spurt of laughter before going back to their discussion of internationally reported H1N1 case counts.

This insider joke belied the fact that H5N1 was the ghost in the pandemic planning machine. When it came to influenza strains, H5 was the scariest virus of them all. So much so that the virus had indeed become the basis for most public health planning efforts in the years leading up to 2009. As a top influenza expert explained in an effort to justify continued pandemic planning: "So many countries have influenza pandemic plans. It's not a new concept. The global community has benefitted from preparedness activities, simulations. Although they were painful, they were beneficial in helping to prepare us for an event like H1."

If the "working assessment was that this was severe," one expert had explained to me, then H5N1 had been part of the underlying rationale for assuming that the novel Influenza A (H1N1) virus would be severe. It wasn't all about biology, as another expert suggested in a meeting on the 2009 H1N1 response in July of that same year. She remarked that

> We prepared for the worst, but it wasn't as bad as we thought. There were political and legal aspects, the review of the pandemic plan was going on. Technically, if we were going by the books as they were published, we would have been at Level 6 in the first week. We didn't have the definition of sustained transmission, etc., and we had to improvise and were unable to give explanations. Being stuck in those phases just signaled our lack of—I don't know. In this case, we tried to go by the book. It was a political decision, it was not severity.

As this quote suggests, and as virologist Michael Oldstone has argued elsewhere: "The history of virology would be incomplete without describing the politics and the superstitions evoked by viruses and the diseases they cause." Fear and anxiety are "woven into the fabric of the history of viral plagues" (Oldstone 1998, 7). In this case, we might argue that fear and politics and the myth of a deadly H5N1 virus capable of sustained human-to-human transmission were woven into the fabric of pandemic influenza planning and disease outbreak planning in toto.

Nearly all the public health experts I interviewed reported feeling hamstrung by the pan flu plans that were already in place. Even if they had a gut feeling that H1N1 was not going to be a severe flu, the response system was not flexible enough to allow for any easy gradation of risk. All the plans were the same; the choice of responses was inflexible and based upon a severe influenza. An epidemiologist working in Europe expressed her personal opinion that there seemed little scientific rationality behind the WHO's response to the 2009 pandemic. Another epidemiologist based in the United States worried that the prior focus on H5N1 had been too "myopic." A leading influenza expert bemoaned that "what's always disappointed me is that there's all this focus on avian influenza" to the exclusion of other animal-based surveillance (such as surveillance of influenza circulating in pigs). The scientific evidence base for decision-making during an influenza outbreak, almost everyone I knew agreed, was very thin.

Most of the plans had been based on the conception of a future outbreak similar to H5N1, but had used 1918 as a model.

At a conference on the 2009 pandemic response, an epidemiologist working at the international level complained, "Our plans were drafted on the basis of the 1918 pandemic. Do we think of this as evidence-based?"

Another expert, responding to the question, said, "I don't think we have evidence for 1918, and that's why we've been modeling."

"And we are comfortable that the data for those models are good?" the first epidemiologist asked.

After a pause, another expert replied, "I think we're comfortable, but do we have proof? No."

Defending the 2009 response, an influenza expert from Europe said, "The pathogenicity of that virus [1918] was quite scary. We cannot say we don't have some element of evidence. It was different, but it's still valuable."

Other epidemiologists felt that the history of—or what was known about—the pandemic of 1918 was not a "controlled situation" (it had no possibility of having scientific controls on evidence) but gave public health experts some "perspective" on what might happen and what responses might be effective during a similarly severe pandemic. As a result, the plans based on scenarios created by using the 1918 H1N1 and 1997 H5N1 viruses as models weren't wrong per se, but needed to "evolve" along with the pathogen itself. One international expert suggested that the word "plan" was too restrictive; "guide" might have been a better term. No one expected public health experts to follow a plan exactly, but rather to use them creatively as a guide for action.

