Heiner Fangerau* and Alfons Labisch

# Nature, Culture and COVID-19—Towards a Global History of Pandemics

https://doi.org/10.1515/jciea-2022-0004
Received February 9, 2022; accepted March 20, 2022; published online June 22, 2022

**Abstract:** From a historical perspective, SARS-CoV-2 and COVID-19 have simultaneously led to known and previously unknown events as well. These seamlessly linked events can only be grasped with a new, integrative perspective of the relationship between culture and disease. Such a view requires a historiography that captures the full spectrum of an epidemic event, from the causes of emerging pathogens to their global spread and impact on different national, regional, and local communities. Integrative approaches to a global history of epidemics essentially include the following:

–Understanding the dynamic relationship between nature and culture to empirically capture changes in local and regional biospheres and their interaction in global contexts.

–Investigating the culturally determined scientific and social negotiation processes that lead to the naming, characterization and communication of initially unknown causes of disease in relation to the culturally determined countermeasures that begin with their emergence.

–Analysis of the effects of worldwide densification through new technical possibilities and new forms of globally organised production and the associated traffic of trade, transport and communication in historical perspective. These empirical approaches represent nodes in a seamless web of interacting factors. Such an approach necessarily has to bring together a wide range of disciplines and perspectives.

**Keywords:** COVID-19; public health; history; pandemics; integrative approach

***Corresponding author: Heiner Fangerau**, Department for History, Philosophy and Ethics of Medicine, Heinrich-Heine-University Düsseldorf, Medical Faculty, Centre Health & Society (Bldg.17.11), Moorenstr. 5, D-40225 Düsseldorf, Germany, E-mail: heiner.fangerau@hhu.de
**Alfons Labisch,** School of History, Beijing Foreign Studies University, Beijing, China, c/o University Hospital Dusseldorf, Düsseldorf, Germany, E-mail: alfons.labisch@hhu.de. https://orcid.org/0000-0003-1911-1280

# 1 Introduction

It's 2020 and COVID-19 rules the world.[1] COVID-19 is caused by a virus named SARS-CoV-2. Virology is a molecular biological science in which genetic engineering plays a crucial role. Because the clinical symptoms of COVID-19 are not specific, especially in the early stages, virus detection by polymerous chain reaction (PCR) technology serves as the "gold standard" for diagnosis and ensures an accurate clinical diagnosis.[2] In disease control, which must also rely on pathogen detection and the isolation of the pathogen or its carriers, it is logical to generate diagnostic evidence—in the classical sense of the immediately obvious (Martin & Fangerau, 2021)—with the aid of molecular genetic techniques. And this also applies to the development of modern vaccines, such as the mRNA vaccines, as well as new and specific remedies, ideally those with a molecular biologically targeted effect.

However, a purely molecular biological perspective, including the corresponding technology, reaches its limits when pandemics and their consequences are to be considered within a broader perspective. Intensive care physicians, psychiatrists, sociologists, epidemiologists, economists and the general public each focus their attention on completely different aspects of an epidemic than those offered by molecular biologists. Therefore, various scientists, policies, administrations or different groups in society may reach different, and possibly contradictory, conclusions on how to deal with the epidemic and the virus that caused it. For some, evidence about the virus's genetics or molecular biology will recede into the background or may even be irrelevant. A classic example of this is the debate that has been going on since September 2020 as to whether people die *from* or *with* the coronavirus (Viglione, 2020): Accordingly, the decisive factor for all further considerations is that people die. Detecting presence of the virus then identifies this casualty as part of the pandemic.

Historians and medical historians have also commented widely on the current pandemic across a number of platforms. In a time when seemingly safe assumptions need to be constantly revised, history appears as a safe retreat for historically coalesced options for action: Historical experience forms the basis of our current health care system (Fangerau & Labisch, 2020, 2022). In this context, the genetic virus test is an epistemologically central procedure, which is admittedly worthy of

**1** A German version of this paper appeared in Fehse et al.: "Fünfter Gentechnologiebericht. Sachstand und Perspektiven für Forschung und Anwendung", Berlin-Brandenburgische Akademie der Wissenschaften (2021).

