Introduction

If you wanted to find out where science happened in early Victorian Britain, you could have done worse than head to the bustling metropolis of Westminster. There you would discover a hive of scientific investigation amidst a densely packed selection of institutions, laboratories, shops, and museums. Along the Strand at Somerset House was the meeting place of the Royal Society, dating its origins back to 1660, and the eminent Geological Society, next door to the newly opened laboratory of King's College London. Just a few minutes away, scientific instrument makers and clock builders offered the latest mechanical contrivances in shops around Charing Cross and Trafalgar Square. About the gentlemen's clubs of St James's and Pall Mall you could bump into learned men of science, bustling to-and-fro between work and dinner. Along Duke Street lived celebrated engineers, such as Isambard Kingdom Brunel, and on Jermyn Street the Museum of Economic Geology displayed the latest findings of the capital's most fashionable science. Walk a little further and you might catch Michael Faraday performing a demonstration of his latest experimental findings at the Royal Institution.[1] Perhaps less obvious though, there was another place of intense scientific activity, and this was the Palace of Westminster, home to Britain's Houses of Parliament (see Map A).

The Palace of Westminster might seem an unusual focus for a history of science, but it is the purpose of this book to revise fundamentally the way we see the new Parliament building, and to show that scientific knowledge was at the centre of its construction. Furthermore, this use of scientific knowledge at Westminster, which included geology, chemistry, and mathematics, matters to our understanding of the relationship between politics and science in Victorian Britain. My account is not only a history

[1] Bernard Lightman, 'Refashioning the spaces of London science: elite epistemes in the nineteenth century', in David N. Livingstone and Charles W. J. Withers (eds.), *Geographies of Nineteenth-Century Science*, (Chicago, 2011), pp. 25–50; Iwan Morus, Simon Schaffer, and Jim Secord, 'Scientific London', in Celina Fox (ed.), *London – World City, 1800–1840*, (New Haven, 1992), pp. 129–42.

of architecture, then, but a study of the interaction between government and specialist knowledge. To contemporary audiences, science appeared as a powerful resource which, if carefully employed, might build credibility for the nation's political elites. Yet it was also a time in which science was not a self-evident, rarefied product; it lacked any clear definition or inherent authority. Varying ideas over how to use it, how to make it, and who could be relied on to undertake it, meant that trustworthy science was a hard thing to find. What constituted scientific knowledge was not just a question of what was 'true' and who was 'right', but rather, what was credible and who could be trusted. At the same time, while science might contribute to political credibility, it could also constitute a dangerous new knowledge, which challenged existing forms of social authority.

No better example of science's troublesome character appeared than during the rebuilding of the Houses of Parliament. On the night of 16 October 1834, a terrifying fire destroyed the old, largely medieval, Palace of Westminster. This apocalyptic event initiated almost three decades of work to rebuild the nation's legislative assembly. While the ruins of the old Palace were converted into temporary debating chambers for the Lords and Commons in early-1835, the Whig government selected architect Charles Barry's designs for a new Gothic legislature in 1836 following a controversial architectural competition. Until his death in 1860, Barry oversaw the new Palace's construction, completing the House of Lords in 1847 and the House of Commons in 1852. This undertaking was a massive architectural challenge, but building the permanent new Parliament also involved the production and employment of scientific knowledge on an immense scale. The invoking of knowledge asserted to be scientific for the new Parliament building was hugely ambitious. It was not only about resolving technical problems, but part of a broader moment where politics looked to science for authority.

The Politics of Science in Early Victorian Britain

The 1830s and 1840s were uncertain times for British society, with the omnipresent threat of revolution never far from the minds of the nation's political elites. Beyond the corridors of Whitehall and Westminster, rapid population growth and industrialization threatened the existing political hierarchy.[2] This was most dramatically realized through the series of

[2] Utilitarian philosopher John Stuart Mill (1806–1873) believed there was a crisis of political authority, see Richard Yeo, 'Science and intellectual authority in mid-nineteenth-century Britain: Robert Chambers and vestiges of the natural history of creation', *Victorian Studies*, Vol. 28, No. 1 (Autumn, 1984), pp. 5–31, 7.

