Tidsskriftet Tidsskrift for Den norske legeforening

Microbes as history's driving force

ESSAY

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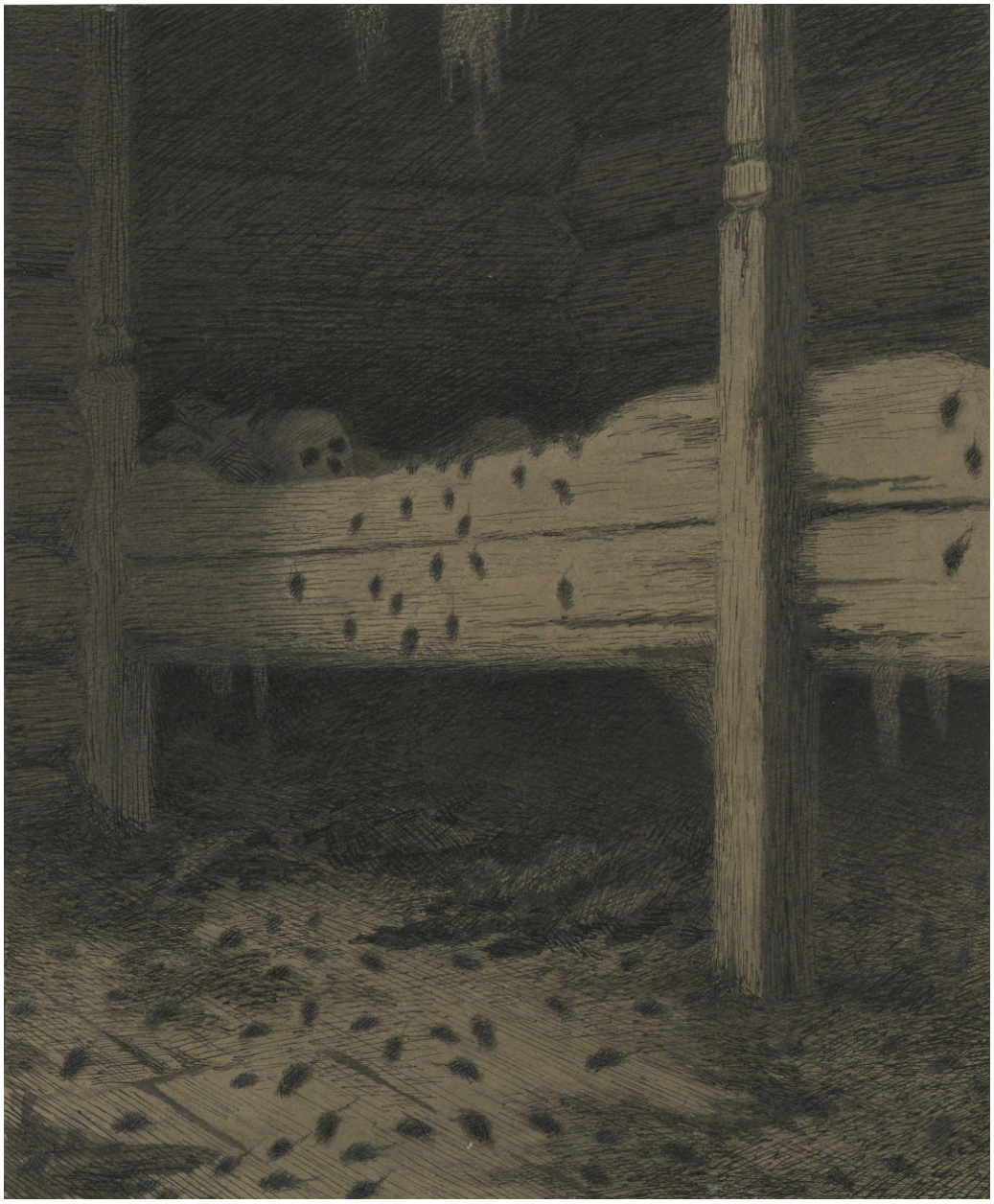
Books on human history often describe individuals or groups who attempt to shape our environment and societies. However, we are all biological beings subject to natural processes. Cosmic phenomena, earthquakes, volcanic eruptions, climate change and epidemics have repeatedly impacted on the course of history. In his book *Pathogenesis*, sociologist Jonathan Kennedy writes compellingly about the latter, but – in my opinion – gives microbes a bit too much power.