**2** https://www.rki.de/DE/Content/InfAZ/N/Neuartiges_Coronavirus/Vorl_Testung_nCoV.html;jsessionid=149C2C54C9D26381AF48C8F6C2695729.internet081?nn=13490888#doc13490982bodyText4 (letzter Zugriff 20.09.2021).

discussion, but historically relevant for past pandemics only to a limited extent. Molecular biological evidence—like all modern aspects of pathogens, by the way —contributes little to our understanding of how societies dealt with earlier epidemics. A pertinent example: the identification of the pathogen that caused the "Black Death" (Spyrou et al., 2016) occurred just a few years ago, but knowing the disease-causing pathogen does little to help our understanding of the history of this epidemic, and its immediate impacts on a city, a region or a society, as well as the significant long-term social consequences (cf. Bergdolt, 1989, 1994). Retrospective evidence of specific pathogens is merely one building block among many others to reconstruct past infectious diseases and epidemics in their full scope (Labisch, 2018). And these limits of biological or medical statements necessarily also apply to current epidemics.

A gap often appears between the detection of a virus and the subsequent sociocultural reaction, both historically and in the present day. Biology and the virus as a natural indispensable entity represent uncontrolled nature on one side, while individuals and societies, with their culture, social life, and scope for action represent the other. This capacity for action, in turn, can be further differentiated into systems such as culture or economy, politics or science, which operate independently of each other and should therefore be considered as independent entities.

However, such a separation of diverse human capacities for action and natural contexts is not sufficient for either historical or social science analysis if historiography or the social sciences wish to go beyond a purely reportorial function. For a century, historians of medicine or sociologists and philosophers of science, in particular, have repeatedly pointed this out. Ludwik Fleck's approach to understanding science as a socially determined, disciplined interpretation of the observed environment (Fleck, 1934/1980) is just as exemplary, as Bruno Latour's bid to understand the mobilization and description of the world as an interplay of human and material exploits and attempts at action (Latour, 1995, 2002).

To the extent that we understand SARS-CoV-2 and COVID-19 at all, they are in many respects familiar from a historical standpoint, but at the same time new and unknown, which means that the current pandemic can only be analyzed from a new, integrated perspective. As new technological advances have led to enhanced strategies for detecting the virus and fighting the pandemic—more or less successfully—we can look to history with different perspective and reanalyze past epidemics with a fresh approach. Such a perspective would enable historiography to take a new and perhaps different look at the history of earlier epidemics and to capture the entire scope of the event from the conditions under which new pathogens emerge, to their global spread, and the impact on the ground.

## 2 Nature, culture and ecological spaces

The foundation of an integrative history of epidemics is the interrelationship between nature and culture. Individuals are both the subject of nature as well as its object. We tend to interpret nature as something that is "other" and not an integral part of who we are. In doing so, it's easy to overlook what the philosophers of antiquity in the East —Laozi or Zhuangzi, for example—or in the West—such as the pre-Socratics—had already recognized: At the moment of awareness, people have already named and classified nature and subjected it to human exploitation. Everything that is unknown remains closed to human awareness and therefore does not exist for human beings—until humans feel compelled to impose a name on something that is manifestly "natural," thereby inserting it into the various modes of communication, until the named identity becomes an actor in the development of cultural patterns.

Culture and society have a distinct effect on discussing, interpreting and ultimately naming what people understand as illness. Charles Rosenberg proposed the term "framing" for this process. Illnesses are not pure social constructs. Rather, nature and culture intertwine in the process of interpreting and defining a certain nomenclature (naming) (Rosenberg, 1989). Cognition, emotions, body sensations and collective cultural conventions together interact in the development of disease concepts (Fangerau et al., 2009). Nature and culture are so neatly interwoven that their mutual effects can no longer be attributed to one entity or the other. However, in the case of an epidemic, nature seems to drive people in circles; for example, from "lock down" to "lock down," and just as the dog cannot catch its own tail, there is often little real prospect of having the ability to direct "natural" events at all.