Chartist gatherings in the northern industrial cities, including meetings in Glasgow of 150,000 and Manchester of 250,000 attendants in 1838.[3] This was an age in which old institutions were not safe. The Crown and Church were obvious targets, but reformers also directed their efforts against Parliament, local government, the legal system, slavery, religious discrimination, and all the trappings of a society riddled with aristocratic patronage. The year 1829 witnessed Catholic emancipation in the form of the Roman Catholic Relief Act, followed by the abolition of slavery in 1833, the replacement of self-appointed boroughs with local councils in 1835, and a continual reduction in the Church of England's privileges. These were proceeded by more than ten years of trade tariff reductions which followed the ever-popular demand for 'Free Trade'. The greatest scalp of all, the reform of Parliament, came in 1832 with the Great Reform Act which extended the franchise to just under a fifth of the adult-male population of England and Wales, gave greater political representation to Britain's booming industrial towns, and largely remedied the corruption of rotten boroughs. Arguably all of these upheavals were attempts to build trust in the state and secure its legitimacy, but they were upheavals all the same.[4] From 1828 until the abolition of the Corn Laws in 1846, the form of the British state changed dramatically as it faced immense pressure from reformers and revolutionaries. It is perhaps telling that around seventy-two radical MPs sat in Parliament between 1832 and 1835. It was amidst all this drama that the construction of the new Houses of Parliament took place.

Britain in the 1830s was a place of reform, and though the extent of this reform has been debated, what is unmistakable is that science was inseparable from this morass of social and political change. Science, or at least varying programmes of science, were central to British reform culture. Most obviously, the traditional institutions of science made tempting targets for restructuring. Perhaps more significantly though, scientific knowledge provided an intellectual basis for those intent on reordering the nation's existing social and economic orders. Science not only appeared simultaneously as an illuminator of divine providence, a form of moral improvement, an inducer of social mobility, and a legitimizer of

[3] Jack Morrell and Arnold Thackray, *Gentlemen of Science: Early Years of the British Association for the Advancement of Science*, (Oxford, 1981), p. 10; among other demands, the Chartists called for universal male suffrage, secret ballots, and paid MPs, see Martin Daunton, *Progress and Poverty: An Economic and Social History of Britain, 1700–1850*, (Oxford, 1995), p. 499.

[4] Martin Daunton, *Trusting Leviathan: The Politics of Taxation in Britain, 1799–1914*, (Cambridge, 2001), p. 61.

political hierarchies, but also a radical body of knowledge.[5] Historians of science have frequently shown how disordered knowledge can be linked to social disruption. As soon as a significant portion of society loses belief in existing forms of knowledge, politics can quickly become chaotic and unpredictable, with populism a troublesome thing to control or reason with. Historians have also maintained that solutions to problems of knowledge are often related to restoring social order. Controlling and regulating new bodies of knowledge can be ways of recovering political order.[6]

At no time has this relationship between society and knowledge been more obvious in Britain than during the 1830s. With the promotion of reading and a surge of cheap publications, broad society had never had such access to scientific knowledge. George Combe's *The Constitution of Man* (1828) and Charles Lyell's *Principles of Geology* (1830–1833) established controversial new subjects, and works such as John Herschel's *A Preliminary Discourse on the Study of Natural Philosophy* (1831) linked the cultivation of science to good character and respectable social behaviour.[7] For the first time, science was disseminated beyond privileged elites to middle class and, occasionally, working class audiences. This expansion in knowledge fermented utopian hopes of a new age of improvement. But it also threatened existing knowledge, namely the traditional Newtonian model of the universe which fit so neatly with Anglican theology, and which seemingly functioned as a bulwark of social and political stability. New chemical and mathematical theories fuelled terrifying interpretations in which all in the universe, including the mental and spiritual, might be the result of matter in motion.[8] It was widely feared that to abandon old accepted truths about nature would see a rise in the belief of a mathematical universe, free from divine interference; science could in this form support materialism and atheism. This knowledge was

[5] On the use of science in programmes for social improvement, see Lawrence Goldman, *Science, Reform, and Politics in Victorian Britain: The Social Science Association, 1857–1886*, (Cambridge University Press: Cambridge, 2002); on politics and medicine in the 1840s, see Anne Hardy, 'Lyon Playfair and the idea of progress: science and medicine in Victorian parliamentary politics', in Dorothy Porter and Roy Porter (eds.), *Doctors, Politics and Society: Historical Essays*, (Rodopi: Amsterdam, 1993), pp. 81–106.

