

# Commentary: Dr John Sutherland, *Vibrio cholerae* and ‘predisposing causes’

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In 1884 the German bacteriologist Robert Koch (1843–1910), already celebrated for identifying the organisms that cause anthrax (1876) and tuberculosis (1882), announced that he had identified the *Vibrio cholerae* in polluted water in India. He thereby confirmed the hypothesis advanced by the English anaesthetist John Snow (1813–1858) 34 years earlier. It would be comforting to record that Koch’s discovery resolved the debate over the causes of epidemic cholera that had occupied scientists and medical practitioners for much of the 19th century. However, such a claim would be false. So resolute were some of the protagonists of the alternative ‘miasmatic’ explanation of disease causation that they were not to be convinced even by a definitive scientific explanation from a future winner of the Nobel prize for medicine. Dr John Sutherland (1808–1891) in the text printed above,<sup>1</sup> discusses many of the alternative theories which were deployed to explain the four epidemics\* which ravaged Great Britain in the mid-19th century and which survived Koch’s discovery in the minds of their more ardent advocates. In one passage Sutherland comes close to identifying polluted water as the culprit but at the last moment, like many of his contemporaries, he steps back and allows it only a subsidiary or ‘pre-disposing’ role. The formidable campaigner for better public sanitation Sir Edwin Chadwick (1800–1890), and his equally redoubtable ally Florence Nightingale (1820–1910), maintained their allegiance to the ‘miasmatic’ explanation of disease causation despite Koch’s discovery many years before their deaths.

## Telluric, Electric, Ozonic or Zymotic?

From the late 1820s the spread of cholera from India across Asia and continental Europe was the cause of much anxious speculation and comment. The fear which followed its arrival in Britain in 1831 (where it first came ashore in Sunderland) was unprecedented since the 17th century plagues. Thirty riots were caused by concern about the disease in 1832 alone.<sup>2</sup> In November 1831, early in the first cholera outbreak, *The Lancet* reported that a community of Jews in Wiesnitz had escaped its effects by rubbing their bodies with a liniment containing wine, vinegar, camphor powder, mustard, pepper, garlic and ground beetles.<sup>3</sup> Between 1845 and 1856 over 700 works were published on the subject in London alone.<sup>4</sup> At the height of the second epidemic, in September 1849, *The Times* published a series of articles<sup>5</sup> which considered some of the theories that had been advanced to explain the propagation of the disease. These included the *Telluric theory* most strongly advocated by the German biologist Max von Pettenkofer (1818–1901) which

‘supposes the poison of cholera to be an emanation from the earth’; the *Electric theory* which attributed the disease to atmospheric electricity; and the *Ozonic theory* which laid the blame on a shortage of ozone. More space was devoted to the *Zymotic theory* advocated by Justus von Liebig, Professor of Organic Chemistry at the University of Giessen. Liebig, who exercised a profound influence on the application of chemical science to agriculture, believed that some compounds were inherently unstable and that, under the influence of temperature, electricity or friction they could be prompted into a condition of fermentation similar to that which occurred in brewing. He hypothesized that the putrefaction of bodies which had suffered from the disease would produce ammonia which could be ‘the means through which the contagious matter received a gaseous form’ thereby creating a ‘miasma’ in the atmosphere which would spread the infection.<sup>6</sup> This ‘miasmatic’ theory became the orthodox explanation for the spread of infections. Nor was the influence of miasma confined to the spreading of disease. Some prison reformers believed that moral, as well as physical contamination could be spread through a miasma<sup>7</sup> and advocated that prisons be designed accordingly.<sup>8</sup>

## Dr John Sutherland

Dr John Sutherland (1808–1891) was born in Edinburgh where he qualified as a doctor in 1831. He is chiefly remembered for the work he performed in connection with the health of the army. In 1855 he visited the Crimea at the request of Palmerston to enquire into the health of the troops, alarming accounts of which had reached London from William Russell, *The Times* correspondent. During this visit Sutherland met Florence Nightingale in her hospital at Scutari. Upon his return to Britain he was summoned to Balmoral to give an account to the Queen of what he had discovered. He was appointed to a series of posts that involved visiting military barracks and hospitals in Britain and India and making recommendations for their improvement.

