

University of Groningen

Riding the Shi

Voelkner, Nadine

Published in:
International Political Sociology

DOI:
[10.1093/ips/olz016](https://doi.org/10.1093/ips/olz016)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2019

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):
Voelkner, N. (2019). Riding the Shi: from infection barriers to the microbial city. *International Political Sociology*, 13(4), 375-391. <https://doi.org/10.1093/ips/olz016>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.

Riding the Shi: From Infection Barriers to the Microbial City

NADINE VOELKNER
University of Groningen

How can a microbial approach to global health security protect life? Contemporary infection control mechanisms set the human and the pathogenic microbe against each other, as the victim versus the menace. This biomedical polarization persistently runs through the contemporary dominant mode of thinking about public health and infectious disease governance. Taking its cue from the currently accepted germ theory of disease, such mechanisms render a global city like Hong Kong not only pervasively “on alert” and under threat of unpredictable and pathogenic viruses and other microbes, it also gives rise to a hygiene and antimicrobial politics that is never entirely able to control pathogenic circulation. The article draws on recent advances in medical microbiology, which depart from germ theory, to invoke an ecological understanding of the human-microbe relation. Here, while a small number of viruses are pathogenic, the majority are benign; some are even essential to human life. Disease is not just the outcome of a pathogenic microbe infecting a human host but emerges from socioeconomic relations, which exacerbate human-animal-microbial interactions. In a final step, the article draws on Daoist thought to reflect on the ways that such a microbial understanding translates into life and city dwelling.

Any visitor to Hong Kong will realize that disinfection is an urgent and pervasive imperative in contemporary everyday life in this global city. In late 2016, Hong Kong was on the way to fashioning itself an antimicrobial global city. Public signs on multiple surfaces including elevator buttons, escalator handrails, and floor mats duly inform the passer-by of hourly or daily sanitation. At various busy urban spaces, including MTR (metro) stations, walkways, libraries, and office and housing complex receptions, free hand sanitizer dispensers compel the passer-by to engage regularly in the act of public cleansing of the body. Similarly, handbag-sized instant hand sanitizer bottles, readily available at every corner store or supermarket, with promises of killing “99.99 percent of germs”; notices of hand-washing rituals; and the donning of masks by individual city dwellers, remind residents of the private acts of virus and bacteria control. All these practices of cleansing nourish an insidious sanitizing imperative in the defense against epidemic infections deeply enmeshed with the pulsating energies of an ambitious global city. It is the experience and fear of infection and death that accompanied the recent experience of the SARS (severe acute respiratory syndrome) outbreak in 2003, which precipitated this aggressive stance to potential contagions emerging in Hong Kong.¹

¹ According to Ng (2008), SARS in 2003 “left a permanent imprint on many families,” lingering on in the public imaginary in Hong Kong.

Li (2014), a scholar of Asian architecture, suggests that infection control in the form of public hygiene in contemporary postcolonial Hong Kong manifests itself in what he has termed “infection barriers.” These antimicrobial-like—that is, antibiotic- and antiviral-like—physical and mental barriers aim to prevent the virus and other microbes from settling in the city. Basing his interpretation on the traditional conception of the Chinese city, “infection barriers” help him to analyze the historico-aesthetics of the city’s contemporary urban defense against infectious diseases. Li succinctly demonstrates how public hygiene is not only governed through overt public health programs but is *affectively* knit into both the fabric of the urban architecture and the tissue of the city population. Infection barriers take the form of structures and widespread cleansing practices, which in Li’s eyes render Hong Kong a hospital disguised as a city.

Like other modern infection control mechanisms, the story of infection barriers in Hong Kong is one of setting the human and the virus against each other, as the victim versus the menace. This *biomedical* polarization, in which an external pathogen threatens the healthy human body, persistently runs through the contemporary dominant mode of thinking about public health and infectious disease governance (Macphail 2002, 2014; Fishel 2015; White 2015; du Plessis 2017), which is rooted in the currently accepted germ theory of disease. It renders a city like Hong Kong pervasively “on alert”—albeit with Chinese characteristics, as will be shown below.

Indeed, the polarization between the human body and the virus in global health constitutes “a world on alert” (Weir and Mykhalovskiy 2010; Lee and McInnes 2012). “Global public health vigilance,” bolstered by an extensive transnational surveillance apparatus led by the World Health Organization (WHO), caters to a world under threat of unpredictable and pathogenic microorganisms and diseases. Over the past two decades, a range of global health issues have reached the highest levels of political concern, prompting states and international organizations to respond to such threats in the language, and with the arsenal, of security (Rushton and Youde 2015). Worryingly, it has been suggested that these security practices render citizens as patients and states as megahospitals (Elbe 2010), as is also the argument in Li’s description of Hong Kong. In her excellent “pathography” of global public health’s experience with the 2009 H1N1 pandemic, MacPhail (2014) examines our collective fear of viruses by tracing the H1N1 influenza virus through history and sites of public health activity, particularly in Hong Kong. The picture she paints is also of anxiety fueling an influenza pandemic narrative in which not only is the virus misunderstood but archaic truths of influenza research dominate (cf. Webster 1993) and infection control stifles the development of necessary, novel ideas of infection control (Schiffman 2014; Lee 2015).

The fallacy of the influenza pandemic narrative lies in it largely misunderstanding the virus and bacteria and their relation to the human. Recent advances in medical microbiology have found that the human-virus relationship is not one of opposition per se but of profound entanglement. One cannot be thought without the other, leading some to theorize the figure of *homo microbis* (Helmreich 2014). In this understanding, few microbes are pathogenic; most are benign, some even essential to human life. Indeed, viruses have been and are a vital source of new genetic information, horizontal gene transfer, and genetic diversity in the evolution of life. Zoonotic viruses’ ability to continuously mutate as they go about infecting hosts and exchanging genetic information renders global health strategies largely obsolete. Moreover, there is an increasing realization that antimicrobial interventions such as antivirals and antibiotics are accelerating antimicrobial resistance, making infection control strategies not just obsolete but also counterproductive. Thus, a rethinking of the human-virus relationship in (urban) politics and security in Hong Kong and global health more generally is timely.

The article begins by tracing the way the global city of Hong Kong has been constituted as an antimicrobial city since the SARS outbreak in 2003. The antimicrobial stance takes its cue from the scientifically accepted germ theory of disease. In a second step, the article explores the recent claims of medical microbiology, which profoundly depart from the germ theory to invoke an ecological or configurational understanding of the human-microbe relation. Here, disease is not just the outcome of a pathogenic microbe infecting a human host but emerges from socioeconomic relations, which intensify human-animal-microbial interactions, thereby leading to pathogenesis—that is, the diseased state (Lorimer 2017). In a final step, the article draws on *Daoist* thought and traditional Chinese medicine to reflect on the ways that such an ecological understanding translates into life and city dwelling.

