We tend to think of Big History in a ‘big way’ – the cosmos,billions of years, trillions of kilometres … but this isn’t thewhole picture. Biologist Lynn Margulis produced a bookabout small-scale life, Microcosmos (1986), which led her tocollaborate with chemist James Lovelock on Earth dynamics.In this way, molecular biologist Elizabeth Martin-Kutter also worked with microbial life and helped develop oneof early courses and texts in Cosmic Evolution and Big History with astrophysicist G. Siegfried Kutter.1

In my work, I’ve experienced such cross-disciplinary integration of fields too. My doctoral research focused on the history of infectious disease and public health in the United States, and then I became a professor of world and global history at Ewha Womans University in Seoul. In 2009, our university joined a national campaign to revitalize education, and I became the first resident professor to teach Big History in Korea.2 This led me to think about how these two studies might be joined together to benefit the global community.

This is not as theoretical as it might seem. The present problems that we face in the world today demand change and creative thinking from all of us. Our colleague at Ewha University, world historian Ji-Hyung Cho, assessed the climate crisis in its global and integrated complexity, while geographer Barry Rodrigue sees Big History as a paradigm for us to better move forward into our 21st century world.3 As a start, let me first share with you a story set in New York City in the 1800s. It was a time that shares such themes with our world today.

**Cholera 1832: Social Reform**

After completion of the Erie Canal, which connected the Great Lakes to the Hudson River in 1825, many other canal and railway projects followed. By 1830, New York had become the largest city in the United States – with over 200,000 residents. The transportation revolution fuelled industrialization, which needed workers. Immigration from the British Isles provided them. By 1850, the urban population had doubled, but the immigrant population had gone from 10% to 50%, further driven by the Irish Famine. Social crises developed.4

Cholera is caused by the bacteria, Vibrio cholerae, which leads to severe dehydration through diarrhoea and vom-
New York City was the country’s economic centre, the commercial link between America and Europe. Its residents had become more materialistic and pleasure-seeking. So, when the president of the New York Medical Council announced that ‘cholera broke out more frequently among the intemperate and dissipated,’ it appeared to lend support to a need for moral reform.9

In the late of 18th century, the celebrated Dr. Benjamin Rush of Philadelphia had noted that excessive drink did physical / mental injury. Many temperance organizations also emphasized that drinking caused economic poverty, split families apart, and led to inefficiency and decrease of productivity. Physicians and the Medical Council worked with social reformers, and in this way temperance reform and disease prevention influenced the enactment of prohibition laws.10

A pernicious movement developed around ethno-religious bias. Until this time, Euramericans tended to be relatively homogenous – of British and Protestant heritage. Because of an upsurge in Irish-Catholic immigration, Euramerican Protestants tried to maintain their ascendancy, which pitted ‘nativists’ against ‘immigrants.’ While reform movements were made up of educated Protestants, nativist workers spawned the violent Know-Nothing Movement.11

Irish Catholics were regarded as a threat, not least because they tended to be poor and lacked skills. Crowded together in urban slums, disease ran rampant. Almost 40% of the deaths from cholera in New York in 1832 were Irish – 1400 people. As a result, many American nativists believed that fatal infectious disease broke out because of the Irish and their ‘intemperate life.’12 The cholera epidemic became a chance to spread hostile discourse about immigrants.

**Cholera 1849: Sanitary Reform**

The movement to control epidemic cholera had improved by the time it next entered New York City, in December 1848, aboard a ship from France.13 The Board of Health isolated passengers and crew, but almost half died. Cholera spread to the city, and almost 5000 people perished. Since the population had grown to half a million, mortality was not as bad as it could have been. The fewer deaths resulted from two English innovations.

When cholera had been in full swing in England in the 1830s, the government had empowered regional health boards to deal with elements that threatened community health, such as managing drains and cleaning streets. In 1848, the British government enacted the Public Health Act, which mandated the establishment of boards of health.14 They also had learned that it was most important to improve water quality to control epidemic cholera.

Waterworks had begun to come into existence in the United States earlier in the century, but there was no fa-
ility to drain wastewater. Each home had a sewer, but few managed them hygienically. Many left a sewer until it overflowed and then threw wastewater into a street or river. When cholera began in 1849, the New York State Board of Health pointed to these sewers as a cause of cholera.\textsuperscript{15}

Officials divided the city into districts and examined the sewers by visiting every home. Some resisted, saying it infringed on their individual rights, but most who had witnessed the effects of cholera accepted the suggestions of States Board of Health so as to better manage their sewer facilities.\textsuperscript{16} Toilet waste was another concern.

A privy was outside the home, and faecal waste was collected in large baskets and used as farm fertilizer. The waste from homes in New York City was more than 100 tons a day. Collection reduced the problem for individuals, but it piled up for transportation and the Board of Health identified it as a cause of cholera. The city decided to install an underground septic system.\textsuperscript{17} Sewage treatment equipment required large construction projects and huge amounts of money, but state and urban sanitation and public health agencies had no choice but to expand. Although there were objections about the burden of taxation, sanitary reform was implemented at private and public levels. It was felt that the cost to process wastewater and sewage was worth it, because of the lives it saved.\textsuperscript{18}

The Report of the Sanitary Commission of Massachusetts (1850) reflected this mood. It put emphasis on ‘the necessity of public health’ for development of the United States.20 The cholera outbreak of 1849 was a watershed time for spreading public understanding of sanitary reform in American society. It was seen that sanitation in homes could be the foundation of urban and national public health.

