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Science, Medicine, and the British Empire

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Science and medicine participated in British expansion from the age of Raleigh to that of Curzon and Nehru.¹ But the critical history of this involvement is hardly thirty years old.² The *Cambridge History of the British Empire* found a corner for literature but none for the research of nature. This new theatre of Imperial history is, in part, a consequence of that flowering of social enquiry which separates us from the world of the historians Hugh Egerton and Sir Reginald Coupland. It owes even more to that unravelling of assumptions which forms part of the unfinished cultural history of decolonization. Only the death of the imperial idea revealed the place of learning and healing in its plumage.

Science and medicine had furnished the means of navigation and war, and skills which allowed profitable intrusion into foreign environments. Intellectual curiosity spurred exploration and encouraged colonization from Elizabethan Virginia to the Victorian Zambezi. Merchants, missionaries, and modern major-generals such as Wellesley or Wolseley found inspiration in botany and geography. On the other hand, Europe's encounter with new lands and peoples shaped its intellectual ambitions. From Francis Bacon on, the growth of trade and colonies was expected to extend the empire of reason. Information and facts, human and natural curiosities, arrived from every ocean. By the late eighteenth century, moreover, the apparent utility of natural knowledge to Empire led to salaried posts being created at the frontier. Until perhaps as late as the Edwardian era, these colonial appointments provided vital opportunities for those participating in emerging disciplines.

What was happening, however, was an ideological symbiosis rather than a mere combination of scientific and imperial means and motives. The laws of mechanics and geometry, political arithmetic and anatomy, provided a perspective on Man's

¹ Themes raised below may also be pursued in the chaps. by Robert A. Stafford, and, in particular, Diana Wylie.

² Although see the failed historiographical bridgehead of Charles Forman, 'Science for Empire, 1895-1940', unpublished Ph.D. dissertation, Wisconsin, 1941.

place in nature which celebrated the power of informed authority to intervene. With Newton's laws, visible in the transit of cannonballs and stars, nature seemed to have shared her secrets with the British. By the era of Joseph Banks and Stamford Raffles, this universal knowledge appeared to equip Britain to undertake the cosmopolitan responsibility of 'improving' exotic lands and peoples. Science and technics came to supplement Christianity as justification for imperial outreach. By the late nineteenth century Comtean Positivism and Social Darwinism gave formal expression to older assumptions about Britain's rung on the ladder of Creation. Science was source and symbol of Progress, and Britain, as its mother and guardian, was entitled to her exalted position in the world. If the authority of St Peter had once empowered Pope Alexander VI to divide the world between the Iberian powers, an apostolic succession, which linked Newton to Kelvin, anointed new conquistadores with mission and prerogative. An alliance with the innocent cause of learning was thus as morally comforting as the gospel in the dark corners of the Earth. Scientific medicine similarly encouraged those who intervened in alien communities to think of themselves as bestowers of health as well as Christian light. Scientists and physicians, moreover, believed themselves to be bearers of precise and useful knowledge. Their faith in themselves as agents of rational improvement rested on the dramatic recent history of the sciences in the West. But this identity was also a precious tool used by scientists, such as Herschel and Huxley, when they campaigned for public and private funding, intellectual and social status. Indeed, Imperial service was itself used to strengthen claims by scientific professionals for support. The Proconsul and the savant thus had a common stake in a Positivist conception of the West's knowledge.

The terms of this alliance of science and Empire had historiographical consequences which endured well into the twentieth century. An emerging History of Science was tightly constrained by the idea of science as the progressive extinction of error. The subject depended on partisan pens, from which had flowed a Whig narrative of the good, usually mathematical, ideas of Great Men replacing ancient superstition. The importance of the medieval Arab world was recognized, but chiefly as a sterile incubator, preserving Greek learning until the West was ready to 'reclaim' it. This worldview positively discouraged research into imperial science or medicine. If Science was part of the cultural bounty which Europe delivered unto a wider world, then its historians could neglect its radiation into the periphery, thus to focus on the implicitly more important subject of its European rise and progress. By the same token, if Science sprang immaculate from Europe's brow, then it was not the concern of imperial historians. J. Holland Rose and his collaborators in the *Cambridge History of the British Empire*, in any event, like those of their contemporaries drawn to Copernicus or Kepler, would surely have

reckoned the typical colonial surveyor, geologist, or plant collector to be a tradesman: an agent of civilization but not wholly worthy of the scholar's attention. Science, in the 1920s, was both too lofty and too common a matter to find its way into a Cambridge History of Empire.

