

Epidemic Cholera and Reform in the 19th Century: Crisis Management and Linkages to Big History

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We tend to think of Big History in a ‘big way’ – the cosmos, billions of years, trillions of kilometres ... but this isn’t the whole picture. Biologist Lynn Margulis produced a book about small-scale life, *Microcosmos* (1986), which led her to collaborate with chemist James Lovelock on Earth dynamics. In this way, molecular biologist Elizabeth Martin-Kutter also worked with microbial life and helped develop one of 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-

iting. Humans are the microbe’s primary host, which are ingested via water, foods and surroundings contaminated by intestinal wastes. Endemic to India, the expansion of global trade networks had led to cholera’s spread. The first widespread outbreak erupted in Bengal in 1817 and infected millions of people throughout Eurasia. Its progress continued.⁵

Cholera entered North America for the first time in the summer of 1832. In New York City, the mortality rate for infected patients was almost 50% – over 3500 people died. The dominant theories of disease at this time were that illness was caused by ‘miasma’ (bad air) or ‘contagion’ (touch). So, the direct treatment of individual patients was seen as being most important, with many doctors prescribed opium or bloodletting.⁶ For cholera, these treatments had no effect.

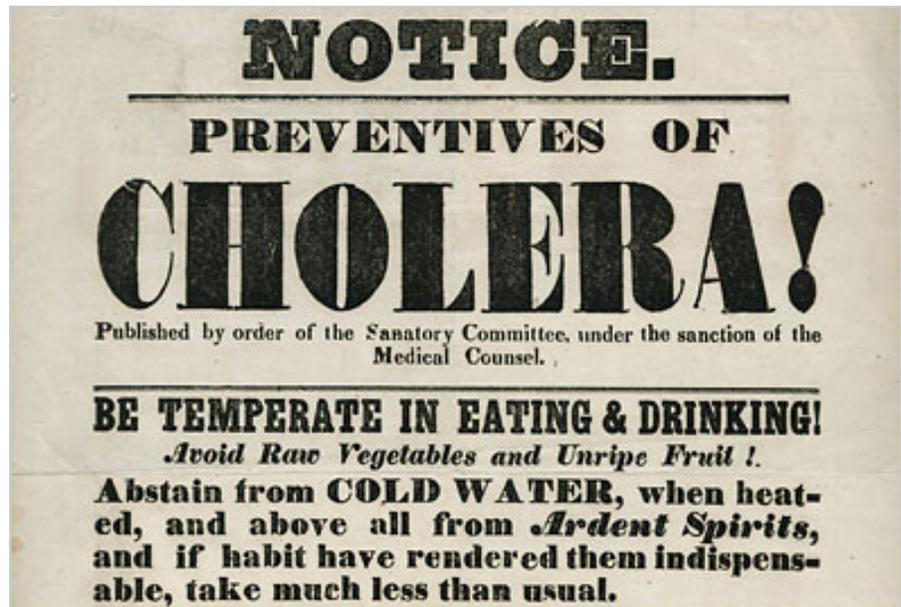
It was widely felt that the cholera outbreak was linked to increased immigration from Europe, especially from Ireland, which had experienced a major famine in 1830. Irish migrants flocked to the colonies in British North America by June 1832, and cholera came with them to the ports of Quebec City and Montreal. New York newspapers proclaimed that ‘Cholera broke out by Irish immigrants,’ and the State of New York enacted a law ‘to quarantine goods and people from Ontario and Quebec, Canada to New York State.’⁷

In response, seven prominent physicians were appointed to a special Medical Council in New York City. They ordered makeshift hospitals to be established, which had positive results, since it isolated patients from unsanitary environments. The council also published a *Cholera Report* to inform citizens about the epidemic, such as the numbers of patients and deaths per day, and it advised people ‘not to eat raw vegetables or fruits.’⁸

Nonetheless, fear and horror about cholera spread rapidly. The Medical Council failed to settle the anxiety of citizens. As a result, distrust of public officials accelerated and private reform movements to control cholera began. Religious people insisted that cholera resulted from the immoral state of American society. Drawing on the Second Great Awakening, their arguments reflected the changes that were happening in American society.