**Cholera 1866: Private Property and Medical Reform**

Reforms continued through the Civil War (1861–1865), which included improvements in military surgery, nutrition, clothing, and accommodation.20 Concerns about infectious disease remained, and moved in a new direction. A New York City physician, Stephen Smith, criticised close-living quarters as incubators for epidemic disease and emphasized the ‘compulsory right to improve sanitary conditions had to be given to city government’ to control cholera.21

Likewise, The Report of the Council of Hygiene and Public Health of the Citizens’ Association of New York (1865) predicted that, if the problem of tenements and public health could not be solved, considerable loss would happen. New Yorkers began to see that sanitation was not only an individual problem but a group and social one too.22

The Metropolitan Health Bill was established in February 1866 and focused on sanitary reform of tenement houses. It set up the Metropolitan Board of Health, the first established by a municipality to improve sanitation in the United States. Immediately afterwards, cholera broke out. By May 1866, more than 1000 died of cholera. The Metropolitan Board insisted unsanitary conditions of tenements was the main cause of this outbreak of cholera.23

The Metropolitan Board’s first strategy to improve tenement sanitation was to examine sewage arrangements and ventilation. They found, in one instance, almost fifteen people living together in a room. The city enacted the Tenement Law (1867), the first of its kind. Each bedroom had to have a window, an emergency exit route was required and a sanitary toilet.24 In this way, epidemic cholera led to public regulation of private property so that American society could deal with infectious disease. It also had an impact on the medical profession.

Before the creation of the Metropolitan Board of Health in 1866, medical doctors had only been dispatched to boards of health after an occurrence of infectious disease. As a result, broad discussions of sanitation, public health and infectious disease had been confined to the political arena. The Metropolitan Board, however, stressed the necessity of having ‘trained medical staff’ such that at least three physicians were among the ten-member staff of the board. As a result, medical doctors began to take charge of public health in American society.25

Before this time, people believed disease resulted from ‘natural causes’ and preferred general treatment over professional care. Books on domestic medicine had been popular, and licensed physicians held little professional standing. Medical students took classes for three years and wrote a dissertation, but few schools kept to strict standards. A license was required to practice, but this didn't restrict who could treat patients. Although New York City issued licenses only to medical graduates and imposed fines on unlicensed doctors, there was little effect.26

But after 1866, the expectation that medical knowledge and professionalization was required to control infectious disease gained ground in the United States. People began to think of infectious disease in the discourse of science and medicine, not politics. They argued it was necessary to have a professional education and real medical experience to successfully investigate causes of disease and to implement effective treatments and policies for individuals and society.

In the 1850s, physicians Filippo Pacini and Joaquim Balcells i Pascual identified the microbe that caused cholera. Thirty years later, microbiologist Robert Koch and his colleagues elaborated the microbial process. And, in the 1950s, medical scientist Sambhunath De found the toxin generated by the cholera bacillus and amplified the details of infection. These studies encouraged new research in epidemiology and phage therapy, as well as revolutionized public health.27

**Conclusions**

Epidemic cholera was the most fatal infectious disease to enter American society in the 19th century. Social dynamics – migration, industrialization and urbanization – exacerbated the first epidemic. A few control strategies merged with moral reform movements in an attempt to solve the outbreak. Knowledge and remedial action evolved. The need for sanitation and public health was begun by the time of the outbreak of 1849, and, by 1866, public regulation of the private sector began, along with professionalization of the medical sector.

Cholera during the 19th century significantly contributed to development and change in American society. Efforts to control infectious disease and to improve sanitation and public health began to be recognized not just an individual problem, but also as a social concern. In this sense, three outbreaks of cholera incrementally brought about reform in American society. These movements were never isolated: Moral reform expanded to sanitary and medical reforms,
Image 3: In this illustration, the blame for cholera focuses on the landlords of New York City’s tenement houses, in which poor ventilation and running water served as a breeding ground for disease. *Harper’s Weekly*, 24 March 1866: 192.
and they influenced each other.

The circumstances were not dissimilar to those we face today. We have a climate crisis linked to population and industrial growth, with impeding migration of climate refugees about to unfold in a massive way. Our political infrastructures are ill prepared to handle existing crises, let alone the enormity of events in the near future. Social reform movements have proliferated – both positive and negative – and are better linking with each other. Will humanity survive? It is an unknown process.

Some big-picture scholars are engaged in these issues. Besides being an astronaut, physician Roberta Bondar has helped to document the changing pattern of disease as a result of climate change and has worked to develop the infrastructure changes to mitigate the effects.28 And while medical anthropologist Robert Aunger had been an early contributor to Big History, his public-health work has led to projects in water, sanitation, nutrition and disease on the African and Eurasian continents.29

The 19th century was a time of grim change. Cholera was one of incidents that gave the most concern and produced terror for people. The interaction of competing and cooperative forces led to integration and improvement in both science, critical judgement, and social justice. This article is intended to show that there is hope by considering the big picture and applying Big History in our world actions.

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Endnotes

17. Segur, Tarr 1975: 601. Tarr and others 1984:
25. Duffy 1990: 120.
26. Buchan 1798: 328–329. Gunn 1834. Suggestions to put professional medical personnel on city / state boards of health had been raised since the 1840s. New York physician John Griscom insisted that it was necessary, not only to improve sanitation but to prevent the city from infectious disease. His idea was not accepted immediately, but it had persuasive power after the establishment of Metropolitan Board of Health and the reoccurrence of cholera in 1866. Griscom 1845. Starr 1982: 43. Mohr 2013: 16. Duffy 1990: 65–66. Whooley 2013.