After gaining his MD in 1831, Sutherland worked on the continent of Europe for over 10 years before opening a medical practice in Liverpool in the mid-1840s. There he first encountered Liverpool’s infamous ‘courts’. These had been condemned by the Liverpool Physician Dr James Currie (1756–1805) as early as 1804 for their lack of ventilation, a particular concern of the miasmatisers. Currie, a Fellow of the Royal Society and a pioneer in the use of the clinical thermometer, had written that ‘a pernicious practice has been introduced of building houses to be let to labourers in small confined courts, which have a communication with the street by a narrow aperture, but no passage for air through them’.<sup>9</sup> Currie’s concern with the lack of ventilation was reflected in the later work of other physicians, including that of Sutherland himself. In 1848 Sutherland was appointed

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\* 1831–32; 1848–49; 1853–54; 1866.

as an Inspector to the General Board of Health which had been set up in that year as a result of a long campaign by Edwin Chadwick and others who were concerned with the insanitary conditions in which much of the population lived, particularly those living in towns. It was in this capacity that he made his contribution to the *Report of the General Board of Health on the Epidemic Cholera of 1848–9*, an epidemic which killed 14 137 citizens in London alone.<sup>10</sup>

## Predisposing causes

The evidence that he gave to the Board reflects his uncertainty about the causes of epidemic cholera and the measures which could be taken to prevent it. In Section 1 Sutherland deals with *Localising Causes* and acknowledges that cholera 'is propagated according to certain fixed laws, although the limits of these laws have not as yet been precisely defined.' He refers to 'that property which is possessed by certain states of the constitution or by certain well-marked characteristics of special localities' which overwhelmed the individual's resistance to the epidemic. He hesitates to judge whether the 'localisation' occurs in the person or the place. A discussion of the symptoms of the disease is followed by some moralizing attempts to explain that 'certain constitutions [are] predisposed by irregular and dissipated habits' to 'rapid and fatal attacks of cholera'. His reference to the Prussian barque *Pallas* concerns nine German seamen who had brought the ship from Hamburg, where there was a cholera epidemic, to Hull. Three of the crew died of cholera but the blame was laid largely at the door of the cargo of plums on which the crew had over-indulged. 'The eating of a few plums would certainly, under ordinary circumstances, have produced no such fatal results but during an epidemic constitution, such indulgence is well known to be fraught with extreme danger.'<sup>11</sup>

The question of 'predisposition' was central to the miasmatic theory. Thomas Watson (1792–1882), Professor of Medicine at Kings College, London and later President of the Royal College of Physicians drew a distinction between *exciting causes* of disease and the condition of the body at the time the exciting cause was applied which could *pre-dispose* the body to infection.<sup>12</sup> He thereby reflected the conclusions of Edwin Chadwick's 1842 *Report on the Sanitary Condition of the Labouring Population of Great Britain*<sup>13</sup> which supposed that poor living conditions, dissipated lifestyles, overcrowding and foul air predisposed urban populations to epidemic disease with little if any need for the intervention of external agencies. All that was required was a disagreeable smell. In 1846 Chadwick took this argument a stage further when he informed the Metropolitan Sewage Committee that: 'All smell is, if it be intense, immediate acute disease; and eventually we may say that, by depressing the system and rendering it susceptible to the action of other causes, all smell is disease.'<sup>14</sup> In reviewing Chadwick's *Report* in the pages of the *Quarterly Review* a former colonial governor, Sir Frances Head, applauded Chadwick's criticisms of foul air and asserted that some settlements in America had been rendered dangerous by ploughing virgin soil, thereby exposing decaying vegetable matter and releasing harmful miasms.<sup>15</sup>

The author of a mid-century text, *A Dictionary of Practical Medicine*, held that *predisposing* causes could themselves be the source of disease without the need for any *exciting* causes. He wrote: 'predisposing causes may, either by their activity, or by

their acting in combination or in close succession, of themselves produce disease, without the aid of any of those usually termed exciting ... the indulgence of the appetites, fatigue, the depressing passions, moist states of the air etc. are often the only causes to which disease can be traced.'<sup>16</sup>

## Unwholesome water

In Section 3 Sutherland considers the problem of *Unwholesome Water* and comes close to identifying the real cause of the epidemic, though without making reference to the seminal paper of Dr John Snow which had been published the previous year.<sup>17</sup> Snow, in his own evidence to the General Board of Health, had drawn attention to the fatal consequences of attaching newly fashionable water closets to antiquated cesspools and sewers which overflowed, sending their contents into nearby wells and watercourses.<sup>18</sup> Snow developed his hypothesis in later papers<sup>19</sup> and in the 1854 cholera epidemic he persuaded the local authority to remove the pump handle from a well outside his surgery in Broad Street (now Broadwick Street) Soho which he had identified as the source of polluted water. Sutherland, in his evidence to the Board, is prepared to concede that 'a number of most severe and fatal outbursts of cholera were referable to no other cause than the state of the water-supply.' However, whereas Snow, in his evidence and in later papers, was prepared to identify polluted water as the prime cause of epidemic cholera, Sutherland would only allow that it was the cause of a 'predisposition', albeit 'perhaps the most fatal of all'. In this Sutherland was simply following the orthodox belief of his time. His near contemporary Max von Pettenkofer (1818–1901) the German public health campaigner, was convinced that germ-bearing cholera excrement would merely prompt a process whereby 'a specific cholera-miasma is developed, which is then spread along with other exhalations into the houses'. In the words of the *Dictionary of Scientific Biography* 'Pettenkofer readily accepted this vibrio [*cholerae*] as his "x" factor but refused to modify his views on the paramouncy of the telluric "y" factor' as the cause of epidemic cholera. So confident was Pettenkofer that cholera germs alone were harmless that in 1892, during a virulent epidemic in Hamburg, he publicly swallowed water which contained cholera bacteria. He suffered diarrhoea and excreted samples of the *Vibrio cholerae* for several days but suffered no worse effects, probably because he had developed immunity from an earlier, mild infection. This demonstration was seen by his followers as a vindication of his theory, thus briefly setting back the cause of medical science.<sup>20</sup>