Infection Barriers and the Antimicrobial City

Sporadic outbreaks of H5N1 in the live bird markets; the spectre of SARS whenever someone with an acute, unexplained upper respiratory tract infection is hospitalized; the occasional case of Japanese encephalitis; thick, humid air that feels pregnant with microbes; the soundless, nearly invisible mosquitos ubiquitous in the lush, dense patches of forest that cover the territory. Contagions seem to originate both from within and from without. (Macphail 2014, 79)

In early 2003, after having treated patients with atypical pneumonia in a Guangzhou hospital, a medical professor arrived in Hong Kong from Guangzhou carrying SARS coronaviruses. The arrival of the coronaviruses led to the volatile outbreak of SARS in Hong Kong. Hitching a ride on the Chinese professor, the pathogenic microbe family began infecting and reproducing among the large pool of hosts—that is, the hospital staff and medical students whom the Chinese professor was visiting. During the professor's short stay at the Metropole Hotel in Kowloon, before he himself fatally succumbed to SARS, the viruses continued infecting seven other hotel guests, who traveled elsewhere in Hong Kong, Singapore, Vietnam, and Canada. The viruses moved into the Prince of Wales Hospital while journeying on a local hotel guest who was admitted in early March. There, they moved through the hospital, infecting over one hundred medical and nursing personnel. By early April, coronaviruses entered the housing estate "Amoy Gardens," where they infected and reproduced among the large pool of hosts living in and beyond this estate (Lee 2003). Only a month later, coronavirus activities finally began to slow down and decrease—however, not before having also spread to a number of global cities including Beijing, Guangzhou, Singapore, and Hanoi in East Asia as well as Toronto.

As Hardy has aptly noted, "The history of the infectious diseases in modern times remains inextricably intertwined with the history of the cities that spawned them" (Hardy 1993, 293; see also McNeill 1976). This can be said too of Hong Kong. With the social and environmental conditions of a global city, the densely populated city is argued to have provided the necessary breeding and circulation ground for a fast-emerging disease such as SARS to spread rapidly in the network of connecting global cities.² Cities afford microbes a large pool of closely connected human hosts by which a "sustainable chain of transmission" is ensured (Harris Ali and Keil 2008, 4). "The city is a playground for parasites," notes *Guardian* writer Kira Cochrane and adds, quoting historian of science Barnett (Cochrane 2014),

² Global cities like Hong Kong, Beijing, Singapore, or Toronto—connected via material, knowledge and information flows, cycles of labor and investment, cultural transfers, and the transnational movement of people—as the contributions in *Networked Disease* (Harris Ali and Keil 2008) suggest, served also as a network for global pathogenic circulation. See also Appadurai 1996; Castells 1996; Scott 2001; Sassen 2002.

There are a lot more exciting human beings they can jump on to, . . . lots more opportunities for vectoring and transmission. It's all about movement. Parasites love movement. So in that sense the city is an absolutely fantastic place for them.

Indeed, in Hong Kong, according to Li Shiqiao, the SARS outbreak brought into painful realization the problem with the city's characteristically Chinese urban architecture of abundance or "maximum quantities," expressed through the functional building of ever-higher skyscrapers to house more and more people within ever smaller spaces (Li 2014, 28–30; also Roloff 2007). This specific urbanity of Hong Kong emerged with the unique political and economic circumstances that came with the arrival of large waves of Mainland Chinese refugees after the creation of the People's Republic of China in 1949. Until the 1960s, an estimated one million people were homeless in Hong Kong. Before they were resettled in tiny spaces in public housing estates by the colonial authority, mainland Chinese refugees lived in squalid squatter-settlements, which gave rise to the circulation of diseases and criminality (Roloff 2007, 112).

Throughout history, cities have responded in different ways to infectious diseases—from the traditional quarantine, to the development of urban hygiene infrastructure through sanitation and waste management systems (Loos 1987, 45–49; Melosi 1999), to the more recent establishment of public health systems. "The whole history of urban life," argues medical historian Richard Barnett, "is of living with parasites and trying to get rid of them" (as quoted in Cochrane 2014). Indeed, in the modernization of cities in the late nineteenth century, Gandy emphasized the way technopolitical discourses became entangled with advances in the medical sciences such as disease epidemiology to influence developments in civil engineering and planning, as well as public health (Gandy 2006, 15).³ Writing about the inclusion of "an architecture of bacteria and virus control" emerging in Europe during this time (Li 2014, 117–18). This found its expression especially in urban architectural designs of whiteness (which expresses the visual act of bleaching and antiseptis) and homogenous surfaces (which express the medical practice of disinfection) (Li 2014, 117–18).⁴ Thus, the concern for public hygiene and microbial control has shaped (particularly Western) urban architecture since the turn of the twentieth century.

Chinese cities, on the other hand, first encountered the late nineteenth century European discourse of urban hygiene⁵ through "treaty-port cities" such as Hong Kong, Shanghai, and Tianjin, which were established to ensure the trading interests of Western powers in China (Rogaski 2004, 141).⁶ Cities like Hong Kong were to participate in late nineteenth century global trade, at a time when a bubonic plague was also spreading globally. Hong Kong's crowded architecture rendered it a

³ Gandy (2006) referred to this as the emergence of the "bacteriological city," to highlight the complex interactions between disease, water, and urban infrastructure. Similar to concepts such as the "sanitary city" and the "hydraulic city" in analyzing the relationship between water and cities in the modernization of cities in late nineteenth century Europe, Gandy's "bacteriological city" nevertheless goes further in emphasizing the role of scientific advances such as disease epidemiology.

⁴ According to Li (2014, 188), whiteness symbolizes "the visual act of bleaching, the physical and metaphorical removal of dirt as an antiseptic practice." It is reflective of ventilation and light in hospital design. "Shine" is produced of homogenous surfaces that find their cue from the medical practice of disinfection.

⁵ Health strategies in China have traditionally focused on preserving the body. Urban hygiene as a rationale was officially incorporated into the Qing imperial administration in the early twentieth century and subsequently adopted by the Communist government in 1949. Urban hygiene was linked to the nationalist project of the Mao regime and launched in mass campaigns to eliminate disease and pest (Li 2014, 119).

⁶ Hong Kong was created in the mid-nineteenth century as a result of the Opium War between the British Empire and the Qing Empire in China. Having lost the war, the Chinese emperor ceded Hong Kong in perpetuity to Britain in 1842. Under British rule, the city was a free trade center with low taxation, a character it still holds today. Its British heritage is an intensely neoliberal mentality reflected in a minimum government, few controls on imports and exports, and the lack of a military arm, which laid the ground for its eventual integration into the global economy and evolution into a global city.

hygienically challenged city that was particularly vulnerable to infectious diseases, leading to urban hygiene becoming a fundamental feature in governing the colonial, and eventually postcolonial, city (Li 2014, 118–19). Historically, Hong Kong is considered a “naturally diseased space,” where new influenzas emerge. With its “year-round humidity and swampy, tropical marshland,” from the early times of British colonization Hong Kong was “seen as a reservoir—pit—of disease” (Macphail 2014, 80). A series of deadly outbreaks in the newly acquired colony led the British to set up hospitals and bring in Western medical authorities to ensure there was little disruption to economic flow. The port of Hong Kong had become indispensable to the British economy and thus necessitated a strategic eye to controlling disease circulation (Macphail 2014, 82).

In 1894, Hong Kong experienced a plague outbreak which led to the establishment in 1906 of what would eventually become the *Bacteriological Institute*, its first modern microbiological research center (Macphail 2014, 83). While until the 1890s Hong Kong’s medical officials followed the widely accepted *miasma* theory in explaining infectious disease circulation, by the early nineteenth century, and with the establishment of the institute, the shift to germ theory in European medical circles had resolutely arrived in Hong Kong. Using the new technology of the microscope, germ theory established that infectious diseases were not caused by atmospheric *miasma* or “bad air” but by pathogenic microorganisms such as bacteria, protozoa, fungi, and viruses in the body. Microbiologists proved that specific microbes, which spread from person to person, caused infectious diseases. Germ theory radically changed the practice of medicine. It influenced how hospital space in Hong Kong and elsewhere had to be rethought toward including microbiological laboratories and isolation wards (Sihn 2017). More importantly, as the accepted scientific theory of disease, which still underlies contemporary biomedicine, germ theory to this day influences and dominates modern sanitary practices and public health.