THE PLAGUE IN FLORENCE: *Yersinia pestis* caused massive outbreaks in Europe and parts of Asia in the period 1346–53, and new waves occurred in the centuries that followed. Engraving by Luigi Sabatelli (1772–1850) based on the descriptions in Decameron (1353) by Giovanni Boccaccio (1313–75). In public ownership through the Wellcome Collection.

In the summer of 1698, five ships set sail from Leith in Scotland towards Panama. The 1200 people on board aimed to establish a Scottish colony called New Caledonia, based on trade with the local population. They also planned to create an overland route to the Pacific coast. However, the attempt at colonisation ended in disaster, and most of the settlers died from starvation and infections within the first six months. A relief expedition in 1699, with an additional 1000 settlers, met the same fate, leading to the abandonment of the so-named Darien Scheme. An estimated 15–40 % of Scotland's total capital was lost, and the resulting economic fallout was a key factor in the transformation of the Union of the Crowns between England and Scotland into the United Kingdom of Great Britain in 1707. The tropical diseases that afflicted the colonists could therefore be considered one of the factors in Scotland losing its independence (1).

Epidemics throughout history



MUSSTAD: In Norway, the Black Death killed around 60 % of the population in the period 1348–1350. Many villages were depopulated, and Norway as an independent nation went to ruin. Drawing by Theodor Kittelsen (1857–1914). Illustration for the Black Death (1900), published by J.M. Stenersen & Co. Publishing House. In public ownership through the National Museum..

Jonathan Kennedy is a sociologist and lecturer at Queen Mary University in London. In his book *Pathogenesis – How germs made history* published in 2023, he argues that pathogenic microbes have played a crucial role in shaping human history (1). The book provides a chronological account of epidemics, from prehistory through antiquity and the Middle Ages, up to modernity. The final chapters describe the role of infectious diseases during the centuries of colonialism, revolutions and the rise of industrial societies. The premise of the narrative is that pathogenic microbes have dictated human living conditions and repeatedly caused mass extinctions, with dramatic consequences for the

evolution of society. Many of these microbes originated in various domesticated animals. After the agricultural revolution in the Neolithic period, populations with gradual and prolonged exposure to livestock had time to develop herd immunity. In contrast, previously unexposed populations experienced catastrophic epidemics with mass death and societal collapse. The author cites a wide range of sources from social sciences, the humanities and natural science. Many of the examples are familiar to the interested reader, but there are also fascinating accounts of lesser-known events and phenomena. The book was published in Norwegian last year, skilfully translated by Lene Stokseth, and includes a foreword by Dag O. Hessen.

The dangerous livestock

Throughout history, humans have been keen to associate pivotal events with specific natural phenomena, often with good reason. Various suggestions have been made regarding celestial phenomena that could explain the biblical account of the Star of Bethlehem, and recent research suggests that the Nordic myth of the Fimbulwinter stemmed from climate change caused by major volcanic eruptions around 536–40, leading to temperature drops, crop failures and disease. The Black Death has always been viewed in Norwegian historiography as a definitive turning point between the golden age of the High Middle Ages and the subsequent 400 years under Danish rule, known as the '400-year night'.

> ***«Kennedy goes to great pains to argue that microbes are the deciding factor in the course of history»***