Only the 'men on the spot' tended the shrine of Colonial Athena.³ Governors and administrators were proud of the benevolent rule they had brought to barbarians. Colonial scientists similarly wanted to ensure that their contribution was not forgotten. Together they left behind vast, often still unmined, records of their work in the archives and publications of official departments and learned societies in every corner of the former Empire. But, until quite recently, historians did not consider these materials as significant. Europe's ignorance of the cultural achievements of a wider world extended to the activities of its own agents abroad. Imperial science and medicine were left to the nibbling curiosity of mice and antiquarians.

Their rescue after 1945 depended, first, on the rise of nationalist and 'peripheral' histories. These, initially, responded to the very cultural assumptions which had made the West's knowledge into the gold standard for civilization. Since by their measure a people without science was marked for subordination, those who rejected subordination were spurred to claim their part in its history. The Academy of Japan, for example, chose in 1941 to launch a great editorial project on the pre-Meiji history of Japanese science.⁴ In the era of decolonization the 'Periphery', as discussed below, came to assert both its participation in the West's learning, and in some cases, the importance of its pre-colonial and indigenous knowledge or medicine. From the 1960s onwards this research of the imperial frontier was joined by attempts to explain peripheral poverty and 'dependency'. As historians came to question the Empire's connection to the work of civilization, they examined how science and medicine had participated in exploitation and subjugation. Some enquired into the colonial origins of the periphery's apparent scientific inferiority.

These examinations of the imperial role of learning and healing depended also

³ See *inter alia*: C. A. Bruce, *The Broad Stone of Empire: Problems of Crown Colony Administration*, 2 vols. (London, 1910); Isaac Henry Burkill, *Chapters on the History of Botany in India* (Calcutta, 1965); Geoffrey B. Masefield, *A History of the Colonial Agricultural Service* (Oxford, 1972); L. Roger, *Happy Toil: Fifty-Five Years of Tropical Medicine* (London, 1950); Harold H. Scott, *A History of Tropical Medicine*, 2 vols. (Baltimore, 1939–42); George J. Snowball, ed., *Science and Medicine in Central Africa* (Oxford, 1965); W. T. Thistleton-Dyer, 'What Science has Done for the West Indies', *West Indies Bulletin*, XI (1911), pp. 249–51; E. Barton Worthington, *Science in Africa: A Review of Scientific Research Relating to Tropical and Southern Africa* (London, 1938).

⁴ S. Yajima, 'Coup l'oeil sur l'histoire des sciences au Japon', *Japanese Studies in the History of Science*, I (1962), p. 4. See also the Fascist compilation of a history of Italian science: Gino Bargagli Petrucci, ed., *L'Italia e la Scienza: Studi* (Florence, 1932).

on a coincidental shift in conceptions of science within the West. Central to this was the rise of a social history and sociology of science and medicine, which paid attention to artisans, 'minor' scientists, and even non-European traditions, which had often been neglected amid the hero-worship of Galileo or Newton.⁵ Marxists and Weberians pioneered research into the social construction and consequences of knowledge. Historians became more conscious of scientists and physicians prosecuting what Frank Turner acutely described as 'public science': a permanent campaign to secure resources, status, and influence within society.⁶ Historians of science thus began to address the impact on intellectual life of politics, economics, cultural values, and disciplinary contexts. Interacting with this was a critique of the empiricist tradition which arose out of empiricism. Philosophers began to question whether science was a market-place where simple descriptions of nature competed, good ideas replacing bad ones.⁷ Thomas Kuhn, for example, in his influential *The Structure of Scientific Revolutions* (1962), argued that participants in a discipline often have wholly irrational investments in those theories which have informed their training and professional achievements. If science and medicine were losing their aura of objectivity, after Auschwitz and Hiroshima they had lost their innocence. For the Frankfurt School and later Structuralists, they were implicated as often in the fabric of despotism as in the path to liberty and cosmopolitan progress.⁸ By the 1960s, therefore, there were endogenous 'Western' reasons to study empire's impact on science and medicine and how these disciplines contributed to imperial domination.