This anthropological narrative must be made manageable for the purposes of historical study. The concept of ecologically balanced spheres can serve this purpose: Among these spheres is a constantly unstable equilibrium between nature and culture, including all animals (of which humans are naturally a part of) and "en-cultured" diseases. George Rosen wrote in this perspective in 1947:

> Health and disease are expressions of changing relationships between the various components of the body, and between the body and the external environment in which it has its being. As a biological phenomenon, the causes of disease are sought in the realm of nature; but in man disease has still another dimension. Nowhere does human disease occur as "pure nature", instead it is ever mediated and modified by social activity and the cultural environment which such activity creates. (Rosen, 1947)

This concept of balanced biospheres does not only apply to pathogens, but to all flora and fauna (e.g., invasive plant and animal species, monocultures and epidemics), which are all engaged in a lively and possibly serious exchange.

On the basis of such an approach, the following scenarios for epidemic events can be established:

–The—always unstable—ecological balance is disturbed from within.
–Ecologically balanced areas are invaded by people who have had no contact with the diseases that have been cultivated there.
–Pathogens are carried into other ecological zones and express themselves there as individual infectious diseases, possibly also in epidemics and possibly in pandemics.

If previously unknown disease phenomena occur in a society, a new disease is defined—in each case in a culturally and historically appropriate manner—through a process of social negotiation. With the strengthening of an iatro-technologically oriented medical landscape, natural sciences and medicine play an increasingly important, though never exclusive, role in this process (Rotschuh, 1978). The power of definitions via genetic virus detection described at the beginning of this article offers a recent example. Finally—once again, as a pertinent example—SARS-CoV-2 as a be-named form of nature has caused people to respond in ways that are deeply rooted in society. Cultures and civilizations will "naturally" (i.e., "of course" or "for sure") respond in different ways to this new threat.

However, one thing should be clear in all these stories of connection: Nature drives people and societies mercilessly and forces them to either act, or to helplessly surrender. Even when a disease appears to be "defeated," such a state is only a snapshot in nature's long-term quest for balance. Complacency is how smallpox, supposedly controlled, could become virulent again, along with other supposedly controlled endemic diseases if the pathogens—such as the smallpox viruses stored in Atlanta or Novosibirsk—were released. And it's not just about viruses. Strains of antibiotic-resistant bacteria could emerge, such as methicillin-resistant staphylococci (MRSA) and join the dreaded pathogens of nosocomial infections.

Such an approach, which understands the relationship between humans and nature as an indissoluble connection, offers a possible entry point into the history of epidemics.

## 3 Trade and traffic

Another relationship to be considered in a new way is the connection between the traffic of people and goods and the historical changes that have taken place. When examining the great historical epidemics in Europe—from the "loimos" of Thucydides in Athens in 430 B.C.E. to the Antonine (from 165 C.E.), the Cyprian

(from 250 C.E.) or the Iustinian plague (from around the sixth century C.E.)—it becomes obvious that they spread via trade routes (Leven, 2021). This can be traced from year to year in the inexorable advance of the "Great Dying," which included the "Black Death" that set out from Central Asia in 1330 C.E. Since the mercantile conquest of the globe, only the permanent worldwide trade networks have led to a "Columbian Exchange" (Crosby, 1972) and ultimately a "unification microbiénne du monde" (Le Roy Ladurie, 1973).

In fact, this connection between trade and epidemics exists as far back as human history can be traced (McNeill, 1976) and is already inherent across the various cultural areas on the planet (Diamond, 1997). It was not until the age of industrialization and imperialism, and the subsequent "transformation of the world" (Osterhammel, 2009), that the rapidly growing global exchange of goods and people also led to a regular global exchange of pathogens, mainly taking place, at the time, through shipping. The "scandalous" epidemic of the time was the pandemic strain of cholera whose relentless March across sea and land could even be traced on a daily basis. The scientists and politicians of the era enacted long-term and unconceivably costly measures to ensure that cholera was confined to its classic endemic biospheres and continued to be contained with appropriate measures. So began the first worldwide heyday of "Homo hygienicus" (Labisch, 1992).

Exchange and transport, as well as human response and economic considerations, offer another possible approach, but this is yet to be seen within the realm of natural, cultural and ecological spaces.