In essence, pandemic plans were used not only to shape actions but to defend them both ad and post hoc. Narratives about the 1918 pandemic and experiences during the SARS and H5N1 outbreaks were used to guide actions taken during the initial days of the 2009 H1N1 outbreak. As Jürgen Habermas has suggested: "Whenever agents use language to coordinate their actions, they enter into certain commitments to justify their actions (or words) on the basis of good reasons." These commitments, for Habermas, are validity claims, which have a "practical function" to "guide action" of social agents. Agents, such as the epidemiologists discussed here, are committed in advance to providing reasons for their actions during an event such as the 2009 pandemic and thus, these "reasons provide the invisible lines along which sequences of interactions unfold." For Habermas,

one cannot know the meaning of an action unless one knows something about the subjectivity of the agent. Meaning, for Habermas, is intersubjective and not objective, and "shared meanings depend on shared reasons." (Finlayson 2005, 26, 27, 38, 35.) The public health experts above used stories about past and future pandemics to make commitments or stake validity claims about H1N1 in 2009.

Using the myth of Ulysses and the Sirens to talk about rational choice theory, scholar Jon Elster argues that "Societies as well as individuals have found it useful to bind themselves." Binding is an example of people "precommitting themselves" to a certain course of action. By binding themselves, in this case through the use of H5N1 pandemic planning, global public health experts thereby committed themselves to a very specific course of action during the 2009 pandemic. In essence, such acts of "investment" are often irreversible and commit the individuals to a preordained course of action that may cost them in the future. (Elster 1979, 37, 42.)

When the pandemic alarm was sounded in March of 2009, there was only one course of action for most public health experts to follow. Bound by pandemic plans set out in advance by the WHO and agreed upon by all member nations, public health institutions everywhere responded to the mild H1N1 pandemic *as if* it were H5N1. Once the emergency switch had been thrown, it was difficult—if not impossible—to change course. Actions set in motion by pandemic flu plans were carried out long after public health experts realized that the threat from H1N1 was relatively small. But this doesn't necessarily mean that pandemic planning itself was irresponsible or ineffective. As Elster suggests: "The Ulysses strategy is a precaution against inconsistency, not against irrationality; in fact it achieves consistency at the cost of an even larger departure from rationality." The choice to bind oneself ultimately depends on the value being placed on consistency over rationality (1979, 76). Borrowing from Elster, then, I suggest that the price of consistency in response action may have been too high during the 2009 H1N1 pandemic.

To really understand the meaning of actions taken during the pandemic in 2009, however, they must be put in juxtaposition to the history of 1918 and to the imagined future of an H5N1 pandemic. Epidemiologists working on the 2009 response constructed meaning around the novel H1N1 virus based on their shared experience and understanding of influenza. That experience included not only recent events such as the 1997 H5N1

outbreak, but knowledge of past events like the 1918 pandemic. But what kind of experience or meaning can be created from such narratives? In many ways, neither the pandemic of 1918 nor the possibility of a future H5N1 pandemic is ever "finished," and the stories we tell about 1918 and H5N1 are always unfinished narratives. And as they continuously unravel, they consciously and unconsciously drive global public health planning. An epidemiologist in Hong Kong put it thus: "I think that as a public health practitioner, you are only as good as your next epidemic, not your last epidemic. And I think, and to paraphrase Pasteur himself, chance favors the prepared mind. Just because we were prepared this time, perhaps that's why the heavens looked favorably on us. In terms of the biology of the bug and the clinical manifestations, H1N1 was not as severe or fatal as 1918. *But* that does not mean that the next time we're going to be as lucky." Such unfinished narratives of past outbreaks, however, work to partially craft the contours of all future outbreaks.

The Real Effect of Imagined Outbreaks: A Sirens' Song of Certain Risk and Ever-Present Uncertainty

The 1918 H1N1 virus and the elusive and enigmatic H5N1 virus are Sirens that continually sing promises of knowledge—and the possibility for action—to those working within global public health response today. Narratives continuously retold and reconstructed about the real, historical 1918 pandemic and the imagined, future H5N1 pandemic played a very real part in creating the 2009 H1N1 pandemic. In many ways, one cannot know about 2009 without recourse to the 1918 pandemic and the avian influenza outbreaks of 1997, 2003, and 2005. And yet how can one know something about a pandemic as it unfolds or has yet to be and—at least in the case of H5N1—has never been? How do public health experts calculate risk and take actions in the midst of such uncertainty? And, perhaps more importantly, how do we even know what we mean when we use the terms "risk" and "uncertainty" in relationship to influenza?