Image 1: Left – Patient M.W. at the Rivington Street Cholera Hospital, New York City. She successfully recovered and was discharged from the hospital. Image in Bartley 1832. Because of dehydration, oxygen was not sufficiently carried throughout the body, which resulted in a bluish skin colour from hypoxemia. Hence, cholera was also called the ‘Blue Death.’ Right – Broadside from the New York City Medical Council, 1832. Courtesy of Wikimedia Commons.



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-

cility 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.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.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.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.¹⁸

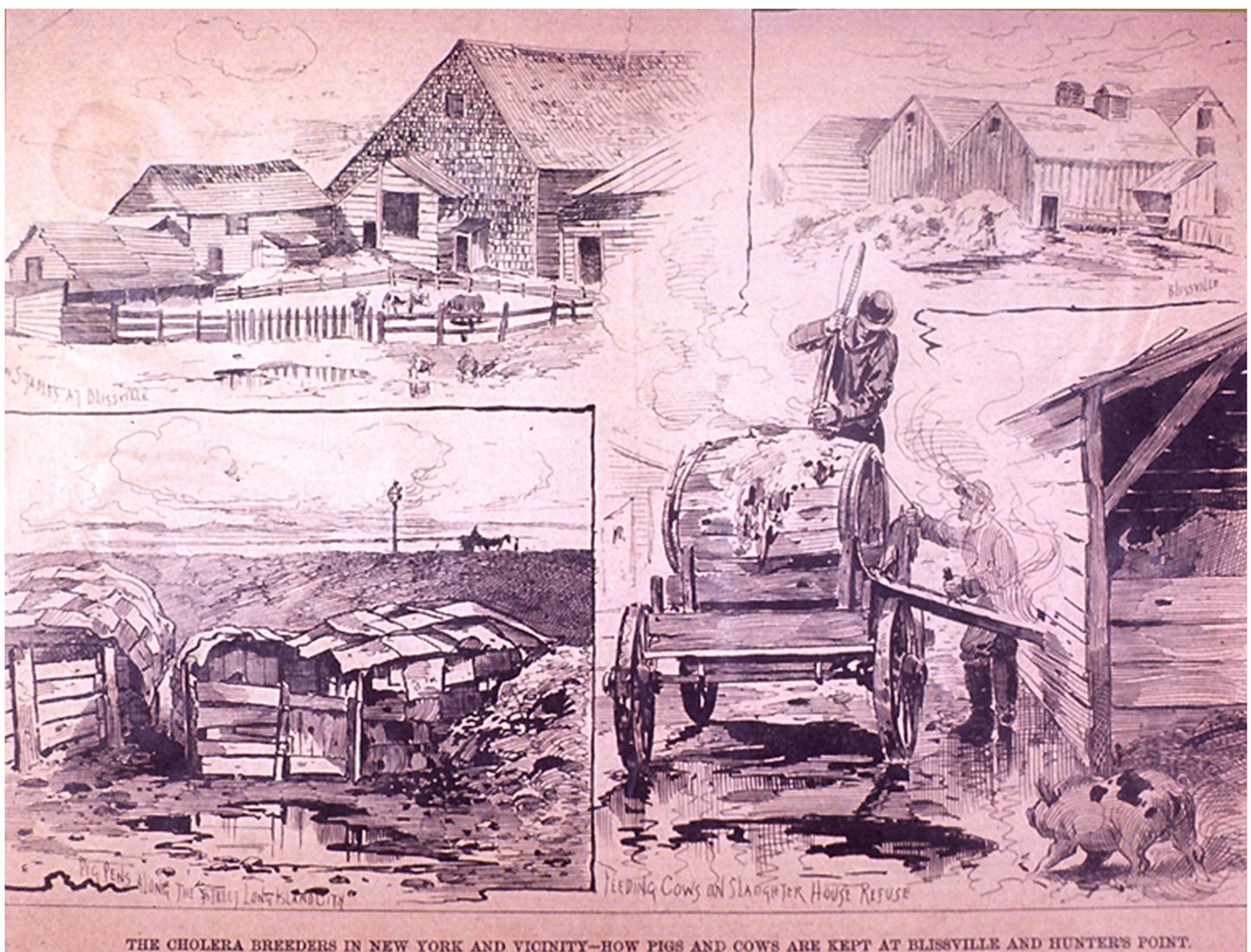


Image 2: 'Cholera Breeders of New York and Vicinity' – cow stables, pig pens, and slaughter-house fodder. National Library of Medicine, public domain, unsourced / undated, mid-19th century.