[6] As shown with respect to the Royal Society during the 1660s, in Steven Shapin and Simon Schaffer, *Leviathan and the Air-Pump: Hobbes, Boyle, and the Experimental Life*, (Princeton, 1985), pp. 15, 283, and 344.

[7] James A. Secord, *Visions of Science: Books and Readers at the Dawn of the Victorian Age*, (Oxford, 2014), p. 3; for examples of the radical impact of reading science, see James A. Secord, *Victorian Sensation: The Extraordinary Publication, Reception, and Secret Authorship of Vestiges of the Natural History of Creation*, (Chicago, 2000), pp. 11–13.

[8] Secord, *Visions of Science*, pp. 7–8.

inherently dangerous and destabilizing, but it found a wide range of receptive audiences.

Evolutionary theories over the development of living organisms presented just such a dangerous body of knowledge in the 1830s. While traditional histories have concentrated on Anglican Oxbridge science and the later acceptance of Charles Darwin's evolutionary theory following his 1859 *On the Origin of Species*, Adrian Desmond has argued that beyond these elite circles, earlier evolutionary theories were not disbelieved. Evolutionary ideas offered new models of social organization which, though rejected in polite scientific communities, were embraced in radical circles. There were myriad audiences eager for new knowledge with which to challenge existing social and economic orders; groups which were keen to proclaim science as a basis for reform. These groups not only looked to new forms of science, but sought to reorganize its institutions. With London displacing Edinburgh as the empire's capital of medicine, young students targeted the Oxbridge dominated Royal Colleges of Physicians and Surgeons. At the forefront of these moves to seize control over anatomical and medical knowledge were students and radical MPs, such as Thomas Wakely and Henry Warburton.[9] Along with medical reformers, London was home to radical artisans, reforming Whigs, and materialist atheists. These groups conscripted new forms of science in their attempts to reform legal, medical, political, and scientific establishments.[10] Equally radical and distinguished were the Utilitarians who promoted a more professional approach to social organization. Mostly of middle class stock, the Utilitarians staked their own claims for reforming both society and science. Rather than polite learning for a hereditary elite, Utilitarian science was a tool for manufacturing knowledge of value to reformers within government and the professions.[11] From 1826 this Utilitarian science found a home at the newly established University of London, as well as on the Royal Institution's governing body.

Not all programmes for reforming science came from radicals. While science provided intellectual foundations for middle-class calls for meritocracy and working-class desires for revolution, it could also be used to build social stability. Amid all the social disaffection of the 1830s, appeals to nature were actively employed to maintain political order. For political and religious authorities, science was rhetorically valuable in explaining the natural place of man, while for manufacturers such knowledge appeared

[9] Adrian Desmond, *The Politics of Evolution: Morphology, Medicine, and Reform in Radical London*, (University of Chicago Press: Chicago, 1989), pp. 12, 101–02.
[10] Ibid., pp. 5, 101. [11] Lightman, 'Refashioning the spaces of London science', p. 29.

to justify their work economically.[12] The formation of the British Association for the Advancement of Science (BAAS) in 1831 was just such an endeavour, declaring its principal objective of giving 'a stronger impulse and more systematic direction to scientific enquiry ... and to turn the national attention to the objects of science and obtain a removal of any disadvantages of a public kind which impede its progress'.[13] Importantly, the BAAS's first meeting in York was held amidst the national controversy of the two failed reform bills to extend the franchise, while its decision to hold annual meetings in different cities throughout the country was an effort to bring science to regions of social unrest.[14] The majority of the BAAS's leadership favoured moderate centrist political reform and were usually Whigs, Liberals, or Peelite Conservatives, while in religion they were often liberal Broad Church Anglicans. These collective values ensured that the BAAS was an instrument of public order and social cohesion.[15] Efforts like those of the BAAS emphasize how the study of nature could be employed to legitimize existing political and economic order. Yet the BAAS was not merely an attempt to order knowledge amidst political turmoil. It was also a response to traditional aristocratic-dominated science, which the Royal Society embodied. After the death of Joseph Bank (1743–1820) who had served as the dominating President of the Royal Society for some forty-two years, London science gradually shed aspects of its aristocratic nature. Indeed, the BAAS was at the centre of this move away from the patronage of the landed Anglican gentry and the Crown.