Scholars of science Michel Callon, Pierre Lascoumes, and Yannick Barthe are careful to articulate the differences between the concepts of risk and uncertainty in their book on decision-making in an increasingly uncertain world. Unhappy with the ways in which the two terms have been

continuously conflated in modern parlance, they suggest that the term risk "designates a well-identified danger associated with a perfectly describable event or series of events." Risks have both objective and subjective probabilities that can be applied to known events: "The notion of risk is closely associated with that of rational decision." In other words, risk can be quantified and qualified. It is knowable. Since risk plays such a pivotal role in "rational choice," it should be reserved for use in situations where actors must choose between several paths of action. In contrast, uncertainty describes an entirely unknowable situation: "We know that we do not know, but that is almost all that we know: there is no better definition of uncertainty." In uncertain situations, then, one must decide without making a "definitive decision." In accordance with the "precautionary principle," precaution in relationship to uncertainty leads to "an active, open, contingent, and revisable approach. It is exactly the opposite of a clear-cut definitive decision." Callon and his colleagues want to be clear, however, about the difference between precaution and prevention. One needs to develop precaution in relationship to uncertainty; prevention is for coping with known risk. In effect, one cannot use prevention to think about uncertain events; for what would be prevented? (Callon, Lascoumes, and Barthe 2001, 19, 20, 21, 191, 192, 195.)

What's worse, expert knowledge—such as epidemiological reports that were broadcast throughout the media during the early days of the 2009 pandemic—can often lack the clarity necessary for communication of risk or uncertainty. Ludwik Fleck, writing about the production of scientific knowledge at the beginning of the twentieth century, asserted that "Certainty, simplicity, vividness originate in popular knowledge. That is where the expert obtains his faith in this triad as the ideal of knowledge" (1979, 115). Epidemiologists want to be certain about risk, to be direct and clear in their communication of that risk, and they desire to create a vivid picture of events. However, as Callon and his colleagues point out, uncertainty does not lend itself to this type of certainty. When it comes to flu, one can be certain only about the continuation of uncertainty. The past is often used as a lens to project risk onto the future, however flawed this procedure might be. As Philip Alcabes quips, "Anxiety is no statistician" (2009, 222).

The problem boils down to this: Prior conceptualizations of a disease entity—such as the influenza virus—seep into modern-day scientific research programs and the collective thinking about that same disease agent.

As Fleck argues, "Concepts are not spontaneously created but are determined by their 'ancestors'" (1979, 20). In the case of the 2009 influenza pandemic, those ancestors were the 1918 H1N1 virus and the 1997, 2003, and 2005 H5N1 viruses. If, as scholars such as Philip Alcabes and Patricia Wald suggest, we are prone to crafting narratives about epidemics, then the stories we tell must also be familiar, or follow along a similar plot line. Even imagined, future outbreaks about deadly influenza must fit the mold in order to be intelligible (Alcabes 2009, Wald 2008).

As I have tried to show, the stories we create about pandemics are always unfinished. They loop back and forth in time and space and weave our fears about death and disease into the fabric of our daily uncertainties. Closing the gaps between reality and mythical tale, the Sirens' song of avian influenza draws us into a deeper dependency on global public health to keep us safe from harm. Or, if not to keep us entirely safe, then at least to alert us, to give us enough warning to protect ourselves. As Philip Alcabes suggests, in the modern age, we "appoint officials to do the imagining for us" (2009, 187), to peer into the abyss of disease and infection and predict what is coming. Epidemiologists become our "soothsayers" (2009, 186) or, to end this chapter where we began it, a collective modern Ulysses strapped to the mast of global public health. We want experts who are able to hear and heed the call of influenza so that they might know our future—and save us from it.