## 4 Technical means of production and reproduction

Against the background of nature and culture, as well as barter and trade, the respective contemporary conditions of production and reproduction are central components of an integrative history of epidemics. The material basis of the current mode of production uses automated techniques based on global data processing. Just as coal and steam in the nineteenth and twentieth centuries increased immeasurably the previously limited labor provided by animals, data processing since the end of the twentieth century has expanded the computational and, potentially, even the brain capabilities of humans. Genetic engineering or molecular biology and medicine are unthinkable without data processing. The globalization of the worldwide connectivity of computers, servers and networks in all areas of production and reproduction is progressing at an inexorable rate. Such advances have occurred at the same time that people are spreading out across the

globe, permanently challenging previously fragile, but at least survivable, balanced biospheres and connecting them with each other through a brisk international trade.

Recently, the historian Mark Honigsbaum has shown that on the basis of the interplay of nature and culture, epidemics—including influenza, Legionnaires' disease/sick building syndrome, AIDS, SARS, Ebola, Zika and COVID-19—are each initially recognized in the realm of politics, business, media, language, and ultimately in science and medicine, as well, and then dealt with during the process of social discourse (Honigsbaum, 2020; Matthews, 2020). Caught up in the midst of this process, the virus does not do what it wants, but appears as an actor that must be reacted to: the new actor is eliminated as much as possible or, as with other diseases such as influenza, a new equilibrium is tolerated in the same sense as that of a well-policed society.

Culturally shaped modes and means of communication thus determine how the virus crosses the threshold of perception and in how it is "scandalized" (Labisch, 2005), i.e., whether the virus or a phenomenon associated with it ultimately becomes the focus of discussion beyond its epidemiological relevance.

## 5 Global and networked history—from meta-theory to empiricism

The disturbed balance of nature and culture under the drive for globalization was first pointed out by Laurie Garrett in 1994 with "The Coming Plague: Newly Emerging Diseases in a World out of Balance" (Garrett, 1994). Others, such as S. Harris Ali and Roger Keil or David Quammen, continued this series in a similar vein (Ali, 2008; Ali & Keil, 2008; Quammen, 2012). The examples touched on here follow on from these works and demonstrate that it is less important whether one writes a conceptual history, economic history, political history, social history or institutional history of epidemics or public health—because all of these fields are not only interrelated, they constantly interact with each other.

Marc Harrison concludes with an energetic plea for a global approach to disease history (Harrison, 2015):

> …that thinking globally about disease means more than considering the movement of pathogens or even relative immunity. Disease is a powerful agent of change, but it never operates in a vacuum and to regard it as a force of globalization is simplistic.
>
> It is necessary to identify the dynamics that forge pathogenic connections and that simultaneously transform the social and natural ecologies into which pathogens and vectors are

> introduced.… Only in this way can we account for the differential impact of disease and its longer-term consequences.

Thus, against the general background of nature and culture, there are essential, interrelated access routes for a global history of epidemics:

- The dynamic relationship between nature and culture is the (meta-) theoretical foundation. Changes in local and regional biospheres and the exchange between biospheres are to be empirically surveyed in a global context.
- The culturally conditioned scientific and social negotiation process that leads to the naming, characterization, and communication of initially unknown causes and pathogens of disease should be investigated, as should the culturally conditioned countermeasures that begin with its occurrence.
- Effects of globalization and the modernizing of technical means of production and communication are to be included in a historiography.

These empirical approaches can be specified—nota bene: always seen in the overall context—in further steps for individual regions and diseases or further defined questions. This list also includes techniques for delineating nature, such as those that have appeared alongside genetic sequencing technology, as well as subjective economic or political interests. The global approach is further revealed by the fact that a pandemic does not hit the entire earth in the same way in terms of world history, but that a specific event is examined and presented in the context of its global interactions.

## 6 Questions, sketches of ideas, and examples for a new history of epidemics

How could such a new epidemic history be structured and built?

First of all, both classical and new historiographies of epidemics must be evaluated in terms of their theoretical background, their epistemological interest, their problems and questions, their empirical material, and their results and narrative. This broad analysis of the state of research is the self-evident ground upon which a new history of epidemics can be built (for the German-language literature cf. Fangerau et al., 2021, for other regions the other essays ibid.).