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.¹⁹ 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,



A WARNING TO LANDLORDS.

CHOLERA (to the exacting Owners of Tenement Houses). "You'll have to come down with your rents. I intend to occupy these premises myself!"

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 impending 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 Auinger 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.

References

- Advertiser, New York City Newspaper.
- Ashton, John; and Janet Ubido, 'The Healthy City and the Ecological Idea,' *Journal of the Society for the Social History of Medicine* 4, 1991.
- Aunger, Robert; 'Major Transitions in Big History,' in *From Big Bang to Galactic Civilizations: A Big History Anthology*, vol. III, *The Ways that Big History Works: Cosmos, Life, Society and Our Future*, eds. Barry Rodrigue, Leonid Grinin and Andrey Korotayev, Delhi: Primus Publishing, 2017: 109–140, 500.
- Bartley, Horatio; *Cholera Asphyxia; in its Different Stages*; New York: S.H. Jackson, 1832.
- Baumgartner, Leona; 'The City that Wast by Stephen Smith and the Report of the General Committee of Health, New York City, 1806,' *Bulletin of the New York Academy of Medicine* 50, 1974.
- Beale, David; *The Mayflower Pilgrims: Roots of Puritan, Presbyterian, Congregationalist, and Baptist Heritage*, New York: Emerald House Group, 2000.
- Bell, John; and D. Francis Condie, *All the Material Facts in the History of Epidemic Cholera*, Philadelphia: Desilver, 1832.
- Berrett, Samuel; *A Sermon Preached in the Twelfth Congressional Church, Boston, Thursday, August 9, 1832. The Day Appointed for Fasting, Humiliation, and Prayer, on Account of the Approach of the Cholera*, Boston: Hillard, 1832.
- Bial, Raymond; *Tenement: Immigrant Life on the Lower East Side*, New York: Houghton Mifflin Harcourt, 2002.
- Blake, Nelson; *Water for the Cities: A History of the Urban Water Supply Problem in the United States*, New York: Syracuse University Press, 1956.
- Bondar, Roberta; 'The Shadow of Night . . . and No Boundaries,' in *From Big Bang to Galactic Civilizations: A Big History Anthology*, vol. I, *Our Place in the Universe: An Introduction to Big History*, eds. Barry Rodrigue, Leonid Grinin and Andrey Korotayev, Delhi: Primus Books, 2015: 19–23.
- Buchan, William; *Domestic Medicine, Or A Treatise on the Prevention and Cure of Diseases by Regimen and Simple Medicine*, Fairhaven: James Lyon, 1798.
- Bynum, William; *The History of Medicine: A Very Short Introduction*, New York: Oxford University Press, 2008.
- Byun, Roy; *The Evolution of Cholera: Molecular Evolution of the Pathogenic Clones of Vibrio Chorea*, New York: VDM Verlag, 2008.
- Chadwick, Edwin; *Report of the Sanitary Conditions of the Labouring Population of Great Britain: A Supplementary Report on the Results of A Special Inquiry into the Practice of Internment in Towns*, London: R. Clowes & Sons, 1843.
- Cho Ji-Hyung; 'The Little Ice Age and the Coming of the Anthropocene,' in *From Big Bang to Galactic Civilizations: A Big History Anthology*, vol. III, *The Ways that Big History Works: Cosmos, Life, Society and Our Future*, eds. Barry Rodrigue, Leonid Grinin and Andrey Korotayev, Delhi: Primus Publishing, 2017: 95–106.
- Citizens' Association of New York; *The Report of the Council of Hygiene and Public Health of the Citizens' Association of New York*, New York: Citizens' Association of New York, 1865.
- Cotter, John; and Larry Patrick, 'Disease and Ethnicity in An Urban Environment,' *Annals of the Association of American Geographers* 71, 1981.

