

Happy Birthday, Dr. Snow

By Dr. Ronald Eckoff

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March 15, 2013 marks the 200th birthday of John Snow, the singular genius who created the modern science of epidemiology. Without fear of historical hyperbole, the occasion merits a global pause of reflection and honor.

Born in York, England, John Snow chose a life in medicine at a relatively young age. At 16, he began an apprenticeship under William Hardcastle, a surgeon who practiced in Newcastle-upon-Tyne. A few years later, in 1831, Snow first encountered cholera, which entered Newcastle via the seaport of Sunderland and decimated his town.

By 1836, Snow moved to London, where he furthered his medical studies at Westminster Hospital and earned his membership in the Royal College of Surgeons and as a licentiate of the Society of Apothecaries. In 1843, he took his bachelor's in medicine and, the following year, received his doctorate in medicine, both at the University of London. He "hung his shingle" or, as the British like to say, "nailed up his colours" in Soho, a raucous neighborhood where he cared for working-class patients for the rest of his career. (1)

After its demonstration at the Massachusetts General Hospital in 1846, ether anesthesia became the rage on both sides of the Atlantic. Snow wrote a superb book on its use, *On Ether*, in 1847 before focusing his attention on another anesthetic called chloroform. Since at least the days of the Old Testament, medical doctrine assumed that childbirth was destined to be a painful event. Yet many physicians like Snow insisted this need not be the case. Snow's opinion became common practice on April 7, 1853, when he was chosen to administer chloroform to Queen Victoria as she delivered Prince Leopold.

It is difficult, if not impossible, for most modern readers to fathom how badly London smelled in the mid 19th century. Every day was a constant negotiation against the odiferous waste left behind by more than 300,000 horses, hundreds of thousands of pigs, sheep, cows, and other livestock waiting to become somebody's meal, and 2.4 million Londoners. With the paucity of modern sewage systems, water closets in wealthier homes expelling streams of stool and urine into the streets and the Thames River, and countless outhouses, privies, and cesspools, the city positively stunk. (2)

When confronted with cholera epidemics in the years before medical scientists elucidated the role microbes play in infectious diseases, many of Britain's finest medical minds took a page from

Hippocrates and associated cholera with the foul-smelling gases produced by mounting piles of rotting garbage and raw sewage. Miasma (from the Greek, for *pollution*) was thought to contaminate the atmosphere. When inhaled, this noxious air upset the balance of an individual's body humors and led to an abundance of *cholera*, or yellow bile, which the body did its best to expel, even if it meant overwhelming dehydration and death.

Snow's genius was his uncanny ability to connect the dots, so to speak, of disease causation. A keen observer of the diffusion of gases, gained from his work on ether and chloroform, Snow began to doubt the miasma theory during the 1848 cholera epidemic that ruthlessly carted off thousands of Londoners to the graveyard. If foul-smelling gases caused cholera, he queried in his landmark 1849 book, *On the Mode of Communication of Cholera*, why were those closest to the emanations, such as garbage removal workers and night-soil men (those who emptied privies) not disproportionately affected? Conversely, given that the concentration of gas tended to dissipate and decline as it traveled over a distance, how could one miasmatic source infect people living far from it, let alone an entire city? The accepted dogma that cholera was inhaled through the air via the respiratory tract – even though the disease clearly struck the gastrointestinal tract with an ugly vengeance – simply made no sense to the inquiring Dr. Snow. (3)

Although there were many miasmaticists and anticontagionists who scoffed at Snow's thesis, the good doctor seized his opportunity during London's 1854 cholera epidemic. He began by meticulously surveying every case and their contacts, even to the point of verifying their water source by checking each home's water bills. Snow discovered that Londoners who drew their water from the Southwark and Vauxhall Water company, which came from the fecal contaminated Thames River, were infected nine times more than those living in areas supplied by the Lambeth Company, whose water originated from an upstream, and less contaminated source. (4)

Snow's greatest scientific moment, however, resulted from an even more detailed study of the cholera's spread in Soho. After carefully charting some 500 cases in his district, Dr. Snow noted that most of the cholera victims had been consuming water from a well located in Broad Street. Unfortunately for those frequenting the hand pump-operated well, it was contaminated with sewage from

Happy Birthday, Dr. Snow cont...

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a nearby house where cholera had previously visited. Snow convinced the parish councilors to remove the well's pump handle, those making it inoperable. Soon after disabling the pump, the cholera rate plummeted, allowing Snow a well-deserved quod erat demonstrandum. The doctor concluded that a specific water-borne "poison" capable of self-reproduction was in the excreta of cholera patients who, in turn, tainted the water supply. His solution: careful washing of the hands, decontaminating soiled linens, and boiling all drinking water. (5)

John Snow died of a cerebral hemorrhage on June 16, 1858. He was 45. Twenty-five years later, in 1883, Robert Koch, who along with Louis Pasteur is credited with demonstrating the germ theory of disease, proved Snow correct. While battling a cholera epidemic in Egypt, Koch identified *Vibrio cholerae*, teeming in fecal-contaminated water supplies, as the microbial cause of cholera. Yet even before Koch's great discovery, Snow was on an upward trajectory toward permanent, albeit posthumous, acclaim in the history books. (6)

Last summer, I had the pleasure of taking my 12-year-old daughter, Bess, on a trip to London. A few hours before a much-anticipated high tea at the Ritz Hotel, Bess asked, "Dad, if you could take me to the most important historical sight in London, where would we go?"

With a spring in my middle-aged step, I escorted her across Piccadilly, past the Royal Academy of Art, and through Soho to Broadwick Street, as Broad Street is presently known. In front of a facsimile of the Broad Street pump, I told Bess how Snow helped usher in the modern world by insisting that we clean up after our excrement. Yet as great as that contribution was, I added, this basic health requirement has still not been met for, at least, 783 million people living in the developing nations of Africa, Asia, and South America who do not have daily access to clean drinking water; 2.6 billion people do not have access to adequate sanitation. Every year, more than 1.5 million people, mostly children younger than 5 years, die because of water-borne diarrhea, including cholera, which modern medicine has known how to prevent, or at least attenuate, since the mid 19th century. (7)

Bess's eyes opened widely as she exclaimed an impressed "Wow!"

Wow, indeed.

Thank you, Dr. Snow. Two centuries after your birth, you still have the power to change the world.

If only everyone had the access and wherewithal to follow your life-saving prescriptions.

-- Howard Markel, MD, PhD

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