



Contents lists available at ScienceDirect

# Studies in History and Philosophy of Biological and Biomedical Sciences

journal homepage: [www.elsevier.com/locate/shpsc](http://www.elsevier.com/locate/shpsc)

## A case study in explanatory power: John Snow's conclusions about the pathology and transmission of cholera

Dana Tulodziecki

Department of Philosophy, University of Missouri–Kansas City (UMKC), 222 Cockefair Hall, 5100 Rockhill Road, Kansas City, MO 64110, USA

### ARTICLE INFO

Article history:  
Received 28 January 2011

#### Keywords:

Explanatory power  
Theoretical virtues  
Scientific reasoning  
Theory-choice  
Epistemic properties of scientific theories  
Methodology of science  
Cholera  
John Snow

### ABSTRACT

In the mid-1800s, there was much debate about the origin or 'exciting cause' of cholera. Despite much confusion surrounding the disease, the so-called miasma theory emerged as the prevalent account about cholera's cause. Going against this mainstream view, the British physician John Snow inferred several things about cholera's origin and pathology that no one else inferred. Without observing the *vibrio cholerae*, however,—data unavailable to Snow and his colleagues—, there was no way of settling the question of what exactly was causing cholera and how, or if, it was passed on. The question then arises as to how Snow arrived at conclusions so systematically different from those of his opponents. In this paper, I want to look at Snow's reasoning in some detail, and show that there were certain principles, explanatory power in particular, that were epistemologically important to Snow in their own right. I will show that Snow himself takes explanatory power to be an *epistemic* property, and makes explicit links between explanatory power and confirmation. Systematically juxtaposing Snow's claims and his opponents', I will show that Snow was right to tout the explanatory power of his theory, and that his conclusions about the epistemic superiority of his theory over that of the miasmatisms<sup>1</sup> were justified.

© 2011 Elsevier Ltd. All rights reserved.

When citing this paper, please use the full journal title *Studies in History and Philosophy of Biological and Biomedical Sciences*

### 1. Introduction

In the mid-1800s, there was much debate about the origin or 'exciting cause' of cholera. Despite much confusion surrounding various aspects of the disease, the so-called miasma theory emerged as the prevalent account about cholera's cause. Going against this mainstream view, the British physician John Snow (1813–1858), during this time, inferred several things about the origin and pathology of cholera that no one else inferred, and that, at the time, were unobservable. Among his claims were the hypothesis that there is a biological cause for cholera, that cholera was a local, not a general disease, that a small quantity of the cholera

era poison is sufficient to bring about cholera, that the cholera agent multiplies in the intestine, that cholera is communicable, that it is communicated, not by effluvia, but by evacuations containing the cholera poison, and that it could be communicated through contaminated water (such as through the Broad Street pump, in Snow's most famous example).

Without observing the *vibrio cholerae*, however, none of these claims could be verified, and there was simply no way of settling for good the question of what exactly was causing the disease and how, or indeed if, it was passed on. In order to do this, it was necessary to observe the poison at work, and all this was, of course, data unavailable to Snow and his colleagues.<sup>1</sup> The question

E-mail address: [tulodzieckid@umkc.edu](mailto:tulodzieckid@umkc.edu)

<sup>1</sup> Robert Koch (1843–1910) is often credited with the discovery of the *vibrio cholerae*; however, the bacterium was actually discovered much earlier by Filippo Pacini (1812–1883) during the Asiatic Cholera Pandemic of 1846–1863. In 1854, the year cholera came to Florence, Pacini published a paper with slides of the cholera bacteria (see Pacini, 1854). However, there is no evidence that this data was available to Snow and his colleagues (see also Vinten-Johansen, Brody, Paneth, Rachman, & Rip (2003, 224)). For more detail, see Bentivoglio & Pacini (1995) and Howard-Jones (1984); for an account of Koch's 1883/1884 cholera expedition, see Gradmann (2005, chapter V.2).

then arises as to how exactly it was that Snow, in each of the above cases, arrived at conclusions so systematically and substantially different from those of his opponents.