The meta-theoretical background is provided by considerations on the topic of "man and nature". To what extent are people— along with their bodies and their psychophysical constitution—a part of nature and to what extent is nature an object with which people (as both subject and object) have to deal with and thus

shape their lives. At first glance, these philosophical–anthropological speculations may seem too remote for historical-empirical studies. Hence, the need for additional concrete problems and questions.

How did people in earlier times, and/or in other cultures, explain the occurrence of epidemics? In this sense, how can the famous report by Thucydides be classified in the pre-Socratic world of thought (e.g. of Anaxagoras) about nature, culture and man? Similar questions can be traced from animistic-demonic world conceptions to modern natural- and life-scientific world conceptions and their political or life-world counterparts, respectively.

Epidemics and pandemics are "scandalized irritations" of social orders and their material foundations triggered by nature. To get even closer to the epidemic: Why are the responses to pandemics so different across societies or people—even though the virological-molecular-biological knowledge of the causative pathogen, the resulting scientific-rational proposals are universally known, and their predictions have nearly always come true? These differences are evident across Europe, but they are especially clear when comparing different interventions, including the wide gaps in infection and death rates between East Asia and the West. This inquiry leads directly to the question of which nature-culture interpretations lead to different behavioral structures, which in turn are clearly rooted in the complex structures of a society, including the vastly different interpretations of nature and culture in East Asia and Europe. Beginning with the *Yi Jing*, *Laozi* and *Zhuangzi* in the East and the early Socratics and later Greek philosophers in the West, these traditions result in the communal orientation versus individual orientation, and the autocratic versus liberal orientation of individuals and societies. Do these rough frameworks, which have been circulated as far as the daily press, really apply when, in a further step, the quite different measures of infection and death rates in East Asia are to be analyzed—especially for neighboring countries that are related? How can the general approaches of different social orientations and the resulting measures of public health security be refined within the conception of comparative historical studies in such a way that they can be empirically grasped? This question opens up an array of fundamental questions about cultural comparison across the globe (cf. as a first attempt Fang et al., 2020).

The above example makes clear that in the classical social history of medicine, the "social" aspect, and its theoretical concepts, form the basis of interpreting medical practices in their environment, including their preconditions and effects. In a new history of epidemics, medicine—in the broadest sense—as well as historically and culturally specific medical practices serve to interpret social action, resulting in a focal shift of 180° with regard to the social history of medicine.

Within this broad theoretical framework, the relationship between nature and culture, divided into specific biospheres, forms a first empirical topic.

In this setting, biology and the worldwide spread of historical epidemic pathogens are the first to be examined. Such a historical inventory would result in a scenario of a seemingly controllable or even fully controlled biosphere. Under the conditions of an always unstable and thus possibly disturbed ecological balance, dangers would arise from within. New pathogens, or at least pathogens that are new to humans, would arise through contact between different animal species, such as bats and common raccoons or "tanuki". These pathogens could then result in infection through a "spillover-effect" in individual humans as the result of contact with raccoons; for example, in the production of furs. In the early stages, an infectious disease is not yet an epidemic. If the new pathogens pass from infected people to other individuals—the other "spillover effect"— and are subsequently introduced into dense human gatherings, the initial spark of an epidemic occurs. The relatively recent, and unimaginably large urban densities and constantly growing urban zones, with their need for continuous food supplies—through large live animal markets, for example—and the problematic disposal of human and animal remains, pose an ongoing potential danger. The same dangers apply to the intrusion of agriculture into former (primeval) forests in subtropical and tropical zones. In such cases, new contacts between different animal and plant species can occur, through which a chain of individual infections, up to and including local epidemics, can result. This is how the Ebola virus, and subsequently Ebola fever, arose in tropical zones in Central Africa. Furthermore, people can invade ecologically balanced spaces which, up to then, had no contact with the diseases currently identified and enculturated there. Examples include typical local pathogens such as different types of typhoid or aggressive malaria pathogens or, these days, the new emerging diseases against which an immunologically naive population has no acquired immunity. Finally, pathogens can be transported into other ecological zones, where they manifest themselves as individual infectious diseases that may transform into epidemics and even pandemics. An analogous historical example to today's events are the cholera pandemics of the nineteenth and twentieth centuries, along with the new emerging diseases, which represent a significant global threat of epidemic and pandemic potential.