- Devine, Shauna; *Learning from the Wounded: The Civil War and the Rise of American Medical Science*, Chapel Hill: The University of North Carolina Press, 2014.
- Dolan, Jay; *The Irish Americans: A History*, New York: Bloomsbury Press, 2010.
- Duffy, John; *The Sanitarians: A History of American Public Health*, Urbana: University of Illinois Press, 1990.
- Edwards, Jonathan; *The Philosophy of Jonathan Edwards*, Oregon: University of Oregon Press, 1955. *Evening Post*, New York City Newspaper.
- Galishoff, Stuart; 'Drainage, Disease, Comfort and Class: A History of Newark's Sewers,' *Review of Social History* 6, 1976.
- Gradmann, Christoph; *Laboratory Disease: Robert Koch's Medical Bacteriology*, Baltimore: Johns Hopkins University Press, 2009.
- Griscom, John; *The Sanitary Condition of the Labouring Population of New York with Suggestions for its Improvement*, New York: Harper, 1845.
- Gunn, John; *Gunn's Domestic Medicine: Or Poor Man's Friend, in the Hours of Affliction, Pain and Sickness: This Book Points Out, in Plain Language, Free from ... is Reduced to Principles of Common Sense*, Madisonville: Edwards & Henderson, 1834.
- Hamlin, Christopher; *Cholera: The Biography*, Oxford: Oxford University Press, 2009.
- Harris, Jason; Regina LaRocque, Firdausi Qadri and others, 'Cholera,' *Lancet* 379 (9835) June 2012: 2466–2476.
- Hawthorne, George; *The Prevention and Treatment of Epidemic Cholera and Its True Pathological Nature in A Series of Letters*, New York: Collins and Hanny, 1832.
- Ho, Solarina; 'Earth Day: Roberta Bondar Says Healthy Population and Healthy Planet Go Hand in Hand,' CTV News, 22 April 2022: <<https://www.ctvnews.ca/mobile/climate-and-environment/earth-day-roberta-bondar-says-healthy-population-and-healthy-planet-go-hand-in-hand-1.5872005?cache=ncyvrizdfixvnx>>.
- Johnson, Steven; *The Ghost Map; The Story of London's Most Terrifying Epidemic and How it Changed Science, Cities and the Modern World*, New York: Riverhead Books, 2007.
- Kim, Seohyung; 'Korean Education and Big History,' in *From the Big Bang to Galactic Civilizations: A Big History Anthology*, vol. II, *Education and Understanding: Big History around the World*, eds. Barry Rodrigue, Leonid Grinin and Andrey Korotayev, Delhi: Primus Books, 2016a: 31–36.
- Katcher, B.S.; 'Benjamin Rush's Educational Campaign against Hard Drinking,' *American Journal of Public Health* 83, 1993.
- Katcher, B.S.; 미처 이루지 못한 세상에서 가장 큰 이야기 [Not Completed, but the Biggest Story in the World: A Commemoration of Professor Ji-Hyung Cho], Seoul: Dongin, 2016b. [Korean and English Publication].
- Kiple, Kenneth; *Plague, Pox, and Pestilence*, New York: Phoenix, 1999.
- Kramer, Howard; 'Effect of the Civil War on the Public Health Movement,' *Mississippi Valley Historical Review* 35, 1948.
- Kutter, G. Siegfried, *Universe and Life: Origins and Evolution*, Boston: Jones & Bartlett, 1987.
- Kutter, G. Siegfried, 'Big History: A Personal Perspective,' *Evolution: A Big History Perspective*, eds. Leonid Grinin, Andrey Korotayev, Barry Rodrigue, Volgograd: Uchitel Publishing, 2011: 101–120.
- Lewis, R.A.; *Edwin Chadwick and the Public Health Movement 1832–1854*, London: Longmans, Green and Company, 1952.
- McCaffrey, Lawrence; 'Ireland and Irish America: Connections and Disconnections,' *U.S. Catholic Historian* 22, 2004.
- McClean, David; *Public Health and Politics in the Age of Reform: Cholera, the States and the Royal Navy in Victorian Britain*, London: I. B. Tauris, 2005.
- Margulis, Lynn, and Dorion Sagan, *Microcosmos, Four Billion Years of Evolution from Our Microbial Ancestors*, New York: Summit Books, 1986.
- Martin-Kutter, Elizabeth, 'Microcosmos: Phages and Life,' in *From Big Bang to Galactic Civilizations: A Big History Anthology*, vol. III, *The Ways that Big History Works: Cosmos, Life, Society and Our Future*, eds. Barry Rodrigue, Leonid Grinin and Andrey Korotayev, Delhi: Primus Publishing, 2017: 71–83. *Mercury*, New York City Newspaper.
- Miller, Douglas; 'Immigration and Social Stratification in Pre-Civil War New York,' *New York History* 49, 1968.
- Moehring, Eugene; *Public Works and the Patterns of Urban Real Estate Growth in Manhattan, 1835–1894*, New York: Arno Press, 1981.
- Mohr, James; *Licensed to Practice: The Supreme Court Defines the American Medical Profession*, Baltimore: Johns Hopkins University Press, 2013.