These political and intellectual influences came together, first, in the United States. America, hospitable to immigrant scholars and ideas, was also a former colony. She shared the anxieties of all ex-colonies, and the particular ambivalence of the 'White Dominions'—a fascination, and perhaps a racial identification, with Britain's power and cultural authority. This sentimental colonization combined

⁵ See, in particular, Richard H. Shryock, *The Development of Modern Medicine: An Interpretation of the Social and Scientific Factors Involved* (New York, 1947); Henry E. Sigerist, *A History of Medicine* (New York, 1951); John D. Bernal, *Science in History* (London, 1954); Robert King Merton, *Science, Technology and Society in Seventeenth-Century England* (Bruges, 1938); Joseph Needham, *Science and Civilisation in China*, 7 vols. (Cambridge, 1954). See also Steven Shapin, 'History of Science and its Sociological Reconstructions', *History of Science*, XX (1982), pp. 157–211.

⁶ Frank M. Turner, 'Public Science in Britain, 1880–1919', *Isis*, LXXI (1980), pp. 589–608.

⁷ For a guide to this diverse literature see John Losee, *A Historical Introduction to the Philosophy of Science*, 2nd edn. (Oxford, 1980), pp. 189–220; particularly important influences include: N. R. Hanson, *Patterns of Discovery: An Inquiry into the Conceptual Foundations of Science* (Cambridge, 1958); Willard van Orman Quine, 'Two Dogmas of Empiricism', in Quine, *From a Logical Point of View: Nine Logico-Philosophical Essays* (Cambridge, Mass., 1953); Ludwig Wittgenstein, *Philosophical Investigations* (Oxford, 1953).

⁸ Max Horkheimer and Theodor W. Adorno, *Dialectic of Enlightenment*, trans. John Cumming (New York, 1972).

with a wish to assert the vitality and importance of their New World situation. Parallel to America's emergence as the dominant power in the West, the historians of her colonial period, as Stephen Foster discusses in this volume, began a revolt against conventional interpretation. Among the expressions of this initiative was the assertion that America, rather than being a derivative colony, had been a frontier of innovation. I. B. Cohen, in *Benjamin Franklin's Experiments* (1941), thus argued that it was precisely Franklin's distance from the restraining assumptions of the Royal Society which allowed his electrical discoveries.⁹ The young Bernard Bailyn and John Clive asserted, similarly, that America's provinciality was its advantage, helping 'to shake the mind from the roots of habit and tradition'.¹⁰ Daniel Boorstin gave this suggestion its 'end of ideology' apotheosis in *The Americans: The Colonial Experience* (1958), which celebrated how the practical American frontiersman had outflanked over-cultivated Europeans in science, medicine, and technology.¹¹

This creole chest-beating might have stayed within the American tribe had it not sparked Donald Fleming in 1962 to offer a coded rebuttal to this intellectual twist on the frontier thesis via a comparison of American, Canadian, and Australian science.¹² Its romantic identification with pioneers seemed to Fleming an attempt to avoid the shame of a colonial past, to bypass the dishonourable 'psychology of abdication, of making over to Europeans the highest responsibilities in science'. These settler communities had consented to the intellectual 'absentee landlordship' of Europe. Linnaeus, Banks, and the Hookers turned Americans, Australians, and Canadians into subordinates supplying the specimens and data from which they concocted a 'European' science and their own reputations. European scholars, he suggested, 'preferred to have the Americans, Canadians, and Australians rehearse their repertory of exotic themes: the rattlesnakes . . . moose . . . [and] Stone Age Aborigines'. Pointing out what would later be called the 'brain drain', Fleming argued that the best colonial minds, such as the New Zealand physicist Ernest Rutherford (who cracked the atom) and the Australian Howard Florey (pioneer in antibiotics), were drawn away into English and Scottish universities. He specifically blamed those scholarships which commemorated the 1851

⁹ A position from which Cohen himself admittedly retreated in *Franklin and Newton: An Inquiry into Speculative Newtonian Experimental Science and Franklin's Work in Electricity as an Example Thereof* (Philadelphia, 1956), and see his *Benjamin Franklin's Science* (Cambridge, Mass., 1990).

¹⁰ John Clive and Bernard Bailyn, 'England's Cultural Provinces: Scotland and America', *William and Mary Quarterly*, Third Series, XI (1954), pp. 200–13.