The dictum "nature strikes back" does not only apply to animals and humans, but also to the new emerging diseases, 70%–80% of which are zoonoses and thus diseases originating from animals. So, the concept of "nature strikes back" also applies to species-specific environments of both nature and culture, as well as the effects of climate change, world population and agriculture.

The next set of topics involves global trade and exchange. Thus, communication is both the elixir of life and became a possible pathway for epidemics to spread throughout the modern world, beginning in prehistoric times to the cholera threat of industrialized societies and the new emerging diseases of globalization.

In addition to the fundamental question of globalization, worldwide densification and communication and the resulting danger of epidemics, modern forms of transport and communication are a point of focus. Shipping has been replaced by air travel, leading to epidemics that spread across continents and the world in a matter of days. The general gazettes of the 19th century reported the advance of cholera not only day by day, but mile by mile. In the 21st century, current pandemics are internet-based media events. Official news is not only sent all over the world, but perhaps even more importantly, people are able to share their personal experiences and opinions worldwide, turning the disease into a communicative force and driving public reactions. Epidemics become internet-based media events, based on floods of images, even from the recent and distant past, and their impact and effects on societies can be followed in real time, worldwide, in sync. A special question arises in the border zones between countries in terms of how to manage trade and travel restrictions in the era of internet-based epidemic surveillance. A central question here is data protection and the individual right to personal data—a different type of cultural borderline, not only in Europe but also between Europe and East Asia and among East Asian countries.

This question closes the circle regarding social issues that were mentioned at the beginning of this discourse. Epidemics are crises of the self-evident: epidemics and social values, effects and side effects of political discussions and administrative and epidemic hygiene measures; the role of science during the course of the pandemic; "the rule of experts" versus "a crisis of expertise"; conflicting interpretations of events; the rise of conspiracy theories; and risk perceptions, exclusions and discriminations in historical perspective are only a few of the many issues requiring solutions. The threat of new emerging diseases is real and will remain. Learning to live with "new emerging diseases" is the ultimate, pragmatic issue at the center of a new epidemic history.

## 7 Finally, how can the various aspects of a new epidemic history be captured, and how can the story of a new epidemic history be told?

In the history of global epidemics, the empirical approaches mentioned here, which are by no means complete, can be thought of as nodes in an unweighted web of interacting factors. In 1986, the historian of technology Thomas Hughes formulated the idea of the "seamless web". With this concept, his aim was to provide the historiography of technology an instrument that freed it from a focus on social constructions, on the one hand, and a coalescing biologism and

concentration on technology as applied knowledge on the other (Hughes, 1986). His proposal was to analyze, with reference to Bruno Latour's actor-network theory, a wide variety of approaches to (technological) history as a seamlessly interlocking and interacting set of actors. For next-generation sequencing techniques in COVID-19 diagnostics, Karen Kastenhofer recently investigated and discussed the value of Hughes' concept in understanding disease, biomedical diagnostics and their social effects (Kastenhofer, 2021).

We would like to take up this idea, but with less focus on actors or actants and more on understanding the approach to a global history of epidemics as a network-like strategy that abandons the idea that there is neither a concrete beginning nor end, as well as no leading or negligible nodes. In this way, we move from networks that make knowledge developments visible as social recognition processes (Fangerau, 2013) to multimodal networks that include relationships and influences of different levels of observation in the explanation of epidemic events. This does not mean that categories of complexity reduction or tried-and-tested think-economic systematizations should be completely abandoned. Lifeworld, the virus as an actor, media, science, and technologies, including, of course, genetic engineering in our time, administrative action, economy—all these entry points into a historiography that makes sense can be retained. However, they are to be understood as nodes and edges of the network that spans between the access routes to the global epidemic history proposed above, and its parts interact seamlessly with each other.