The building of the new Houses of Parliament unfolded in the context of this intimate relationship between science and society. While it is well-known that Victorian science was deeply political, the intense scientific activity surrounding the project shows the extent to which this relationship shaped the character of Britain's government. Science could appear a valuable commodity for politicians, carrying implications of modernity and enlightened governance. In an increasingly urbanized and industrialized nation, it was important for Parliament to appear as the legitimate organ of political power.[16] Political reforms and institutional restructurings were central to this

[12] Morrell and Thackray, *Gentlemen of Science*, p. 33; on the economy as natural order, see Daunton, *Progress and Poverty*, p. 495.
[13] Bodleian Library, Oxford (BOD) Ms Dep. Papers of the British Association for the Advancement of Science (BAAS) 5, Miscellaneous Papers, 1831–1869, Folio 39, 'First Resolution of the York Scientific Meeting', (1831).
[14] Morrell and Thackray, *Gentlemen of Science*, p. 10, 98–99; on this mobile character, see Charles W. J. Withers, *Geography and Science in Britain, 1831–1939: A Study of the British Association for the Advancement of Science*, (Manchester, 2010), pp. 24–65.
[15] Morrell and Thackray, *Gentlemen of Science*, pp. 20–22.
[16] Vernon's answer to this is that from 1832 to 1867 the English state increasingly disciplined radical political forms, replacing them with a progressively less democratic political system, see James Vernon, *Politics and the People: A Study in English Political*

programme, but the rebuilding of the Palace of Westminster was also part of these efforts to secure political credibility. When it came to building a new legislature, this entailed the selection of specific scientific instruments and practices, and individuals possessing technical know-how. In short, the fashioning of Parliament as a physical network of scientific knowledge provides insights into nineteenth-century understandings of how to be modern and progressive in government.

The prominence of scientific knowledge in building the new legislature involved broader questions of governance. The challenge of how to exercise power and gain the respect of subjects is one which governments constantly face, and this is a central concern for my work.[17] Recent histories have asserted that the defining characteristic of the nineteenth-century British state was that it governed subtly through liberalism, and that this governance often took material forms. Patrick Joyce argues that the state, consisting of a collection of institutions and practices, exerted power by securing society's apparent liberties.[18] Liberalism engendered a commitment to maximizing individual freedoms, but was accompanied by 'political technology' for control, including surveillance and increased specialist expertise: in other words, forms of knowledge which were also techniques for ruling.[19] For Joyce, this exercising of state power was manifest through the material world, such as infrastructure networks. Physical objects, often guided by extensive bodies of knowledge, were engineered as forceful, but subtle ways of governing.[20] As Joyce puts it, 'it quickly becomes apparent that the seemingly neutral world of

Culture, c.1815–1867, (Cambridge, 1993), p. 9; for the political workings of Parliament, see T. A. Jenkins, *Parliament, Party and Politics in Victorian Britain*, (Manchester, 1996); on the post-1832 rise of centralized power to manage an expansion of liberty, see David Vincent, 'Government and the management of information, 1844–2009', in Simon Gunn and James Vernon (eds.), *The Peculiarities of Liberal Modernity in Imperial Britain*, (Berkeley, 2011), pp. 165–81, 181.

[17] Michel Foucault, 'Governmentality', in Graham Burchell, Colin Gordon, and Peter Miller (eds.), *The Foucault Effect: Studies in Governmentality with Two Lectures by and an Interview with Michel Foucault*, (Chicago, 1991), pp. 87–104, 87–88; for example, eighteenth-century mechanical automata inspired metaphors for social order and were also directly connected to Enlightenment understandings of government, industry, management, and labour, see Simon Schaffer, 'Enlightened automata', in William Clark, Jan Golinski, and Simon Schaffer (eds.), *The Sciences in Enlightened Europe*, (Chicago, 1999), pp. 126–65, 131, and 164.

[18] Patrick Joyce, *The State of Freedom: A Social History of the British State Since 1800*, (Cambridge, 2013), pp. 10, 28; this builds on Foucault's work on liberal governance and the exertion of control through spatial apparatus, see Michel Foucault, *Discipline and Punish: The Birth of the Prison*, (Trans.) Alan Sheridan, (Harmondsworth, 1977), pp. 200–06.