It is well-known that infectious diseases and epidemic outbreaks have played a significant role in shaping the course of important events. Kennedy goes to great pains to argue that microbes are the deciding factor in the course of history, but he is not the first to point out the significance of disease transmission from livestock to non-immune populations. In 1997, Jared Diamond published the book *Guns, Germs, and Steel: The Fates of Human Societies*, which won the Pulitzer Prize for non-fiction (2). Diamond sought to explain why the proliferation of so-called Western civilisation was at the expense of other cultures. He concluded that access to particular natural resources (steel), technologies (weapons) and immunity to epidemic diseases (plague) had been deciding factors. The agricultural populations of Eurasia had natural access to a variety of animal species that could be domesticated (cattle, pigs, sheep, horses), in contrast to populations in other parts of the world. They were therefore immune to many pathogenic microbes of zoonotic origin. Western expansion was thus facilitated by the fact that non-Western empires had already been weakened by epidemics or had collapsed entirely before the European conquerors had even reached them. Some historians found Diamond's approach to be too general and simplistic, while others viewed his

theories as bold and refreshing contributions to a field that often seems complex and unwieldy. *Guns, Germs, and Steel* was a commercial success and has delighted many history buffs like myself.

> ***«It is impossible to consider the role of microbes without considering other factors that have also significantly impacted on the course of history»***

The complexity of history

In his book, Kennedy engages in a dialogue with Diamond but argues that Diamond does not sufficiently recognise microbes as the definitive driving force. Diamond highlights the importance of access to steel and other natural resources within a societal and cultural context that fostered innovation and development, whereas Kennedy claims that the role of microbes alone explains the course of history. I find this argument difficult to follow. The waves of plague caused by *Yersinia pestis,* from antiquity well into modernity, have undoubtedly had dramatic consequences for the economy, military power balances and the social order. The spread of measles and smallpox in the New World (the Americas) unquestionably decimated the Aztec and Inca empires. The high prevalence of yellow fever and malaria made it impossible for European settlers to colonise tropical regions of Africa. However, this did not hinder the transatlantic slave trade; in fact, it became cost-effective to use slaves of African origin on sugar and tobacco plantations in the Caribbean and on the American mainland.

NAHUAS INFECTED WITH SMALLPOX: The transmission of epidemic diseases had catastrophic consequences for the population of the 'New World' following the arrival of Europeans in 1492. Original illustration by an unknown artist from the 16th century. This version is reproduced in the Florentine Codex (1540–85) by Bernardino de Sahagún (1499–1590). In public ownership through Wikimedia Commons.

It is nevertheless impossible to consider the role of microbes without considering other factors that have also significantly impacted on the course of history. Within the tradition of medical microbiology, microbes and host populations are, on the contrary, viewed as closely interconnected. The previously rigid distinction between pathogenic and non-pathogenic microbes has been abandoned in favour of a more nuanced assessment of how particular microbes behave in a given individual or population. Preexisting immunity is, of course, an important factor, but so are genetics, population density, age distribution, nutritional status and the prevalence of other diseases. All of these factors, in turn, are consequences of human biology, history, living conditions and culture. Assigning a single factor with a decisive and causal role in shaping history makes little sense when the underlying causes and processes are clearly interwoven and mutually dependent. The scientific data from the prehistoric encounter between Neanderthals and *Homo sapiens* points precisely to such a complex explanatory model. Differences in immune systems resulted in varying resistance to pathogens, a phenomenon recently demonstrated during the COVID-19 pandemic. Genetic variants inherited from Neanderthals have been linked to the regulation of two chemokines that affect the immune response to the SARS-CoV-2 virus (3). There has been speculation that the relatively high prevalence of Neanderthal DNA in northern Italian populations is relevant to the severe course of the pandemic in this region. However, the fate of the Neanderthals in their encounter with *Homo sapiens* must also be considered in relation to factors such as overall population size, social organisation and the number of individuals in different groups. While many have previously attributed the success of *Homo sapiens* to their intelligence, ability to develop a spoken language or upright posture, Kennedy argues that immunology is the key.

> ***«Humanity's long history is a tale of disease and death, but it is also a tale of development and adaptation.»***

Microbes, for better or worse

FATHER THAMES: Father Thames introduces his children to the city of London – diphtheria, scrofula (glandular tuberculosis) and cholera. During the industrial revolution, overpopulation and poor socioeconomic conditions led to the spread of a number of infectious diseases in the new urban areas.. Caricature by John Leech (1817–64) published in Punch in connection with 'The Great Stink' in 1858. Pictorial Press Ltd/Alamy Stock Photo.