¹¹ This patriotic line was supported by Brooke Hindle, *The Pursuit of Science in Revolutionary America, 1735–1789* (Chapel Hill, NC, 1956), and Raymond Phineas Stearns, *Science in the British Colonies of America* (Urbana, Ill., 1970), even in the wake of Cohen's hesitations.

¹² Donald Fleming, 'Science in Australia, Canada, and the United States: Some Comparative Remarks', *Proceedings of the Tenth International Congress of the History of Science, Ithaca, 1962* (Paris, 1964), pp. 179–96.

Exhibition and Cecil Rhodes for this spiritual haemorrhage. This remarkable essay traced many outlines later filled in by Australian, Canadian, and 'Third World' historians of science.

More immediately influential, however, was an essay by George Bassala on 'The Spread of Western Science'.¹³ Bassala, publishing in the principal American scientific journal, offered a model for the imperial history of science more congenial to those who saw Science as a field of cumulative advance, and Empire as no more than the diffusion of Europe into the world. In an argument which resembled, in its gait, W. W. Rostow's contemporaneous theory of economic growth, Bassala argued for a three-stage process: European reconnaissance, characterized by a peripatetic natural history managed from Europe, followed by an era of dependent 'colonial science', culminating in an autonomous national scientific tradition. Against Fleming, he argued that 'colonial science' should not pejoratively suggest that the non-European nation was suppressed or kept in a servile state by the imperial power. Bassala appeared untroubled that only his country, itself latterly an imperial power, provided an unqualified example of this intellectual 'take off'. His diffusionist approach, however, offered scaffolding against which arguments might lean, and attracted sympathy among those who aspired to be New World British.

The Bassala model, indeed, adequately described how scientists in the colonies of settlement had understood their own place as the partners of British science.¹⁴ The problem of the boundary between 'colonial' and 'national' science, central to his essay, stimulated the beginnings of an Australian, Canadian, and New Zealand historiography of science.¹⁵ Its pioneers often acted in spite of the

¹³ George Bassala, 'The Spread of Western Science', *Science*, CLVI (1967), pp. 611–22.

¹⁴ See, for example, Henry M. Tory, *A History of Science in Canada* (Toronto, 1939); E. Scott, 'The History of Australian Science', *Australian Journal of Science*, I (1939), pp. 105–16; Charles A. Fleming, *Science, Settlers, and Scholars: The Centennial History of the Royal Society of New Zealand* (Wellington, 1987); Alexander Claude Brown, *A History of Scientific Endeavour in South Africa: A Collection of Essays on the Occasion of the Centenary of the Royal Society of South Africa* (Cape Town, 1977).

¹⁵ See, *inter alia*, for Australia: N. R. Barrett, 'The Contributions of Australians to Medical Knowledge', *Medical History*, XI (1967), pp. 321–33; Michael E. Hoare, 'Science and Scientific Associations in Eastern Australia, 1820–1890', unpublished Ph.D. dissertation, Australian National University, 1974; Roderick Weir Home, ed., *Australian Science in the Making* (Cambridge, 1988) and, with Sally Gregory Kohlstedt, eds., *International Science and National Scientific Identity: Australia Between Britain and America* (Dordrecht, 1991); Ann Mozley Moyal, *A Guide to the Manuscript Records of Australian Science* (Canberra, 1966); Roy M. MacLeod, ed., *The Commonwealth of Science, ANZAAS and the Scientific Enterprise in Australasia, 1888–1988* (Melbourne, 1988); for Canada: Richard A. Jarrell and Norman R. Ball, eds., *Science, Technology, and Canadian History* (Waterloo, Ont., 1980) and its 1983 and 1991 sequels; Suzanne Elizabeth Zeller, *Inventing Canada: Early Victorian Science and the Idea of a Transcontinental Nation* (Toronto, 1987); and for New Zealand: Michael Edward Hoare, *Reform in New Zealand Science, 1880–1926* (Melbourne, 1976) and *Beyond the 'Filio Piety': Science History in New Zealand: A Critical Review of the Art* (Melbourne, 1977); M. E. Hoare and L. G. Bell, eds., *In Search of New Zealand's Scientific Heritage: History of Science in New Zealand Conference* (Wellington, 1984).

self-doubt characteristic of the colonial, as the foreword to the papers of the first Canadian conference plaintively put it: 'In our efforts to follow the history of Canadian science and technology, we have to battle the notion that anything done here was, in any event, a pale imitation of more creative work done elsewhere.'¹⁶