[19] Patrick Joyce, *The Rule of Freedom: Liberalism and the Modern City*, (London, 2003), p. 1; Simon Gunn and James Vernon, 'Introduction: what was liberal modernity and why was it peculiar in imperial Britain', in Gunn and Vernon (eds.), *The Peculiarities of Liberal Modernity in Imperial Britain*, pp. 1–18, 9.

[20] Joyce, *The State of Freedom*, p. 30.

science and technology is eminently political, just as the political world partakes of science and technology'.[21] Government then, does not just take place through law and legislation, but through material cultures. Material networks are forms of governmentality, or rather they are rationales and technologies involved in governing human actions.[22] It is not that objects have a deterministic power of their own, but that human agency can be embedded in material systems, and that this can exert a governance of its own.[23] If we think about the implications of this understanding of the Victorian state for a study on the architecture of the Palace of Westminster, then it seems clear that the building was itself intended to fulfil a purpose in the business of governance. In this interpretation of the state, there is an apparent distinction between the government, in a more traditional sense of centralized bureaucratic power consisting of MPs in Parliament and administrators in Whitehall, and governance through material networks.[24]

By looking at the ways science featured in the building of the new Parliament building, my study unites these two notions of governance. On the one hand the Palace was itself a material network of technologies, including lighting and clocks, which could shape the actions of politicians. However, this was also a way for these politicians to teach lessons to society. By being seen to build and work in a building embodying scientific knowledge they could appear as enlightened statesmen. The question then, is how did science contribute to Parliament's credentials as a legitimate venue of political power? Part of the answer to this lies in

[21] Ibid., p. 10; for examples, see pp. 53–99; Patrick Joyce, 'Filing the Raj: political technologies of the imperial British state', in Tony Bennett and Patrick Joyce (eds.), *Material Powers: Cultural Studies, History and the Material Turn*, (London, 2010), pp. 102–23; Jo Guldi, *Roads to Power: Britain Invents the Infrastructure State*, (Cambridge, Massachusetts, 2012), pp. 5, 21; also see, Stuart Oliver, 'The Thames embankment and the discipline of nature in modernity', *The Geographical Journal*, Vol. 166, No. 3 (September, 2000), pp. 227–38; on the government's use of scientific knowledge more generally, see R. A. Buchanan, 'Engineers and government in nineteenth-century Britain', in Roy MacLeod (ed.), *Government and Expertise: Specialists, Administrators and Professionals, 1860–1919*, (Cambridge, 1988), pp. 41–58; on the government and lighthouses, see Roy M. MacLeod, 'Science and government in Victorian England: lighthouse illumination and the Board of Trade, 1866–1886', *Isis*, Vol. 60, No. 1 (Spring, 1969), pp. 4–38; Timothy Mitchell, *Rule of Experts: Egypt, Techno-Politics, Modernity*, (Berkeley, 2002), pp. 21, 34–35.

[22] Patrick Joyce and Tony Bennett, 'Material powers: introduction', in Bennett and Joyce (eds.), *Material Powers*, pp. 1–21, 3.

[23] Ibid., pp. 3–7; Otter recognizes that while technological networks do not determine human actions, they do condition behaviour, see Chris Otter, *The Victorian Eye: A Political History of Light and Vision in Britain, 1800–1910*, (Chicago, 2008), pp. 258–63.

[24] Joyce and Bennett argue that the state is not an entity, but a site of transient powers, see Joyce and Bennett, 'Material powers: introduction', pp. 2–3.

science's apparently unbiased, empirical nature; it appears free of politics.[25] To mobilize knowledge of the natural sciences, seemingly apolitical, to maintain social order was a persuasive technique for governance.[26] That this was done for the rebuilding of the Palace of Westminster presents a very material example of how scientific knowledge contributed to the character of the nineteenth-century British state.[27]

Spectacular Credibility

Through wonderful new technologies, promises of ceaseless progress, and utopian hopes for the future, Victorian science captivated a broad range of society. Recent studies have shown science to have been an increasingly popular subject, open to non-elite groups which included the working classes and women, and which increasingly diverse and sophisticated performers popularized.[28] The politics of knowledge stretched much further than ideas over social reform. It was inseparable from the authority and content of science itself. Different understandings over how science should be performed and demonstrated embodied contrasting political ideologies. It was the performance of scientific practitioners and their relation with audiences which shaped their authority.[29] These alternate models of what was proper and appropriate scientific behaviour became embedded through different venues of scientific display. Artefacts and experiments were performed and understood differently in the Royal Institution and the Royal Society than they were in public galleries. Performances of science in these differing locations were tailored to specific audiences and carried distinctive epistemological and cultural messages.[30] As Iwan Morus observed, to really understand Victorian science