Thus, a major problem arises at the end: How can such an integrative epidemic history be told or written? When considering the concept as a whole, it becomes clear that this proposal for a "new history of epidemics" is interdisciplinary in nature and must therefore be approached in an interdisciplinary manner. Such an approach would lead to a multitude of contributions. What might an overall view look like? Perhaps something like a pointillist picture, but in the form of a strictly edited anthology, for example, which, when viewed from a distance, would provide an impression of the whole? Perhaps a multi-author work with comprehensive final editing? Or a documentary-like film? A four-dimensional or multi-perspective globe? An electronic document or Wiki with countless animated cross-references?

For the time being, we address the question how to write such a new integrative global history of pandemics to the readers in order to stimulate a discussion.

**Research funding:** Our research on this paper has been partially funded by the Gisela Eisenreich Foundation, a private Foundation of the "Gesellschaft der Freunde und Förderer der Heinrich-Heine-Universität Düsseldorf".

# References


Ali, S. H. (2008). *Networked disease emerging infections in the global city*. Wiley-Blackwell.

Ali, S. H., & Keil, R. (2008). *Networked disease: Emerging infections in the global city (= Wiley-Blackwell studies in urban and social change series)*. Blackwell.

Bergdolt, K. (Ed.). (1989). *Die Pest 1348 in Italien: fünfzig zeitgenössische Quellen* [The 1348 plague in Italy: Fifty contemporary sources]. Manutius.

Bergdolt, K. (1994). *Der Schwarze Tod in Europa. Die Große Pest und das Ende des Mittelalters* [The Black Death in Europe. The Great Plague and the end of the Middle Ages]. Beck.

Crosby, A. W. (1972). *The Columbian exchange: Biological and cultural consequences of 1492*. Greenwood.

Diamond, J. (1997). *Guns, germs, and steel: The fates of human societies*. Norton.

Fang, Y., Fangerau, H., & Labisch, A. (2020). COVID-19 and governments: Emerging infectious diseases and governance—Some preliminary thoughts. In Heidingsfelder, M., & Lehmann, M. (Eds.), *Corona. Weltgesellschaft im Ausnahmezustand?* (pp. 187–212). Velbrück Wissenschaft.

Fangerau, H. (2013). Evolution of knowledge from a network perspective: Recognition as a selective factor in the history of science. In Fangerau, H., Geisler, H., Halling, T., & Martin, W. (Eds.), *Classification and evolution in biology, linguistics and the history of science* (pp. 11–32). Steiner.

Fangerau, H., Koppitz, U., & Labisch, A. (2021). History of pandemics, epidemics and endemics: A bibliographical essay on secondary sources in German. In Weldon, S. P. & Sankaran, N. (Eds.), *ISIS.CB Special issue on pandemics*. https://isiscb.org/special-issue-on-pandemics/essay.html?essayID=04.

Fangerau, H., & Labisch, A. (2020). *Pest und Corona. Pandemien in Geschichte, Gegenwart und Zukunft* [Plague and Corona. Pandemics in history, present and future]. Herder.

Fangerau, H., & Labisch, A. (2022). 历史、 当下及未来的大流行病 [Plague and Corona, extended Chinese edition] (X. Li Trans.). The Oriental Press.

Fangerau, H., Martin, M., & Lindenberg, R. (2009). Vernetztes Wissen: Kognitive Frames, neuronale Netze und ihre Anwendung im medizinhistorischen Diskurs [Networked knowledge: cognitive frames, neural networks and their application in medical-historical discourse]. In Fangerau, H. & Halling, T. (Eds.), *Netzwerke. Allgemeine Theorie oder Universalmetapher in den Wissenschaften? Ein transdisziplinärer Überblick* [Networks. General theory or universal metaphor in science and humanities?] (pp. 29–48). Transcript.

Fleck, L. (1980). *Entstehung und Entwicklung einer wissenschaftlichen Tatsache. Einführung in die Lehre vom Denkstil und Denkkollektiv* [Origin and development of a scientific fact. Introduction to the theory of thought style and thought collective]. Suhrkamp. Originally published in 1934.

Garrett, L. (1994). *The coming plague. Newly emerging diseases in a world out of balance*. Farrar.

Harrison, M. (2015). Reframing the history of health, medicine, and disease. *Bulletin of the History of Medicine*, *89*(4), 639–689.