In many contexts, the role of microbes in history is highlighted solely as a cause of disease and death. I consider this a disappointing and poorly informed simplification. The last few decades have provided us with a large body of knowledge on how our microbiome (the collection of all microbes), particularly the bacterial flora in the gut, affects us in a variety of ways. The most obvious is, of course, how the gut flora enables us to benefit from various nutrients, but we also know that the gut's metabolome (the complete set of small-molecule chemicals) is central to a number of life processes in the body (4). Humanity's long history is a tale of disease and death, but it is also a tale of development and adaptation. A comprehensive description of the role of microbes in human history should take such perspectives into account. In this context, we could also speculate on how human behaviour affects the microbes around us and how this, in turn, could shape our own conditions for survival.

Much has been written and said about the medical revolution after penicillin and other antibiotics came into general use around the mid-20th century (5). While humans and animals have gained significant health benefits from antibiotics, exposure to them has fundamentally changed the evolution of several microbial species. This is particularly the case for bacteria that are part

of our own normal flora. Epidemic pathogens from earlier times, such as *Mycobacterium tuberculosis* and *Vibrio cholerae*, have been replaced by infections caused by pneumococci, staphylococci and various intestinal bacteria from our own flora, often in resistant variants. The COVID-19 pandemic, caused by a new and unknown pathogen, is an exception in this context, diverging from the everyday disease burden caused by 'ordinary' bacteria, which, in terms of prevalence, have a much greater impact on public health overall. Just as antibiotics shape microbial evolution, our modern lifestyle, with its travel, industrial food production, disinfectants, etc., has also altered our microbiome and our interaction with the microbes within and around us. Extensive research activity is underway to shed light on the role of microbes in health and disease, and interesting breakthroughs in this field are likely in the years ahead.

> ***«We cannot manipulate individual factors within the system without affecting other areas, be it climate, biodiversity or microbes»***

What about all of the other microbes?

In addition to microbes that directly affect human health, we must not overlook the broader impact of microscopic life. Animal and plant health are closely related to human history through our food supply. In Norway, we take good animal health in agriculture for granted, but today's favourable situation is the result of decades of meticulous breeding and disease control. Mycotoxins have been a blight on humanity ever since we started cultivating grains and other useful plants, decimating crops and, in the most severe cases, poisoning us. A thorough account of microbes' role in history must describe how all aspects of the biosphere are interconnected within the One Health framework, which acknowledges the countless ways that humans, animals and the environment are connected and mutually dependent. We cannot manipulate individual factors within the system without affecting other areas, be it climate, biodiversity or microbes.

What is popular science?

FACSIMILE: Manuskript forlag/Spartacus

One final question that arises when reading *Pathogenesis*, is how historians should approach contemporary political issues, particularly in areas where they hold strong opinions of their own. Jonathan Kennedy makes no secret of his dedication to public health and a fairer world, but at times, his political engagement comes at the expense of a critical perspective on the book's central hypothesis. 'Decolonisation' is a term that is widely used today to describe the process of addressing the lasting harmful effects of European expansionism. However, Kennedy's portrayal is strikingly Eurocentric, as nearly all his examples focus on encounters between Western conquerors and cultures in other parts of the world. Selective use of sources undermines the principle of researchers challenging their hypotheses rather than merely seeking to confirm their own views and opinions. I have a great deal of sympathy for many of the author's viewpoints, but the scientific credibility is weakened when the reader is repeatedly told what to think about contemporary social and political issues. Historical writing is never objective, and in many ways, it is entirely acceptable for the author to be transparent about his stance. However, some sections read more like a debate book than academic communication, and in those instances, the author's voice detracts from the material itself..

Despite some objections, I would recommend that anyone interested in history reads *Pathogenesis*. It does not live up to the ambitions of explaining epidemics with pathogenic microbes as the central, let alone sole, driving force of history. Nonetheless, it is well-written and engaging, offering many interesting perspectives – as long as the reader maintains a healthy critical distance.

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Publisert: 22 April 2025. Tidsskr Nor Legeforen. DOI: 10.4045/tidsskr.25.0100