The battle against SARS, occurring only five years after Hong Kong’s handover to China in 1997, revealed considerable problems both with the Sino-British political arrangement of “One Country, Two Systems” and with the city’s public health governance system. SARS “can be understood epidemiologically as a virus that tested Hong Kong’s healthcare system and governance to the maximum” (Baehr 2008, 147). While a number of stringent but important measures to control the spread of infections—including isolation and home confinement, regular health checks at the border, and public information sharing—were introduced during the outbreak, the Hong Kong government’s response was widely considered to have been severely delayed and inadequate (Ng 2008, 71–73).⁷ In fact, the change in political rule and the insufficient governmental response provoked a distinct cultural reaction to SARS by the Hong Kong people who mistrusted mainland Chinese and associated Hong Kong officials. Culturally, Baehr found the “mask culture,” which arose during this time, a sign of an emerging social solidarity among Hong Kong people in which they paid tribute to a common good by meeting one’s duty not to endanger the wider Hong Kong community. The plague, or any other pandemic in Chinese culture, is traditionally seen as a sign of evil: it “summons up the possibility of a collective death: the extirpation of the social itself” (Baehr 2008, 147). Mask-wearing thus “became the quickly improvised, if obligatory, social ritual: failing to don one was met with righteous indignation, a clear sign of ritual violation” (Baehr 2008, 150).

In the immediate SARS aftermath, partly to be seen to regain control of the battle against infectious diseases and partly to defend its beleaguered image as “Asia’s world city,” the Hong Kong government aggressively promoted a new culture

⁷ According to Ng (2008), the Hong Kong government’s approach to the SARS outbreak was beset by poor communication, inadequate information sharing, and lack of coordination between public health agencies in Hong Kong and across the border in mainland China.

of urban hygiene (Roloff 2007, 74). Building on the “positive hygiene spirit” and mask-culture during the SARS outbreak, the city government began working to normalize a mentality of urban hygiene in the Hong Kong community. Shortly after the SARS outbreak, it established the governmental organization *Team Clean*. Its role was to regain Hong Kong’s status as a world-class city by instituting high hygiene standards throughout the city. Former chief secretary for administration, Donald Tsang, declared on May 28, 2003:

there are problems emanating from personal hygienic habits, household hygiene unsatisfactory conditions and some environmental unhygienic problems relating to building maintenance and so on. . . . it is a monumental task but it is an important step that Hong Kong must go through if we aspire to be a city of the first rank and not only as a very successful international financial centre, but in fact a “clean room” in Asia. (Tsang 2003)

The work of *Team Clean* began by identifying, defining, and clearing “hygiene blackspots” in nearly one hundred public housing estates. But the city’s hygiene efforts extended not only to cleaning up buildings and surrounding infrastructure, it crucially involved changing the behavior of the people of Hong Kong:

We believe that all efforts must begin with the self, extend to the family and the immediate neighbourhood, and then radiate throughout the entire community of Hong Kong before we can claim a place as a world-class city. (Team Clean Report as quoted in Roloff 2007, 97)

By orchestrating mass campaigns of hygiene habits through posters, audio announcements, television broadcasts on public transportation, and the display of disinfection stations, public notices of disinfection routines, etc. and by incorporating regular and mandatory hand washing in schools, Hong Kong actively worked to induce an antimicrobial (sanitizing) imperative in the Hong Kong people. Its stringent urban hygiene regime is creating hygienic world-class citizens who are to carry Hong Kong back into the top ranks of global cities (Roloff 2007, 91).

In Li’s reading of the post-SARS climate in Hong Kong, an architecture of bacteria and virus control was manifesting in distinctly Chinese-style “infection barriers” in the city. Historically, the Chinese city is “conceived as a set of concentric corporeal defenses of the body, the family, the village, the work unit, and the state family” (Li 2014, 133). The preferred method of defense in traditional cities in China was walls. Infection barriers in Chinese cities like Hong Kong, Li claims, take on some of the characteristics of the traditional walls in their concentric forms. Unlike city walls or gated communities, however, infection barriers manifest according to the principles of antimicrobials. As such, in reproducing the Chinese imperative of prudence in preserving the body, they defend the body by “fighting bacteria and viruses from within the tissues of architecture” (Li 2014, 130).

In this way, the “monumental task” of transforming Hong Kong into an antimicrobial global city was underway. Li concludes, “In Hong Kong, the hospital is poised to take over the entire city, spreading its standard practices of hand-washing, mask-wearing, and temperature-taking” (Li 2014, 130–31). Building on germ theory—which posits that pathogenic microorganisms such as bacteria, protozoa, fungi, and viruses residing in human bodies spread from person to person to cause infectious diseases—an extreme urban hygiene culture emerged in this global city to prevent germs from spreading. This is not only fueling and normalizing anxieties of infection and disease as I experienced when visiting Hong Kong in late 2016, it may also not be achieving what it set out to do, namely, securing human life. Considering recent advances in gene sequencing in microbiology, through which a “vast diversity of microbial life in, on and around the human body” (Lorimer 2017, 544) has been identified as residing in complex relationality with one another, how befitting is it to fight infectious diseases by indiscriminately eliminating microbes through the use

of antimicrobials and practicing urban hygiene as in the case of Hong Kong? What happens when the enemy is not the virus or other microbes but us (Methot and Alizon 2014, 778)?

Homo Microbis

Like many others caught up in the emerging-disease narrative, which is based on the tenets of germ theory, the story of infection barriers is one of setting the human and the nonhuman virus against each other, as the victim versus the menace. Viruses are commonly understood to be “‘bad matter’ to be prepared for, brought under control, and ultimately eradicated or rendered impotent” (White 2015, 145–46). Unlike the germ theory of disease, which makes a specific microbe responsible for a specific disease (e.g., the coronavirus is responsible for SARS), an ecological perspective holds that microbes are not essentially pathogenic (Methot and Alizon 2014). Rather, as Hinchliffe et al. (2016) have argued, disease emerges from the complex entanglement between the immune system of a host and the microbial milieu in and outside of the host. Various scholars have noted how, much like Hong Kong in the face of SARS, global public health programs adopt an antimicrobial stance to the control and/or elimination of infectious diseases, however, which might prove to be counterproductive in securing human life (Macphail 2014; Methot and Alizon 2014; Fishel 2015, 2017; White 2015; Hinchliffe et al. 2016; du Plessis 2017; Lorimer 2017, 545).

At the microbial level, ecological microbiologists understand most viruses and bacteria are not pathological; they are benign and even indispensable to human life. Scientists are understanding better the causes of infectious diseases, but they also “increasingly hear about beneficial microbes and the consequences of their decline or absence” (Lorimer 2017, 544).⁸ Causal links remain unclear and contested, however; as Lorimer finds, there is “a widespread reappraisal underway in modern medicine of the salutary potential of the microbiome and the therapeutic use of microbes” (Lorimer 2017, 544). Humans and microbes seem deeply and irrevocably entangled. This has led anthropologist Stefan Helmreich to consider the figure of *homo microbis*, made up of bacteria, viruses, fungi, and protozoa (Helmreich 2014, 2015). What are the implications of this understanding of the human body as mostly microbial to the way we fight infectious diseases in global cities and elsewhere?

