

BOOK REVIEWS

**THE GHOST MAP: THE STORY OF LONDON'S MOST TERRIFYING EPIDEMIC — AND HOW IT CHANGED SCIENCE, CITIES, AND THE MODERN WORLD**

By Steven Johnson. 299 pp., illustrated. New York, Riverhead Books, 2006. \$26.95. ISBN 978-1-59448-925-9.

**THE STRANGE CASE OF THE BROAD STREET PUMP: JOHN SNOW AND THE MYSTERY OF CHOLERA**

By Sandra Hempel. 321 pp., illustrated. Berkeley, University of California Press, 2007. \$24.95. ISBN 978-0-520-25049-9.

LONDON IN 1854 WAS A VIRTUAL SEA OF HUMAN and animal waste, and it stank. Two and a half million people were crammed into a 30-mile circumference with no means of safe sewage disposal. Historically, cholera, which had been endemic in India for millennia, was spread by people in caravans, military operations, pilgrimages, and sailing ships to cause seven great pandemics. The disease reached England for the first time during the second pandemic, in June 1831, and again during the third pandemic, in 1853 and 1854. The causative agent, *Vibrio cholerae*, was unknown until it was isolated in pure culture by Robert Koch in Egypt in 1883. Until John Snow, the subject of the two books under review, conducted his experiment, the miasma, or “bad air,” theory of the cause of cholera prevailed over the contagion theory, whose believers held that the disease was somehow transmitted from person to person, but not by water.

Snow (1813–1858) was the founding father of boots-on-the-ground epidemiology. A vegetarian and teetotaler, Snow received his apothecary and surgeon’s licenses at age 25 from the Hunterian School of Medicine and established a general practice in London. He was a witness to one of the first uses of ether in London — for a dental extraction in 1846 — and this started his highly successful career as a researcher and practitioner in anesthesiology. In 1853, he administered

chloroform to Queen Victoria for the birth of her eighth child.

Snow’s interest in cholera began when he saw patients as a physician’s apprentice during the epidemic of 1831 and 1832 in England, which killed 32,000, and was rekindled during the outbreak of 1848 and 1849, which killed 52,000. A series of cases and other observations led Snow to hypothesize that the disease was spread from person to person by the oral route and most likely through water, in contrast to the prevailing view that it was caused by the stench arising from open sewers, kitchen sinks, and rubbish piles. His 1849 publication describing his conclusions was ignored by the medical establishment. He needed an *experimentum crucis*, which would become known as “Snow’s grand experiment,” to show that water, conveyed to a distant locality where cholera had been hitherto unknown, produced the disease in those who consumed it, whereas those who did not consume it escaped.

This trial came in the summer of 1854, when cases of cholera began occurring mainly among people living along the Thames River, and Snow conceived his perfect experiment. In 1849, both water suppliers — the Lambeth Water Company and the Southwark and Vauxhall Water Company — drew their water from the most polluted part of the river, but in 1852 Lambeth moved its supplies north, beyond the city’s outpouring of sewage into the Thames. Snow compared the incidence of cholera in 300,000 people whose circumstances were similar except that one group was supplied with water containing the sewage of London and the other was supplied with water free from the sewage. This involved Snow’s “shoe leather epidemiology” technique of going from house to house to determine which company supplied each household’s water. In the first 7 weeks, there were 1263 deaths from cholera in the 40,046 houses with water supplied by Southwark and Vauxhall, a rate of 315 per 10,000 houses. There were 98 deaths from cholera in the 26,107 houses with water supplied by Lambeth, or 37 per 10,000 houses. These figures would be hard for the medical community to ignore. But the signal event

was about to occur right in Snow's neighborhood near Golden Square in Soho, where cholera was out of control — 197 residents had died within 3 days.

Snow again marked the houses where the deaths had occurred and drew "The Ghost Map" showing their distribution. The result: 61 of the 83 people who died had obtained their water from the pump on Broad Street. This evidence convinced the skeptical members of the Board of Governors of St. James Parish to close down the pump by removing its handle on September 8, a week after the outbreak had begun. It is generally acknowledged that the removal of the pump handle had little or no effect on the outbreak, which had already peaked and was in decline — many of the "susceptibles" having fled the area — but it did perhaps prevent a second outbreak. (Curiously, none of the 70 employees of the Lion Brewery a few yards from the pump got cholera. Why? Having free access to malt liquor, they rarely, if ever, drank water.)

Snow died of a stroke at age 45, before the impact of his work was fully appreciated. His brief obituary in the *Lancet* cited his research on anesthetics but did not mention his epic cholera studies. However, his story and the contributions that led to his legacy — the recognition of the importance of clean water — changed the world. Countless millions of lives have been spared as a consequence. The result of his research was certainly equivalent to that of Robert Koch, Louis Pasteur, Alexander Fleming, Albert Sabin, and Jonas Salk.

The two books read like novels. They describe in detail the events and the environs that enabled (and still enable) cholera epidemics, and they describe and discuss the players — the disease itself, patients, officials, and Snow's other contemporaries — and their interactions. Florence Nightingale, a miasmatist, is included, as are Charles Dickens, Friedrich Engels, Karl Marx, and others. Neither of the authors is a scientist, but each has done a creditable job of reporting the science. If forced to choose between the two books, I would lean toward Johnson's because it is more focused; I found myself somewhat bewildered by the details of Hempel's book. Both authors certainly presented more than I needed to know about John Snow. Interested readers wanting to learn more may wish to examine the Web site about Snow that is maintained by the Department of Epide-

miology at the University of California, Los Angeles, located at [www.ph.ucla.edu/epi/snow.html](http://www.ph.ucla.edu/epi/snow.html).

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