Astute scholars noticed that the cultural insecurities had been shared by colonial scientists themselves. Roy MacLeod, in a seminal essay on the condition of 'White Dominion' science, enlarged Fleming's suggestion that intellectual dependency, not least in science, sustained, and was encouraged by, the colonial experience.¹⁷ MacLeod and John Todd have argued that Australians, in the nineteenth and twentieth centuries, accepted a subordinate position in the intellectual world, supplying the needs of British men of science, while individually and in association they looked towards London and Oxford and Cambridge for guidance and approval.¹⁸

In independent India, both the 'modernizing' Nehru mainstream of the Congress Party and Marxists prized science as a cultural commodity. Between 1959 and 1963 the National Institute of Sciences thus constituted a National Commission for the Compilation of the History of Sciences of India and, in 1966, the *Indian Journal of the History of Science*. Under this Commission's influence, scholars attempted to prepare comprehensive histories.¹⁹ The diffusion model had some appeal among them, with O. P. Jaggi, for example, presenting twentieth-century Indian science as the fruit of transplanted European learning.²⁰ But Indians, naturally, were less happy than Americans or Australians with a pre-conquest *tabula rasa*. Much effort thus went into the recovery of the wealth of ancient and medieval Indian science.²¹ Deepak Kumar pointedly urged that the category

¹⁶ B. Sinclair, 'Foreword', in Jarrell and Ball, eds., *Science, Technology, and Canadian History*, p. ix.

¹⁷ R. M. MacLeod, 'On Visiting the "Moving Metropolis": Reflections on the Architecture of Imperial Science', *Historical Records of Australian Science*, V, 3 (1982), pp. 1-15.

¹⁸ See John Todd, 'Transfer and Dependence: Aspects of Change in Australian Science and Technology, 1880-1918', unpublished Ph.D. dissertation, New South Wales, 1991; and 'Science at the Periphery: An Interpretation of Australian Scientific and Technological Dependency and Development Prior to 1914', *Annals of Science*, L (1993), pp. 33-58.

¹⁹ O. P. Jaggi, *History of Science and Technology in India*, 15 vols. (New Delhi, 1969-); D. M. Bose, Samarendra Nath Sen, and B. V. Subarayappa, *A Concise History of Science in India* (New Delhi, 1971); K. Kumadamini and G. Kuppuram, eds., *History of Science and Technology in India*, 12 vols. (Delhi, 1990).

²⁰ See Jaggi, 'Preface' to *History of Science and Technology in India*, Vol. IX.

²¹ Debiprasad Chattopadhyay, *Science and Society in Ancient India* (Calcutta, 1977); A. Rahman, *Bibliography of Source Material on History of Science and Technology in Medieval India: An Introduction* (New Delhi, 1975). See also the important contribution of David Edwin Pingree, *Census of the Exact Sciences in Sanskrit*, Series A (Philadelphia, 1970-81).

of 'pre-colonial science' should replace 'non-scientific society' in Bassala's model.²² Kumar, Satpal Sangwan, and others have explored how this indigenous knowledge was appropriated, often without acknowledgement, by Europe, how Western science organized the administration and exploitation of India, how the colonial order led to the deprecation of local learning, and how Indians were long excluded from participation in 'modern' science.²³ They enlarged the suspicions of Flory, George Orwell's protagonist in *Burmese Days*, that Indian technology had been destroyed to give advantages to British industry. Some South Asians, such as Susantha Goonatilake, feared that Empire had produced a syndrome of 'aborted discovery', in which Indian practitioners of Western science and medicine were doomed both to look always to the West and to reproduce the unhappy social relations once imposed, from outside, on the East.²⁴

Unlike South Asia, Africa, before or after colonial rule, had not enjoyed political or cultural unity, or a 'scientific tradition' which could easily be compared with European models.²⁵ Precisely, perhaps, because of this, historians of Africa pioneered studies in the 1960s of the role of science, technology, and medicine as imperial history. Philip D. Curtin showed how images of Africa as diseased and primitive, fit for slavery and (benevolent) conquest, were the obverse of Europe's modern identification with Enlightenment and progress.²⁶ From Curtin's exploration of the role of malaria, others examined how medicine, and the myth and reality of disease, had shaped the colonial experience.²⁷ The particular role of technology, in the form of firearms, attracted a volume of contributions to the *Journal of African History* in 1971. Others showed how anthropology, biology, and

²² Deepak Kumar, 'Patterns of Colonial Science in India', *Indian Journal of the History of Science* (hereafter *IJHS*), XV (1980), p. 107.