Microbes are everywhere. Apart from the ocean floors (Helmreich 2009), soil, and deep forests, they inhabit nearly all of living matter, including mammals. Humans are colonized by many viruses. This collection of viruses found in or on humans is known as the human virome, which is the viral component of the human microbiome—the assemblage of microorganisms including bacteria, fungi, protists, archaea, and viruses residing in/on the human body. Only a minority of viruses infect human cells and can cause “acute, persistent, or latent infection”; some viruses are even “integrated into the human genome such as endogenous retroviruses” (Wylie, Weinstock, and Storch 2012), which are essential to human reproduction.⁹

⁸ “Missing microbes” have arguably been linked to several metabolic, immunological, and mental health conditions, such as allergies, obesity, inflammatory bowel disease, and depression. See Velasquez-Manoff 2012; Blaser 2014; and Lorimer 2017.

⁹ Endogenous retroviruses are fossil viruses which “began to be integrated into the human genome some 30–40 million years ago and now make up 8% of the genome” (Tugnet et al. 2013). They may be associated with autoimmune diseases such as rheumatoid arthritis, though evidence is still limited. Yet, while many mammalian viruses, such as the endogenous retrovirus, picked up mammalian genes during their evolution by subverting these “to provide a selective advantage to the virus,” an opposite story can be told too. An endogenous *defective* retrovirus “has been sequestered to serve an important function in the physiology of a mammalian host” by encoding a protein called syncytin. Syncytin has been found to be vital in placenta production, a necessary prerequisite to human reproduction (Mi et al. 2000; Zimmer 2012).

There is no scientific consensus on whether viruses are living matter.¹⁰ This is because viruses cannot live without a host cell: “they must invade and ‘hijack’ a cell’s mechanism” so that they can produce the proteins needed for their own reproduction (Macphail 2014, 8). It is in this sense that van Regenmortel and Mahy (2008) have noted, viruses lead “a kind of borrowed life.” Their capacity to produce an effect—that is, their efficacy—, like other nonhuman matter, is “not only to impede or block the will and designs of humans but also to act as quasi agents or forces with trajectories, propensities, or tendencies of their own” (Bennett 2010, viii). By not taking seriously their efficacy to alter the course of events, however, their animating role in evolution has until very recently been overlooked.

Viruses have been and are a vital source of new genetic information, horizontal gene transfer, and genetic diversity in the evolution of life, including increasing and decreasing immunity to certain viruses or bacteria.¹¹ They have effected change on the direction of human evolution and were involved in the making of human history, most visibly in the form of plagues and diseases (McNeill 1976). They are essential to sustaining the environment, including sea and freshwater regulation, as well as human reproduction; humans are deeply involved with viruses, in the positive and negative sense (Fishel 2015, 158). The vital role of viruses in human evolution necessitates an epistemological rethinking of evolution, as Melissa A. White has noted, “from Darwinian models of the ‘survival of the fittest’ to the phenomenon of emergent life” (White 2015, 146–47).

Viruses are able to evolve very quickly, reinventing themselves by mutation and adaptation, thereby “evading immune systems and other means of eradicating them” and “surviving under conditions that would cripple or kill other organisms” (Macphail 2014, 9). Essentially, viruses are “packets of pure information” in that they are protein encasements of genetic material in the form of either DNA or RNA. RNA viruses such as Influenza A (responsible, for example, for avian flu in 2003, the 1918 flu, and swine flu in 2010) evolve by engaging in “antigenetic drift” when mutating while replicating. Zoonotic viruses that are able to jump species also evolve by engaging in “antigenetic shift” during which they exchange “entire genetic segments with other viruses inside a host” (MacPhail 2014, 9). It is in this capacity that viruses ought to be recognized as “bioinformatic transport machines.” Indeed, White argues, “they ought to be considered active participants in creating the potentiality of new conditions of life through their capacity to assemble novel coalitions of genes” (White 2015, 147).

Antigenetic shifts can change the surface proteins of the virus (the antigens), which are then no longer recognizable by the host’s immune system, thus provoking a slower or no response to fend off the virus. Virologists studying Influenza A tend to focus on any incremental changes or dramatic shifts in genetic makeup to the viral antigens hemagglutinin (HA) and neuraminidase (NA). It is after these specific antigens that Influenza A viruses are named by their H and N numbers

¹⁰ Generally, scientists apply a list of a priori criteria to decide on life. Following this, according to virologists van Regenmortel and Mahy (2008), viruses today are considered somewhere in-between living and nonliving. Similarly, Theresa Macphail (2104) argues, while viruses ought to be considered to have a “certain type of nontrivial agency,” they are usually seen as “liminal objects” “with some of the properties of life, yet they cannot be considered fully ‘alive’ while outside of a permissive host.” They are “organisms at the edge of life” (Rybicki 1990).

¹¹ In fact, historical viral traces in human DNA were, until recently, controversially referred to as “Junk DNA.” This noncoding DNA makes up a greater portion of the human genome than “segments of DNA that actively code for genes” (Macphail 2014). The human genome effectively consists of only two to three percent of coding DNA, while the remaining ninety seven to ninety eight percent was thought to be just a “sea of genetic gibberish” with no biological function, hence “Junk DNA” (Hall 2012). This idea was debunked in 2012 by the ENCODE group, which revealed that “junk DNA” was in fact brimming with important genetic information. The ENCODE group produced “a stunning inventory of previously hidden switches, signals and sign posts embedded like runes throughout the entire length of human DNA.” This essential noncoding DNA, as Macphail (2014) has noted, is evidence of past infections or “of a long-standing symbiotic partnership” with viruses. Viral “junk” may even be responsible for creating new genes and for enabling the immune system to adapt to emerging infections (MacPhail 2002).

(MacPhail 2014, 10). The pathogenicity of Influenza A viruses is established both by their molecular makeup and their ability to cause serious illness in their host species, birds or other. A highly pathogenic virus causes severe or lethal illness in bird or other species populations. It is possible for a virus to “jump” from its host species into a human host, resulting in an usually severe and lethal infection. Yet, viruses do not have “motives, or thoughts, or diabolical plans to wreak havoc to our cities”; “their function and purpose (if we can even say that they have one) is to replicate, to evolve, to survive” (Macphail 2014, 11).¹²

Most viruses, however, infect microorganisms including bacteria in the human microbiome (Edwards and Rohwer 2005). These prokaryotic viruses “affect human health by impacting bacterial community structure and function” (Reiman 2015; also Wylie et al. 2012). Because viruses evolve very quickly, the human virome (and thus also the microbiome) is changing all the time. Each human virome is different and unique as it evolves and is formed both by preexisting immunity and viral and human genetics as well as by human lifestyle, age, geographic location, and susceptibility to disease, all of which affect individual exposure to viruses (Delwart 2013). From this perspective, diseases are not the outcome of a virus or other microbe infecting a human, as germ theory holds, but emerge from the unique constellation of political and ecological relations that affect the biological interactions of the human, the animal, and the microbe and lead to the potential development of a diseased state—that is, pathogenesis. Hinchliffe et al. usefully speak of disease as “multispecies conditions configured by specific socio-ecological ‘situations’” (Hinchliffe et al. 2016; Lorimer 2017, 545).

Some scientists already seek a shift toward this ecological or configurational thinking. The emerging diseases and global health security narrative runs on the notion that the bacteria or virus is the enemy against which the global surveillance / health security apparatus must operate (Weir and Mykhalovskiy 2010). This narrative rests on the germ theory of disease currently dominating microbiology/bacteriology. In her pathography of the H1N1 influenza pandemic in Hong Kong in 2009, Macphail finds that a few “heretic” microbiologists are challenging the dominant emerging infectious diseases narrative, calling for a new epistemology in which microbes are understood not as enemies but as coinhabitants of the world (Macphail 2014, 17).