Honigsbaum, M. (2020). *The pandemic century. A history of global contagion from the Spanish Flu to COVID-19*. Penguin.

Hughes, T. P. (1986). The seamless web: Technology, science, etcetera, etcetera. *Social Studies of Science*, *16*(2), 281–292.

Kastenhofer, K. (2021). The seamless web of next generation sequencing and COVID-19. *TATuP* [Internet], *30*(2), 18–23.

Labisch, A. (1992). *Homo hygienicus. Gesundheit und Medizin in der Neuzeit* [Homo hygienicus. Health and medicine in modern times]. Campus-Verl.

Labisch, A. (2005). "Skandalisierte Krankheiten" und "echte Killer"—zur Wahrnehmung von Krankheiten in Presse und Öffentlichkeit ["Scandalized diseases" and "real killers"—On how diseases are perceived by the press and the general public]. In M. Anděl u.a. (Ed.), *Propaganda, (Selbst-) Zensur, Sensation. Grenzen von Presse- und Wissenschaftsfreiheit in Deutschland und Tschechien seit 1871* (pp. 273–289). Klartext.

Labisch, A. (2018). Molecular Historiography—neue Gegenstände und neue Methoden einer neuen Geschichtsschreibung? [Molecular historiography—New subjects and new methods of a new historiography?]. *NTM Zeitschrift für Geschichte der Wissenschaften, Technik und Medizin*, *26*, 1–16.

Latour, B. (1995). *Wir sind nie modern gewesen: Versuch einer symmetrischen Anthropologie* [We have never been modern: An attempt at a symmetrical anthropology]. Akademie-Verl.

Latour, B. (2002). *Die Hoffnung der Pandora: Untersuchungen zur Wirklichkeit der Wissenschaft* [Pandora's hope: Inquiries into the reality of science]. Suhrkamp.

Le Roy Ladurie, E. (1973). Un Concept: l'unification microbienne du monde (XIV.–XVII. siècles) [A Concept: The microbial unification of the world (XIV.–XVII. centuries)]. *Schweizerische Zeitschrift für Geschichte*, *23*, 627–696.

Leven, K.-H. (2021). *Seuchen: Eine Geschichte von der Antike bis zur Gegenwart* [Plagues: A History from antiquity to the present day]. Böhlau.

Martin, M., & Fangerau, H. (2021). *Evidenzen der Bilder. Visualisierungsstrategien in der medizinischen Diagnostik um 1900* [Evidence of the images. Visualization strategies in medical diagnostics around 1900]. Steiner.

Matthews, A. (2020). Review of the book *The pandemic century. A history of global contagion from the Spanish Flu to COVID-19*, by Mark Honigsbaum. *Postdigital Science and Education*, 2, 1006–1014.

McNeill, W. H. (1976). *Plagues and peoples*. Anchor.

Osterhammel, J. (2009). *Die Verwandlung der Welt. Eine Geschichte des 19. Jahrhunderts* [The transformation of the world. A 19th century history]. Beck.

Quammen, D. (2012). *Spillover animal infections and the next human pandemic*. Norton.

Rosen, G. (1947). What is social medicine? A genetic analysis of the concept. *Bulletin of the History of Medicine*, *21*, 674–733.

Rosenberg, C. (1989). Disease in history: Frames and framers. *The Milbank Quarterly 67* (Supplement 1). Framing disease: The Creation and Negotiation of Explanatory Schemes, 1–15.

Rotschuh, K. E. (1978). *Konzepte der Medizin in Vergangenheit und Gegenwart* [Concepts of medicine in past and present]. Hippokrates.

Spyrou, M. A., Tukhbatova, R. I., Feldman, M., Drath, J., Kacki, S., Beltrán de Heredia, J., Arnold, S., Sitdikov, A. G., Castex, D., Wahl, J., Gazimzyanov, I. R., Nurgaliev, D. K., Herbig, A., Bos, K. I., & Krause, J. (2016). Historical Y. pestis genomes reveal the European Black Death as the source of ancient and modern plague pandemics. *Cell Host Microbe*, *19*(6), 874–881.

Viglione, G. (2020). How many people has the coronavirus killed? *Nature*, *585*(7823), 22–24.