- Mushtaq, Muhammad Umair; 'Public Health in British India: A Brief Account of the History of Medical Service and Disease Prevention in Colonial India,' *Indian Journal of Community Medicine* 34, 2009.
- Nair, G. Balakrish; and Yoshifumi Takeda, *Cholera Outbreaks*, New York: Springer, 2014.
- New York City, Planning Department, Population Division; 'Total / Foreign-Born Population, New York City, 1790–2000': <https://www1.nyc.gov/assets/planning/download/pdf/data-maps/nyc-population/historical-population/1790-2000_nyc_total_foreign_birth.pdf>.
- New York City, Planning Department, Population Division; Metropolitan Board of Health, *Annual Report of the Metropolitan Board of Health*, New York: Metropolitan Board of Health, 1866.
- Okrent, Daniel; *Last Call: The Rise and Fall of Prohibition*, New York: Scribner, 2011.
- Peters, Stephanie True; *Cholera: Curse of the Nineteenth Century*, New York: Cavendish Square Publishing, 2004.
- Peterson, John; 'The Impact of Sanitary Reform upon American Urban Planning, 1840-1890.' *Journal of Social History* 13 (1979).
- Porter, Dorothy; *Health, Civilization and the State: A History of Public Health from Ancient to Modern Times*. New York: Routledge, 1999.
- Rodrigue, Barry; 'Migration, Myth, and History: A Cross-Border Case Study,' in *Cross-Fertilizing Roots and Routes: Identities, Social Creativity, Cultural Regeneration and Planetary Realizations*, ed. Ananta Kumar Giri, Singapore: Palgrave Macmillan / Springer Nature, 2021: 161–195.
- Rodrigue, Barry; 'Big History—A Study of All Existence: Part 1: A World Connected,' *Journal of Big History* 5 (1) April 2022a: 1–47.
- Rodrigue, Barry; 'Disaster's Offspring: Catastrophe, Narrative and Society,' *Writing in Times of Displacement: The Existential and Other Discourses*, eds. Mbuh Tenu Mbuh, Meera Chakravorty and John Clammer, Abingdon: Routledge, 2022b, pp. 13–27.
- Rosen, George; Elizabeth Fee and Pascal Imperato, *A History of Public Health*. Baltimore: Johns Hopkins University Press, 2015.
- Rosenberg, Charles; *The Cholera Years: The United States in 1832, 1849, and 1866*, Chicago: University of Chicago Press, 1962.
- Segurm B.A.; 'Privy-Vaults and Cesspools,' *Papers and Reports of the American Public Health Association* 3, 1876.
- Sekar, Ramalingam; *Microbiological Investigation of Diarrheal Outbreak in South India: Cholera Outbreak*, New York: LAP Lambert, 2012.
- Shattuck, Lamuel; and Larry Gordon, *Report of the Sanitary Commission of Massachusetts 1850*, Boston: Dutton & Wentworth, 1850.
- Sheppard, Francis; *London 1808–1870: The Infernal Wen*, Berkeley: University of California Press, 1971.
- Simcox, David; 'Major Predictors of Immigration Restrictionism: Operating "Nativism"', *Population and Environment* 19, 1997.
- Smith, Timothy; *Revivalism and Social Reform: American Protestantism on the Eve of the Civil War*, New York: Wipf & Stock, 2004.
- Spring, Gardiner; *A Sermon Preached August 3, 1832, A Date Set Apart in the City of New York for Public Fasting, Humiliation, and Prayer, on Account of the Malignant Cholera*, New York: Gale, 2012.
- Starr, Paul; *The Social Transformation of American Medicine*, New York: Basic Books, 1982.
- Strong, George; *Recollections of the Cholera of 1832*, New York: Full Well Ventures, 2014.
- Tarr, Joel; 'From City to Farm: Urban Wastes and the American Farmer,' *Agricultural History* 49, 1975.
- Tarr, Joel; James McCurley III, Francis McMichael and Terry Yosie, 'Water and Waste: A Retrospective Assessment of Wastewater Technology in the United States, 1800–1932,' *Technology and Culture* 25, 1984.
- Tomes, Nancy; and John Warner, 'Introduction to Special Issue on Rethinking the Reception of the Germ Theory of Disease: Comparative Perspectives,' *Journal of the History of Medicine and Allied Sciences* 52 (1) January 1997: 7–16.
- Watson, William; J. Francis Watson, John H. Ahtes III and Earl Schandelmeier III, *The Ghosts of Duffy's Cut: The Irish Who Died Building America's Most Dangerous Stretch of Railroad*, New York: Praeger, 2006.
- Waring, George; *Draining for Profit and Draining for Health*, New York: Kessinger Publishing, [1867] 2007.
- Whooley, Owen; *Knowledge in the Time of Cholera: The Struggle over American Medicine in the Nineteenth Century*, Chicago: University of Chicago Press, 2013.
- Woods, Margaret; and Peter Chi, 'Sanitary Reform in New York City in 1866 and the Professionalization of Public Health Services: A Case Study of Social Reform,' *Sociological Focus* 19, 1986.