Hong Kong biologist Frederick C. Leung suggests that the problem with the alarmist influenza pandemic discourse lies partly in the way viral genetic data revealed through “signature sequences” has been interpreted by leading influenza scientists such as the virologist Robert Webster (Webster 1993). Speaking against the central focus on the H and N proteins as the key to what makes an influenza virus deadly or not in the dominant influenza surveillance and research discourse, Leung and others believe that “the public health orthodoxy has become too ready to see what it has already been prepared to look for and to fear” (Macphail 2014, 190). Evolutionary biologist Paul W. Ewald suggests that although the H and N proteins are most visible to our immune system, it is not certain that they are the reason for a strain’s pathogenicity or severity (Macphail 2014, 190). Ewald believes that scientists tend to confuse “sources of variation—the mutation and recombination of genes—with the process of evolution by natural selection” (Ewald 2000, 22–23).

¹² Hong Kong biologist Frederick C. Leung suggests that the problem with the alarmist influenza pandemic discourse lies partly in the way viral genetic data, revealed through “signature sequences,” has been interpreted by leading influenza scientists such as the virologist Robert Webster (1993). Speaking against the central focus on the H and N proteins as the key to what makes an influenza virus deadly or not in the dominant influenza surveillance and research discourse, Leung and others believe that “the public health orthodoxy has become too ready to see what it has already been prepared to look for and to fear” (Macphail 2014). Evolutionary biologist Paul W. Ewald (2000) suggests that although the H and N proteins are most visible to our immune system, it is not certain that they are the reason for a strain’s pathogenicity or severity. Ewald believes that scientists tend to confuse “sources of variation—the mutation and recombination of genes—with the process of evolution by natural selection.”

To date, our understanding of the human virome, benign viruses, and the virus-human relation remains limited. Yet,

viruses may not simply be bits of “bad matter” that slow down, disassemble, and debilitate complex systems. Rather, viruses might well be approached from another vantage point altogether, as vitalizing forces in complex ecological systems in which humans are not the center. (White 2015, 149)

The relation between the human and microbial communities is not antagonistic but symbiotic. While the rapid emergence of infectious diseases is creating a “world on alert,” as Weir and Mykhalovskiy (2010) have observed, it demonstrates the frail character of the ecological balance of this vital symbiosis between humanity and their vital environment (Methot and Alizon 2014, 782). The study of the biology and ecology of viruses forces us to appreciate our mostly symbiotic relationship with viruses and other microbes. It compels us to rethink how (human) life has come to be. It is not the Darwinian paradigm of “the survival of the fittest” but rather an emerging paradigm revolving around a microbiological understanding of “emergent life” that explains our evolution. It also necessitates that we understand and respond to disease not as the invasion of enemy microbes but as the pathogenesis, that biological mechanism, of a unique constellation of politico-ecological relations and human-animal-microbial interactions, which gives rise to a malady. How can this emerging ontological and epistemological understanding of human life inform the governance of disease?

Riding the *Shi* and the Microbial City

The best defence we have against microbes is our brains, which can surely work out how to live in harmony with the microbes we know, and find non-disruptive ways of combating those that emerge in the future. (Crawford 2007, 213)

How do we live in harmony with the microbial world but still prevent infectious diseases from developing? How do we move from a potentially destructive antimicrobial perspective such as is embodied in Hong Kong to a microbial perspective in which we take responsibility for our vital relation with the microbial world?

New materialist thinking (cf. Hinchliffe 2007; Coole and Frost 2010; Dolphijn and Tuin 2012), which takes seriously the efficacy and ecology of human bodies and nonhuman bodies such as the virus and other microbes, invites us to examine how the human-microbe relationship can be rethought in politics. While a number of theorists have begun to conceptualize a new materialist politics and ethics within modern political theory (Bennett 2010; Connolly 2013; Mitchell 2014), others have looked to indigenous cosmologies, which take into account the world we share with other kinds of beings, to formulate a postanthropocentric politics (Kohn 2013; Tsing 2015; du Plessis 2017). The Daoist cosmology underlying Chinese medicine and Chinese strategic thought and practices provides a first step to think in distinctly Chinese ethical terms about how public health strategies in Hong Kong and beyond can begin to direct a human-microbial ecology to the advantage of protecting all life.

Daoist thought takes reality as dynamic, and the regulation of this changing reality is immanent to the interaction of the heterogeneous factors involved, thus emerging spontaneously (Jullien 2004). Sunzi’s philosophy strategizes how best to direct a heterogeneous ensemble of human and nonhuman (virus, bacteria, and other nonhuman) bodies, by shifting the inherent potential, the *shi*, of this ecology to our advantage. In the *Art of War* (515–512 BCE), success in war was achieved not through the courage, activity, and talent of any individual fighter but through careful planning instead of actual combat. In fact, combat in Chinese thought is not violence; violence is to be avoided. In medicine too, defending the body from

danger demanded care for the body manifested in preservation regimes instead of reactive “Western drug- and surgery-based medical practice” (Li 2014, 83). Chinese medicine is about preserving rather than curing. This can be seen in its guise as a conception of food: it demands specific diet regimes developed from “observations of the characteristics of the vegetation and animals in the season.” Over time, it came to incorporate a puzzling spectrum of diet-based caring regimes that are still widely practiced today (Li 2014, 83).

Reflecting on this, medical anthropologist Judith Farquhar has noted of Chinese medicine that it “heals in a world of unceasing transformation.” This a priori dynamism in Chinese medicine contrasts sharply with the modern Western “world of discrete entities characterized by fixed essences, which seem to be exhaustively describable in structural terms.” Since motion and change are a given, they rarely require explanation with reference to their causes. According to Farquhar, “One consequence of this dynamic bias in Chinese medicine is that the body and its organs (i.e., anatomical structure) appear as merely contingent effects or by-products of physiological processes” (Farquhar 1994 as quoted in Needham 2000). In a comparable vein, Methot and Alizon (2014) and others (Hincliffe and Bingham 2008; Lorimer 2017) have argued that pathogenesis results not from any single pathogenic microbe but from the configuration of socio-ecological relations and human-animal-microbe interactions.

Chinese thought, Francois Jullien explains, takes reality as an immanently “regulated and continuous process that stems purely from the interaction of the factors in play (which are at once opposed and complementary: the *yin* and *yang*)” (Jullien 2004, 15). Reality is dynamic, and the regulation of this transformative reality—that is, the order of reality—emerges spontaneously. It is not achieved through external intervention but is “entirely contained within the course of reality, which it directs in an (inherent) fashion, ensuring its viability” (Jullien 2004, 15). Two notions are central to this ancient Chinese strategy: (a) the notion of a situation or configuration (*xing*)—that is, as a relation of forces such as are immanent to an ecology—and (b) the notion of the potential (*shi*) of a situation/configuration. This is commonly illustrated by “a mountain stream that, as it rushes along, is strong enough to carry boulders with it” (Jullien 2004, 17). The configuration (*xing*) of the mountain consists of a downward-sloping course and narrow channel, while this configuration itself gives rise to the potential (*shi*) for the rushing stream to carry boulders with it. Thus, it is not “what we ourselves personally invest in the situation” that counts so much but rather “the objective conditioning that results from the situation” (Jullien 2004, 17).¹³