While there have been many discussions of Snow, and, in particular, many discussions of the by now famous Broad Street pump episode,<sup>2</sup> relatively little attention has been given to the kinds of considerations, especially the kinds of reasoning, that Snow used in arriving at his sometimes complex conclusions about the various aspects of cholera. In fact, the only discussions that explicitly pay attention to Snow's reasoning are by Vinten-Johansen et al. (2003) and, although they mention Snow using principles such as reasoning by analogy, and the fact that Snow thought miasmatic explanations unsatisfactory, they do so only in passing and with the further aim of supporting their claim that Snow's various strategies provide an illustration of the hypothetico-deductive method, and that this method is useful for epidemiology in general.<sup>3</sup>

In this paper, I want to look at Snow's reasoning in more detail, and show that there were certain principles that were epistemologically important to Snow in their own right. In particular, I want to focus in some detail on explanatory power, and show that its role for Snow was substantially bigger than previous analyses suggest. As we will see, explanatory considerations played a crucial role for Snow at almost every juncture. What's more, Snow himself is clear about the fact that he takes the explanatory power of his theory to be an *epistemic* property,—a property connected to the theory's truth(-likeness)—, repeatedly suggesting that what puts his own conclusions on a more secure epistemic footing than those of the miasma and effluvia theorists' is the fact that his theory can explain a number of phenomena for which the extant rival hypotheses fail to provide an explanation. In fact, Snow is explicit about the fact that he thinks that there is a connection between explanatory power and confirmation: it is not just the case that “[t]he belief in the communication of cholera is a much less dreary one than the reverse” (MCC1, 30), and that “[t]hese opinions respecting the cause of cholera are brought forward . . . as containing a greater amount of probability in their favour than any other” (MCC1, 29), but also that “there are certain circumstances connected with the

history of cholera which admit of a satisfactory explanation according to these principles explained above [i.e. Snow's views about the mode and transmission of cholera], and *consequently tend to confirm those principles*” (MCC 2, 115, my emphasis).<sup>4</sup> Thus, Snow believes there is a direct connection between explanatory power and his theory's confirmation-theoretic status: the fact that his theory could explain phenomena that the various miasmatic and effluvial explanations failed to account for makes it more likely, in Snow's view, for his theory to be *true*.<sup>5</sup> Lastly, I want to show—through a systematic juxtaposition of Snow's various conclusions and those of the miasma/effluvia theorists—that Snow was correct in claiming that his theory could explain the phenomena he claimed it could explain, and that the extant rivals failed to do so. Thus, Snow was right to tout the explanatory power of his theory. Explanatory considerations did support Snow's theory over others, and Snow was justified in making the claims he did.<sup>6</sup>

## 2. The miasma theory

In the mid-1800s, there was much debate about the origin or ‘exciting cause’ of various diseases.<sup>7</sup> While it was generally accepted that some diseases were contagious—smallpox, syphilis, and measles, for example—, there was much discussion surrounding the transmissibility of other diseases, such as cholera, typhus, typhoid fever, and tuberculosis.<sup>8</sup> In particular, there was much debate about cholera, not just its origin, but also about its pathology and treatment.<sup>9</sup> During the first big cholera outbreak in Britain, the 1832 epidemic, many different treatments had been tried, but doctors varied widely as to what the right medicine to prescribe was, with prescriptions differing from opium, bleeding, laxatives, and peppermint to brandy. This confusion is reflected in an editorial in *The Lancet* from 1853 in which Thomas Wakley, the journal's founder and editor, wrote: “The question, What is cholera? is left unsolved. Concerning this, the fundamental point, all is darkness and confusion, vague theory, and a vain speculation. Is it a fungus, an insect, a miasm, an electrical disturbance, a deficiency of ozone, a morbid off-scouring from the intestinal canal? We know nothing; we are

<sup>2</sup> Despite its popularity, I won't discuss the Broad Street pump episode here, since its complexity would make a full discussion too lengthy for the purposes of this paper. Snow himself discusses the pump in a number of places, but of particular interest are his 1849a, 1849b, and 1855d. Besides Snow's own accounts, the single best treatment is Vinten-Johansen et al. (2003, especially chapter 11).