Endnotes

1. Kutter 1987. Kutter 2011. Martin-Kutter 2016.
2. Kim 2016.
3. Cho 2017. Kim 2016b. Rodrigue 2022a.
4. Peterson 1979: 83. New York City, Planning Department, Population Division c. 2000.
5. Peters 2004. Mclean 2005. Mushtaq 2009: 11. Harris and others 2012. Johnson 2007. Byun 2008. Gradmann 2009. Sekar 2012. Nair and Takeda 2014.
6. Hawthorne 1832: 21. Woods and Chi 1986: 338. Kiple, 1999: 142. Tomes and Warner 1997. Rosenberg 1962. Watson and others 2006. Strong 2014.
7. Dolan 2010. Rodrigue 2021. *Evening Post*, 13 June 1832. Duffy 1990: 440. Miller 1968.
8. *Advertiser*, 26 June 1832. Rosenberg 1962: 30.
9. Spring 1832. Rosenberg 1962: 40. Rosen and others 2015: 210–211. Edwards 1955: 140–144. Starr 1982: 35. Berrett 1832: 9. *Mercury*, 18 July 1832.
10. Griscom 1845. Katcher 1993. Okrent 2011: 195.
11. Simcox 1997. Beale 2000. Smith 2004. Rodrigue 2022b.
12. Bell and Condie 1832: 47. Cotter and Patrick 1981: 44. McCaffrey 2004. Dolan 2010.
13. Rosenberg 1962: 104.
14. Sheppard 1971: 250. Ashton and Ubido 1991: 175. Kramer 1948: 449. Notably, Edwin Chadwick, an English reformer, emphasized the necessity to improve sanitary condition in towns and cities to control cholera effectively. Lewis 1952: 7. Chadwick 1843: 276–278.
15. Blake 1956: 12. Galishoff 1976: 127–128.
16. Moehring 1981: 139. *Advertiser*, 12 January 1849.
17. Segurm 1876. Tarr 1975: 601. Tarr and others 1984: 229. The Board of Health decided to install a city septic system to process wastewater and feces, a technique invented in France. Waring 2007: 537.
18. *Mercury*: 22 February 1849, 24 February 1849. Waring 2007: 222.
19. Shattuck and Gordon 1850: 102. Duffy 1990: 98.
20. Devine 2014.
21. Baumgartner 1974: 956.
22. Citizens' Association of New York 1865.
23. New York City, Metropolitan Board of Health 1866. Duffy 1990: 120–121. Rosen and others 2015: 206. Kramer 1948: 453–455. Rosenberg 1962: 177.
24. This Tenement Law led to the Tenement House Act in 1901. By this time, tuberculosis had begun to spread in tenements, so the city government built a new department specifically to oversee tenements and implement strategies and policies to improve tenement sanitation. Porter 1999: 152. Bynum 2008: 80. Rosen and others 2015: 140. Bial 2002: 21.
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.
27. Hamlin 2009. Martin-Kutter 2017.
28. Bondar 2015. Ho 2022.
29. Aunger 2017.