Jullien has argued that *shi* helps to “illuminate something that is usually difficult to capture in discourse: namely, the kind of potential that originates not in human initiative but instead results from the very disposition of things” (Jullien 1995, 13). Bennett (2005, 461) usefully elaborates on this by explaining that “*Shi* is the style, energy, propensity, trajectory, or élan inherent to a specific arrangement of things.” For Bennett, “*shi* names the dynamic force emanating from a spatiotemporal configuration rather than from any particular element within it.” As “both the membership (of a configuration or assemblage) changes over time and the members themselves undergo internal alteration,” as Bennett points out, the *shi* or mood of a configuration also changes (Bennett 2005, 461). In Margaret Archer’s words, everyone in the configuration “possesses autonomous emergent properties which are thus capable of independent variation and therefore of being out of phase with one another in time” (Archer 1995, 66). It is possible that an individual element such

¹³ Biophilosophers Deleuze and Guattari (2004) describe something comparable when they discuss the milieu as a force field composed of nonhuman and human things (*xing*). Not only do these heterogeneous elements constituting a milieu each entail some form of efficacy, but the milieu as a whole gives rise to a potential to effect (*shi*). Jane Bennett (2005) likewise argues that there is an agency that attaches to assemblages of human and nonhuman entities. She contends that this agency of an assemblage is comparable to the Chinese strategic notion, *shi*.

as a virus, in an antigenic shift, “becomes out of sync with its (previous) self” and forms new relations within an assemblage, “leaning towards a different set of allies” (Bennett 2005, 462). As such, the members of an assemblage “maintain an energy potentially at odds with the *shi*” (Bennett 2005, 462). It is for this vibrancy, according to Bennett, that the agency of assemblages cannot be understood in terms of passive social structures.

Crucially, in Chinese strategic thought, it is the *shi* that “can be made to play in one’s favour” (Jullien 2004, 17). It is because of their variability that circumstances or ecologies can little by little be turned advantageously by the propensity or efficacy immanent to a situation. A Chinese sage, according to Jullien, “is inclined to concentrate his attention on the course of things in which he finds himself involved in order to deter their coherence and profit from the way that they evolve” (Jullien 2004, 16). A good general, in turn, “must be able to read and then ride the *shi* of a configuration of moods, winds, historical trends, and armaments” (Bennett 2005, 461). This “logic of regulated evolution” allows the potential of a situation “to develop of its own accord and to ‘carry’ us with it” (Jullien 2004, 17). Jullien illustrates this by drawing on an old Chinese proverb that captures the core idea of this thinking (Mencius as quoted in Jullien 2004, 16): “even with a mattock and a hoe to hand, it is better to wait for the moment of ripening.”

Unlike the Western tradition of establishing a model that is projected onto a variable reality, according to Jullien, Chinese thought will concentrate on understanding how things unfold so as to discover their configuration (relationality) in order to come up with alternative ways to effect a more advantageous outcome. Thus,

instead of constructing an ideal Form that we then project on to things, we could try to detect the factors whose configuration is favourable to the task at hand; instead of setting up a goal, we could allow ourselves to be carried by the propensity of things. (Jullien 2004, 16)

To ride the *shi*—in other words, to live harmoniously alongside and with the microbial world—we need to identify those factors whose configuration is favorable to human life. *Daoist* ethics and Chinese strategic thought lead us to embed *homo microbis* in an environment that is favorable to all life.

As Hong Kong biologist Frederik Leung points out, the problem not only lies in the prevailing dominance of germ theory in science, it also lies in the way we relate to the animal and nonhuman world at large with which humans are so deeply entangled. He speaks against the culling of birds and animals as a response to an emerging influenza pandemic (Macphail 2014, 192). In fact, the flu is argued to be unpredictable only because influenza experts “don’t understand the basic science” (Leung, as quoted in Macphail 2014, 193). Viruses naturally undergo constant mutation. In the case of cross-species transmission, such as the SARS coronavirus which crossed over from civet cats to humans in 2003, it became clear that “highly pathogenic influenza viruses naturally burn themselves out, . . . they pose no greater risk to humanity than ‘normal’ influenza viruses” (Macphail 2014, 193). In fact, “the more virulent the virus, the faster the virus dies out. By evolutionary principle” (Leung, as quoted in Macphail 2014, 194). Leung laments the current focus on the development of influenza vaccines, since intervention through the vaccine encourages further mutation, whereas allowing the virus to take its natural course leads to its natural burn out (Macphail 2014, 194).

Leung’s call for rethinking how we relate to the animal world echoes the recent effort to do just that in the *One World One Health* initiative of scientists, physicians, and veterinarians worldwide to collaborate across disciplines in addressing emerging diseases. In part, this effort came about due to concerns for shared risks across human, animal, and environmental health. The focus, however, has tended to lie on the contamination and transmission of pathogens rather than on the socioeconomic relations underlying disease and health. It has been criticized for

reducing diversity and for underappreciating the local, contingent, and practical engagements that first make health possible (Hinchliffe 2015).

Yet, it is not just how we relate to the animal world that matters. It is also about how we think about life in cities, especially as SARS in Hong Kong in 2003 revealed,

a set of absent actors—animals, microbes, airplanes, sewage systems, respirators—that had been banished to the margins of our conceptions of urban life, even as they actively contributed to how urban lives were composed and lived. (Braun 2008, 251)

The SARS encounter and the post-SARS politics force us to think about the microbes, animals, and many other organisms living amongst us and influencing the “social” collectives of humans. That social collective, the city, needs to be rethought on microbial terms. At the turn of the twentieth century, cities thrived on “bacteriological” (Gandy 2006) and “epidemiological” conceptions of urban spaces in Europe and North America. They aimed to transform urban spaces and the behavior of city people accordingly (Braun 2008, 3). In his exploration of the Chinese city, Li Shiqiao highlights the key imperative of prudence, understood in terms of “the principle of endurance and an unknown future reward,” which firmly runs through Chinese conceptual thought (Li 2014, 81). He interpreted this in the post-SARS situation of Hong Kong to be the donning of masks and ultimately striving to become hygienic subjects. Yet, it seems prudent to build a microbial instead of an antimicrobial city, to rethink space and the behavior of the city people in Hong Kong and other (global) cities in ecological and sustainable terms, and to take into account the social-economic relations that intensify human-animal-microbial interactions.

Conclusion

This article set out to show how a better understanding of the microbe and its deeply entangled existence with humans is crucial to conceptualizing a better approach to health and life. Specifically, it argued for an inclusive approach to the virus and other microbes with which we share the world we live in over an exclusively oppositional approach to eradicating pathogenic circulation, which also eliminates or mutates benign viruses essential to human life.

The article began by looking at the antimicrobial politics in Chinese postcolonial Hong Kong since the turn of the century. It particularly focused on the notion of “infection barriers” advanced by Li (2014). Li bases his analysis on the traditional conception of the Chinese city and the practice of defense in walling the city off against danger. By arguing that, in the struggle against infectious diseases, contemporary practices of urban defense have taken on another guise, namely infection barriers, Li is able to demonstrate how the politics of public hygiene operates not only through overt public programs but through infection barriers that are *affectively* knit into the fabric of the urban architecture and tissue of city dwellers. Although his lens on Chinese urban defenses takes seriously ancient Chinese thought in the making of urban spaces, nonetheless, the politics of infectious disease remains caught up in the prevalent and dominant oppositional narrative of the human against the microbe. Infection barriers set up the human and the nonhuman virus against each other, as the victim versus the menace. Like antivirals and antibiotics, urban hygiene practices are never entirely able to control pathogenic circulation. This is because urban hygiene proceeds on the basis of a very narrow conception of disease, namely the widely accepted germ theory of disease.