<sup>3</sup> In fact, Vinten-Johansen et al. discuss Snow's reasoning in more than one place. There are a number of joint publications, in which they link Snow and the hypothetico-deductive method (see, for example, Brody, Vinten-Johansen, Paneth, & Rip (1999), Brody, Rip, Vinten-Johansen, Paneth, & Rachman (2000), and Paneth, Vinten-Johansen, Brody, & Rip (1998)). In their book, they discuss Snow as a thinker in more detail (see especially chapter 8); in particular, on pp. 219–223, they focus on “Snow as a systems thinker” (220), outlining, in the form of a table, various inductive and deductive instances of reasoning they attribute to Snow, and once again, they claim that Snow “used a hypothetico-deductive [sic] model of science” (222), omitting any discussion of abductive aspects of Snow's reasoning, such as those tied to explanation and considered in this paper.

<sup>4</sup> The references to Snow's works are as follows: ‘MCC1’ refers to *On the Mode of Communication of Cholera*, first edition, London: John Churchill, August 1849; ‘MCC2’ refers to *On the Mode of Communication of Cholera* (1855), second and much enlarged edition; ‘PMCC’ refers to ‘On the Pathology and Mode of Communication of Cholera’, *London Medical Gazette*, vol. 44, Nov. 2, 1849, 745–752/Nov. 30, 1849, 923–929; ‘MPC’ refers to ‘On the Mode of Propagation of Cholera’, *Medical Times* 3, Nov. 29, 1851, 559–562/Dec. 6, 1851, 610–612 (Snow, 1851a, 1851b), and ‘OPC’ refers to ‘On the Prevention of Cholera’, *Medical Times and Gazette* 7, 1853, 367–369 (Snow, 1853b).

<sup>5</sup> In this respect, the case-study in this paper supports a view held by many scientific realists: that a theory's non-empirical virtues (such as explanatory power, but also others, such as consilience, unifying power, etc.) can be epistemic properties. This is in direct contrast to the scientific anti-realist view, according to which such virtues might be pragmatically useful but are explicitly denied any sort of epistemic power or link with truth (see, for example, van Fraassen, 1980, p. 87). I develop a philosophical case for the potential epistemic significance of such theoretical virtues in Tulodziecki (2011). For an overview and some discussion of this debate, see Psillos (1999), Churchland (1985), and Kukla (1998).

<sup>6</sup> Morens (2004), in a book review of Vinten-Johansen et al., raises “[t]he problem of missing context”, “such as the distancing of Snow as a person and a “Snow-centric” emphasis on what he alone thought and did, omitting much of the context within which his ideas evolved” (605). Let one put forth the same objection to my project, I should stress that, in this article, my main concern is with the potentially *epistemic* properties of Snow's reasoning. Thus, this project is not a historical one (in which missing context might be problematic), but one which is better viewed as making a contribution to philosophical projects involving historical records and patterns, and whose proponents think we can learn important philosophical lessons from examining historical case-studies from an epistemic perspective. Stanford, for example, has argued (2006) that historical patterns suggest that, typically, there are unconceived alternatives to our scientific theories that are also scientifically credible, and might even be equally well-confirmed by the existing evidence. However, Stanford thinks there are still important questions about what theories are particularly vulnerable, and, thus, this case-study might contribute to the important project of figuring out “when we should and should not expect to be able to confirm theoretical hypotheses against a knowably exhaustive space of alternatives” (2009, p. 256). See also Tulodziecki (2007, this journal), for trying to link theories' methodological properties with their overall epistemic success. Defending any such philosophical conclusions adequately, however, would require a separate paper, and, thus, more argument than is possible here.

<sup>7</sup> For some general accounts of medicine in the nineteenth century, see, for example, Bynum (1994), Porter (1997, especially chapters XI and XII), and Rosenberg (1977). For more detail on the confusion concerning the various cholera theories, see Baldwin (1999, especially chapter 3), Hamlin (2009, especially chapter 4), Pelling (1978), and Vinten-Johansen et al. (2003, especially chapter 7).

<sup>8</sup> For different views of and responses to some of these different diseases (cholera, smallpox, and syphilis, in particular) by different states, see Baldwin (1999).

<sup>9</sup> For more detail on cholera treatment, see, for example, Hamlin (2009, pp. 28–34) and Howard-Jones (1972).

Download English Version:

<https://daneshyari.com/en/article/1162211>

Download Persian Version:

<https://daneshyari.com/article/1162211>

[Daneshyari.com](https://daneshyari.com)