## Putrid exhalations

Finally, in Section 7, Sutherland considers *Defective Sanitary Alterations* and here he examines the problem of 'putrid exhalations from a number of open conduits' which 'impregnate the whole air both internally and externally with a strong cess-pool odour'. The offending buildings were the site of a cholera outbreak in Bristol and are identified as 'courts' dependent for ventilation on the adjacent burial ground, similar in design to those he had encountered in Liverpool.<sup>21</sup> Sutherland draws attention to the fact that 'a death took place in every house under the floor of which a drain passed' and suggests that 'it would indeed be difficult for human ingenuity to contrive and arrange

a set of conditions more thoroughly unhealthy, or more likely to predispose the inhabitants to epidemic disease'. Many well-regarded authorities would have applauded his judgement. Florence Nightingale in her *Notes on Nursing* suggested that many common diseases such as smallpox, measles and scarlet fever were caused by the practice of laying drains beneath houses.<sup>22</sup> Once again 'predisposition' is allowed without a prime or 'exciting' cause being identified. A former colleague in Liverpool, Dr WH Duncan, Liverpool's (and Britain's) first Medical Officer of Health would have supported Sutherland's condemnation of foul air. In 1844 Duncan had informed a Royal Commission: 'By the mere action of the lungs of the inhabitants of Liverpool, for instance, a stratum of air sufficient to cover the entire surface of the town, to a depth of three feet, is daily rendered unfit for the purposes of respiration.'<sup>23</sup> In the same year a professor of chemistry had advocated watering the streets so that the consequent evaporation 'will carry up with it into the atmosphere, and above the reach of mischief, the various decomposing and decomposed organic matters floating about, and which otherwise allowed to remain would be productive of contagious miasms'. He added, as if to remove any doubts about the power of smells, 'from inhaling the odour of beef the butcher's wife obtains her obesity'.<sup>24</sup>

## Postscript

Four years later Sutherland was asked to comment on the 1853–1854 cholera outbreak and his views are recorded in the report which was sent to Palmerston, the Home Secretary.<sup>25</sup> In this later report Sutherland concludes that 'there is no sufficient proof that water in this [impure] state acts specifically in generating cholera' but acknowledges that 'the use of water containing organic matter in a state of decomposition is one predisposing cause of cholera'. His work for the army later led him to investigate epidemics in the garrison communities of Malta and Gibraltar in 1865. In the case of Malta he concluded 'we must exclude impure water from the chain of causes' and added 'the hypothesis that cholera is propagated by emanations from excreta receives no countenance ... the events give no countenance to any hypothesis as to epidemics taking their origin from specific cholera germs'.<sup>26</sup> Foul air, overcrowding and filth were still the favoured explanations as 'predisposing' populations to cholera.<sup>27</sup> It took a further cholera epidemic in the Whitechapel area of London in 1866 and a thorough investigation of it by the statistician William Farr to conclude that the epidemic had been caused solely by infected water supplied by the East London Water Company from the river Lea. In the words of Farr's report 'Only a very robust scientific witness would have dared to drink a glass of the waters of the Lea'.<sup>28</sup> John Snow was posthumously vindicated but many sceptics remained.

John Sutherland died on 14th July 1891. By that date seven years had passed since Robert Koch had announced his discovery of cholera as a bacillus carried in polluted water though not, as we have seen, to the satisfaction of sceptics like Max von Pettenkofer. In its appreciative obituary *The Lancet* hinted, perhaps unintentionally, at Sutherland's equivocal stance on the causes of cholera. It wrote: 'To say that some disease or other was solely attributable to contagion, or depended upon a bacillus, and to stop there, as seems to be so much the tendency

of these days, brought little satisfaction and no comfort to practically minded men like Dr Sutherland.' Few would have disagreed. John Sutherland reflected the confusions as well as the anxieties of his time.

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