By studying the biology of microbes, it becomes possible to grasp more what the virus and other microbes are and do but particularly how they relate to the human. First, the activities of the virus escape the political designs, regimes, and practices because the virus and other microbes are forever in transformation. How then can

human efforts be conceived to control pathogenic, while fostering benign, viral circulation? Second, viruses play a large and essential part in making up the human. While a small number of viruses are pathogenic, the majority are benign, and some are even essential to human life. Strategies to eliminate them may kill pathogenic viruses but essential viruses might also be killed off in the process. As the human cannot be thought without the virus, and attempts to alter or eliminate it (in)directly also affect the human, how might we think differently about urban spaces and public health if we consider the human and the virus not as opposed but as fundamentally interrelated?

Finally, the article considered *Daoist* thought, to begin to reflect on the governance of microbes, which takes seriously their efficacy, dynamism, and deeply historical relationality with humans. From the biological vantage point of ecologies in which the virus, the human, and many other organisms are fundamentally interconnected forms that vitally depend on, but can also harm, each other, all interventions to control viruses will affect all involved, including the virus as well as the human. Thus, it is in the interest of human beings to proceed with interventions to control viruses that cause the least direct or indirect harm to humans. Daoist thought offers some ideas for how to strategize public health schemes, which take due consideration of this deep involvement of viruses and humans.

Public health schemes that develop defenses against pathogenic viral circulations, especially in a densely populated global city such as Hong Kong, remain important. However, there is also a need to consider and adapt the human practices that both create(d) the easy passages for viral circulation as well as forced viral mutations through the overuse of antiviral (and antibiotic) agents or vaccine development which is thought to have led to antiviral resistance. Most of all, rather than fostering an oppositional relation between the human and the virus, there is a need for an appreciation of the vital role of the virus in human lives as well as of how deeply we are entangled with the virus.

Instead of only arming against pathogenic viral circulation by sanitizing both the urban environment and the minds of city dwellers, as in the case of Hong Kong, such circulation might be more usefully countered by championing an approach that proceeds on the understanding that the human irrevocably inhabits an ecosystem in which the multiplicity of life forms are deeply interrelated and dependent on each other. Much like the Chinese general evaluating the course of things immanent to a situation, since humans thrive on a range of other beings doing well, “an interest in human security becomes an interest in biodiversity: thriving is not a zero-sum game between different species, in fact, quite the opposite” (du Plessis 2017, 18). Global health projects ignore this and are struggling to deliver what they aim to do.

Acknowledgements

I thank the anonymous reviewers and the editors of *IPS* for their generous comments. I am also grateful for insightful comments on earlier versions of the article presented at the EISA convention 2017, EWIS 2018, and before the IRSS research group, University of Groningen. I am especially thankful to Gitte du Plessis, Luis Lobo-Guerrero, and Christopher Long for thought-provoking nudges.

Funder information

This paper was produced under the aegis of the Groningen Centre for Health and Humanities and the Aletta Jacobs School of Public Health, University of Groningen.

References

- APPADURAI, ARJUN. 1996. *Modernity at Large: Cultural Dimensions in Globalization*. Public Worlds. Minneapolis: University of Minnesota Press.
- ARCHER, MARGARET S. 1995. *Realist Social Theory: The Morphogenetic Approach*. Cambridge: Cambridge University Press.
- BAEHR, PETER. 2008. "City under Siege: Authoritarian Toleration, Mask Culture, and the Sars Crisis in Hong Kong." In *Networked Disease: Emerging Infections in the Global City*, edited by S. Harris Ali and Roger Keil, 138–51. Chichester: Blackwell.
- BENNETT, JANE. 2005. "The Agency of Assemblage and the North American Blackout." *Public Culture* 17 (3): 445–65.
- . 2010. *Vibrant Matter: A Political Ecology of Things*. Durham, NC: Duke University Press.
- BLASER, MARTIN. 2014. *Missing Microbes: How Killing Bacteria Creates Modern Plagues*. London: Oneworld Publications.
- BRAUN, BRUCE. 2008. "Thinking the City through Sars: Bodies, Topologies, Politics." In *Networked Disease: Emerging Infections in the Global City*, edited by S. Harris Ali and Roger Keil, 250–66. Chichester, UK: Blackwell.
- CASTELLS, MANUEL. 1996. *The Rise of the Network Society*. Cambridge, MA: Blackwell Publishers.
- COCHRANE, KIRA. 2014. "Sick Cities: Why Urban Life Is Breeding New Illness Fears." *Guardian*, February 24, 2014.
- CONNOLLY, WILLIAM. 2013. *The Fragility of Things: Self-Organizing Processes, Neoliberal Fantasies, and Democratic Activism*. Durham, NC: Duke University Press.
- COOLE, DIANA, AND SAMANTHA FROST. 2010. *New Materialisms: Ontology, Agency, and Politics*. Durham, NC: Duke University Press.
- CRAWFORD, DOROTHY H. 2007. *Deadly Companions: How Microbes Shaped Our History*. Oxford: Oxford University Press.
- DELEUZE, GILLES, AND FÉLIX GUATTARI. 2004. *A Thousand Plateaus: Capitalism and Schizophrenia*. Translated by Brian Massumi. London: Continuum.
- DELWART, ERIC. 2013. "A Roadmap to the Human Virome." *PLoS Pathogens* 9 (2): e1003146. <https://doi.org/10.1371/journal.ppat.1003146>.
- DOLPHIJN, RICK, AND IRIS TUIN. 2012. "New Materialisms: Interviews and Cartographies." In *New Metaphysics*, edited by Graham Harman and Bruno Latour. Ann Arbor, MI: Open Humanities Press.
- DU PLESSIS, GITTE. 2017. "When Pathogens Determine the Territory: Toward a Concept of Non-human Borders." *European Journal of International Relations* 24 (2): 391–413.
- EDWARDS, ROBERT A., AND FOREST ROHWER. 2005. "Viral Metagenomics." 3 (6): 504–10.
- ELBE, STEFAN. 2010. *Security and Global Health: Towards the Medicalization of Security*. Cambridge: Polity.
- EWALD, PAUL W. 2000. *Plague Time: How Stealth Infections Cause Cancers, Heart Disease, and Other Deadly Ailments*. New York: Free Press.
- FISHEL, STEFANIE. 2015. "Microbes." In *Makings Things International: Circuits and Motion*, edited by Mark Salter, 156–70. Minneapolis: University of Minnesota Press.
- . 2017. *The Microbial State: Global Thriving and the Body Politic*. Minneapolis: University of Minnesota Press.
- GANDY, MATHEW. 2006. "The Bacteriological City and Its Discontents." *Historical Geography* 34: 14–25.
- HALL, STEPHEN S. 2012. "Journey to the Genetic Interior." *Scientific American* 307 (4): 80–85.
- HARDY, ANN. 1993. *The Epidemic Streets: Infectious Diseases and the Rise of Preventive Medicine 1865–1900*. Oxford: Oxford University Press.
- HARRIS ALI, S., AND ROGER KEIL. 2008. "Networked Disease: Emerging Infections in the Global City." In *Studies in Urban and Social Change*. London: Blackwell.
- HELMREICH, STEFAN. 2009. *Alien Ocean: Anthropological Voyages in Microbial Seas*. Berkeley, CA: University of California Press.
- . 2014. "Homo Microbis: The Human Microbiome, Figural, Literal, Political." *Thresholds* 42: 52–59.
- . 2015. *Sounding the Limits of Life: Essays in the Anthropology of Biology and Beyond*. Princeton, NJ: Princeton University Press.
- HINCHLIFFE, STEVE. 2007. *Geographies of Nature: Societies, Environments, Ecologies*. London: Sage.
- . 2015. "More Than One World, More Than One Health: Re-configuring Interspecies Health." *Social Science & Medicine* 129: 28–35.
- HINCHLIFFE, STEVE, AND NICK BINGHAM. 2008. "Mapping the Multiplicities of Biosecurity." In *Biosecurity Interventions*, edited by Stephen J. Collier and Andrew Lakoff. New York: Columbia University Press.
- HINCHLIFFE, STEVE, NICK BINGHAM, JOHN ALLEN, AND SIMON CARTER. 2016. *Pathological Lives: Disease, Space and Biopolitics*. London: Blackwell.