[25] Latour explains that 'modernity' consists of identifying nature and culture as two distinct beings, and then designating two ontological zones, in Bruno Latour, *We Have Never Been Modern*, (Trans.) Catherine Porter, (Cambridge, Massachusetts, 1993), pp. 10–11.
[26] Argued in, ibid., p. 37.
[27] Dan Hicks, 'The material-cultural turn: event and effect', in Dan Hicks and Mary C. Beaudry (eds.), *The Oxford Handbook of Material Culture Studies*, (Oxford, 2010), pp. 25–98, 28–9.
[28] Bernard Lightman, *Victorian Popularizers of Science: Designing Nature for New Audiences*, (Chicago, 2007), pp. 8, 18; also see Bernard Lightman, 'The visual theology of Victorian popularisers of science: from reverent eye to chemical retina', *Isis*, Vol. 91, No. 4 (December, 2000), pp. 651–80.
[29] Consider, for example, Humphry Davy's chemical displays, in Jan Golinski, *Science as Public Culture: Chemistry and Enlightenment in Britain, 1760–1820*, (Cambridge, 1992), 188–235; on the development of spaces of chemical knowledge, see Robert Bud and Gerrylynn K. Roberts, *Science Versus Practice: Chemistry in Victorian Britain*, (Manchester, 1984).
[30] Iwan Rhys Morus, 'Worlds of wonder: sensation and the Victorian scientific performance', *Isis*, Vol. 101, No. 4 (December, 2010), pp. 806–816, 810–11.

we have to look at this relationship between audience and performer. If scientific performances embodied particular approaches to knowledge, then examining which audiences gathered where, what they witnessed, and how performers tailored their display to each audience are all important for revealing the dynamics of Victorian science.[31]

To understand how science was used at Parliament, we have to look at these relationships between producers of scientific knowledge and their audiences. It is not enough to examine the content of the knowledge conveyed; we must instead examine how such knowledge was construed to be creditworthy. This is because in early-Victorian Britain, it was unclear exactly what constituted science.[32] It was a challenge for protagonists to construct their knowledge as different to alternative, non-scientific bodies of knowledge.[33] At different times during Parliament's construction, governing ministries, committees, royal commissions, bureaucrats, the Office of Woods and Forests, independent MPs, and the architect Barry all made efforts to select scientific knowledge for the building. These were the audiences, then, to whom scientific practitioners sought to promote their work. But they held differing notions of what constituted science. Accounting for the knowledge chosen for the Palace can best be achieved by analysing how science was believed to be credible within these audiences. How knowledge was produced was important to how it might be designated scientific and, ultimately, creditworthy.[34] The trouble at Westminster in the 1830s and 1840s was that there was no unanimously agreed framework for producing credible science and this was a source of constant controversy which dogged the building of Parliament. In particular, the notion of 'experiment' proved extremely difficult to categorize. Experiment could make knowledge scientific, sustaining innovation and legitimizing failure, but it could also be risky if it threatened to undermine the physical structure of

[31] Ibid., p. 815.
[32] On demarcating what was science, see Thomas F. Gieryn, 'Boundary-work and the demarcation of science from non-science: strains and interests in professional ideologies of scientists', *American Sociological Review*, Vol. 48, No. 6 (December, 1983), pp. 781–95, 782; scientific authority did not correspond neatly with social hierarchies or particular training, see Graeme J. N. Gooday, 'Liars, experts and authorities', *History of Science*, Vol. 46, No. 4 (2008), pp. 431–56; the categories authority and expertise are easily, and often wrongly used interchangeably, see Don Leggett, 'Naval architecture, expertise and navigating authority in the British Admiralty, c.1885–1906', *Journal for Maritime Research*, Vol. 16, No. 1 (May, 2014), pp. 73–88.
[33] Yeo, 'Science and intellectual authority', p. 8; a point well made in Alison *Winter, Mesmerized: Powers of Mind in Victorian Britain*, (Chicago, 1998), pp. 6–8.
[34] Argued in Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts*, (Princeton, 1986), pp. 19–21, 24.