- JULLIEN, FRANCOIS. 1995. *The Propensity of Things: Towards a History of Efficacy in China*. Translated by Janet Lloyd. New York: Urzone.
- . 2004. *A Treatise on Efficacy: Between Western and Chinese Thinking*. Translated by Janet Lloyd. Honolulu: University of Hawai'i Press.
- KOHN, EDUARDO. 2013. *How Forests Think: Toward an Anthropology Beyond the Human*. Berkeley: University of California Press.
- LEE, KELLEY. 2015. "Revealing Power in Truth." *International Journal of Health Policy and Management* 4 (4): 257–9.
- LEE, KELLEY, AND COLIN MCINNES. 2012. *Global Health and International Relations*. Cambridge: Polity.
- LEE, SHI HUNG. 2003. "The Sars Epidemic in Hong Kong: What Lessons Have We Learned?" *Journal of the Royal Society of Medicine* 96: 374–8.
- LI, SHIQIAO. 2014. *Understanding the Chinese City*. Theory, Culture and Society. London: Sage.
- LOOS, ADOLF. 1987. "Plumbers." In *Spoken into the Void*, edited by Jane O. Newman and John H. Smith. Cambridge MA: The MIT Press.
- LORIMER, JAMIE. 2017. "Parasites, Ghosts and Mutualists: A Relational Geography of Microbes for Global Health." *Transactions of the Institute of British Geographers* 42 (4): 544–58.
- MACPHAIL, THERESA. 2002. "The Viral Gene: An Undead Metaphor Recoding Life." *Science as Culture* 13 (3): 325–45.
- . 2014. *The Viral Network: A Pathography of the H1N1 Influenza Pandemic*. Expertise: Cultures and Technologies of Knowledge. Ithaca: Cornell University Press.
- MCNEILL, WILLIAM H. 1976. *Plagues and People*. Garden City, NY: Anchor.
- MELOSI, MARTIN. 1999. *The Sanitary City: Urban Infrastructure in America from Colonial Times to the Present*. Creating the North American Landscape. Baltimore, MD: John Hopkins University Press.
- METHOT, PIERRE-OLIVIER, AND SAMUEL ALIZON. 2014. "What Is a Pathogen? Toward a Process View of Host-Parasite Interactions." *Virulence* 5 (8): 775–85.
- MI, SHA, XINHUA LEE, XIANG-PING LI, GEERTRUIDA M. VELDMAN, HEATHER FINNERTY, LISA RACIE, EDWARD LAVALLE, XIANG-YANG TANG, PHILIPPE EDOUARD, STEVE HOWES, JAMES C KEITH, JR., AND JOHN M MCCOY. 2000. "Syncytin Is a Captive Retroviral Envelope Protein Involved in Human Placental Morphogenesis." *Nature* 403: 785–9.
- MITCHELL, AUDRA. 2014. "Only Human? A Worldly Approach to Security." *Security Dialogue* 45 (1): 5–21.
- NEEDHAM, JOSEPH. 2000. *Part VI: Medicine*. Science and Civilisation in China: Biology and Biological Technology. Cambridge: Cambridge University Press.
- NG, MEE KAM. 2008. "Globalization of Sars and Health Governance in Hong Kong under "One Country, Two Systems."" In *Networked Disease: Emerging Infections in the Global City*, edited by S. Harris Ali and Roger Keil, 70–85. Chichester, UK: Black Publishing.
- REGENMORTEL, MARC VAN, AND BRIAN MAHY. 2008. "Are Viruses Alive?" *Scientific American*, August 8, 2008. <https://www.scientificamerican.com/article/are-viruses-alive-2004/>.
- RELMAN, DAVID A. 2015. "The Human Microbiome and the Future Practice of Medicine." *JAMA* 314 (11): 1127–8.
- ROGASKI, RUTH. 2004. *Hygienic Modernity: Meanings of Health and Disease in Treaty-Port China*. Berkeley: University of California Press.
- ROLOFF, EVELYN LU YEN. 2007. *Die Sars-Krise in Hong Kong: Zur Regierung Von Sicherheit in Der Global City*. Materialitäten. Bielefeld: Transcript Verlag.
- RUSHTON, SIMON, AND JEREMY R. YOUNG. 2015. *Routledge Handbook of Global Health Security*. London: Routledge.
- RYBICKI, EP. 1990. "The Classification of Organisms at the Edge of Life, or Problems with Virus Systematics." *South African Journal of Science* 86 (4): 1182–86.
- SASSEN, SASKIA. 2002. *The Global City: New York, London, Tokyo*. Princeton, NJ: Princeton University Press.
- SCHIFFMAN, JEREMY. 2014. "Knowledge, Moral Claims and the Exercise of Power in Global Health." *International Journal of Health Policy and Management* 3 (6): 297–9.
- , ed. 2001. *Global City-Regions: Trends, Theory, Policy*. Oxford: Oxford University Press
- SIHN, K. H. 2017. "Reorganizing Hospital Space: The 1894 Plague Epidemic in Hong Kong and the Germ Theory." *Uisihak* 26 (1): 59–94.
- TSANG, DONALD. 2003. Transcript of the Press Conference with the Chief Secretary for Administration in the Conference Hall of the Central Government Offices New Annexe on May 28, 2003. Accessed June 13, 2019. <https://www.info.gov.hk/gia/general/200305/28/0528326.htm>.
- TSING, ANNA LOWENHAUPT. 2015. *The Mushroom at the End of the World: On the Possibility of Life in Capitalist Ruins*. Princeton, NJ: Princeton University Press.
- TUGNET, NICOLA, PAUL RYLANCE, DENISE RODEN, MALGORZATA TRELA, AND PAUL NELSON. 2013. "Human Endogenous Retroviruses (Hervs) and Autoimmune Rheumatic Disease: Is There a Link?" *The Open Rheumatology Journal* 7: 13–21.

- VELASQUEZ-MANOFF, M. 2012. *An Epidemic of Absence: A New Way of Understanding Allergies and Autoimmune Diseases*. New York: Scribner.
- WEBSTER, ROBERT. 1993. "Influenza." *Morse* 1993: 37–45.
- WEIR, LORNA, AND ERIC MYKHALOVSKIY. 2010. *Global Public Health Vigilance: Creating a World on Alert*. Routledge Studies in Science, Technology and Society. New York: Routledge.
- WHITE, MELISSA AUTUMN. 2015. "Virus." In *Making Things International: Circuits and Motion*, edited by Mark Salter, 141–55. Minneapolis: University of Minnesota Press.
- WYLIE, KRISTINE M., GEORGE M. WEINSTOCK, AND GREGORY A. STORCH. 2012. "Emerging View of the Human Virome." *Translational Research: The Journal of Laboratory and Clinical Medicine* 160 (4): 283–90.
- ZIMMER, CARL. 2012. "Mammals Made by Viruses," *Discover*, February 14, 2012. <http://blogs.discovermagazine.com/loom/2012/02/14/mammals-made-by-viruses/#.XQINm9MzZQY>.