²³ Matthew H. Edney, *Mapping an Empire: The Geographical Construction of British India, 1765-1843* (Chicago, 1997); Deepak Kumar, ed., *Science and Empire: Essays in Indian Context, 1700-1947* (Delhi, 1991); Satpal Sangwan, *Science, Technology and Colonisation: An Indian Experience, 1757-1857* (Delhi, 1991); S. K. Sen, 'The Character of the Introduction of Western Science in India During the Eighteenth and Nineteenth Centuries', *IJHS*, I (1966), pp. 112-22. More recently Faheer Baber, *Science of Empire: Scientific Knowledge, Civilization and Colonial Rule in India* (Albany, 1996).

²⁴ Susantha Goonatilake, *Aborted Discovery: Science and Creativity in the Third World* (London, 1984). See the comparable analysis of the intellectual consequences of slavery and the plantation system in the Caribbean in Richard Drayton, 'Sugar Cane Breeding in Barbados: Knowledge and Power in a Colonial Context', unpublished A.B. dissertation, Harvard, 1986.

²⁵ Although see the provocative essay of Robin Horton, 'African Traditional Thought and Western Science', *Africa*, XXXVII (1967), pp. 51-71 and 155-87.

²⁶ Philip D. Curtin, *The Image of Africa: British Ideas and Actions, 1780-1850* (Madison, 1964).

²⁷ R. E. Dummett, 'The Campaign Against Malaria and the Expansion of Scientific, Medical and Sanitary Services in British West Africa, 1898-1910', *African Historical Studies*, I (1968); Leo Spitzer, 'The Mosquito and Segregation in Sierra Leone', *Canadian Journal of African Studies*, II (1968), pp. 49-61.

increasing technical prowess helped a 'scientific' racism to crystallize, which in turn gave confidence to the Victorians in Africa.²⁸

This suggestion that modern science helped to construct the racial 'Other' was rapidly absorbed in the 1970s into the mainstream of imperial history.²⁹ At the same time, studies of the Dominions, India, and Africa interacted with more general explorations of science and technology's centrality to the imperial enterprise. Where Carlo Cipolla had suggested in 1965 that guns and ships were the original secret of Europe's predominance, Gerald Graham, Paul Kennedy, and Lucille Brockway examined the contribution of steam gunboats, submarine telegraphy, and economic botany to British expansion.³⁰ Daniel R. Headrick brought these threads together in two seminal studies which argued that territorial annexation in Asia and Africa and the consolidation of 'formal' Empire depended on nineteenth-century technological revolutions.³¹ Both the regional and comparative work were stimulated by contemporary 'structuralist' analyses of the origins of modern inequality. Brockway, like Goonatilake, for example, took inspiration from Immanuel Wallerstein's 'world systems' approach, and sought to explain science's place in the imperial 'development of underdevelopment'.³² The Gramscian concept of 'hegemony', refracted through Edward W. Said's *Orientalism*, similarly influenced Michael Adas's exploration of how science and technology as *ideas* gave confidence to Europeans and won submission from the colonized.³³

By the early 1980s similar work began to emerge on colonial medicine.³⁴ This in part derived from metropolitan studies on the 'political economy of health'.³⁵

²⁸ Christine Bolt, *Victorian Attitudes to Race* (London, 1971); T. O. Ranger, 'From Humanism to the Science of Man: Colonialism in Africa and the Understanding of Alien Societies', *Transactions of the Royal Historical Society*, XXVI (1976), pp. 115–41; Gloria Thomas-Emeagwali, ed., *Science and Technology in African History: With Case Studies from Nigeria, Sierra Leone, Zimbabwe, and Zambia* (Lewiston, NY, 1992).

²⁹ See Ronald Hyam, *Britain's Imperial Century, 1815–1915: A Study of Empire and Expansion* (new edn. London, 1976), and James Belich, *The New Zealand Wars and the Victorian Interpretation of Racial Conflict* (Auckland, 1988).

³⁰ Carlo Cipolla, *European Culture and Overseas Expansion* (London, 1966); Gerald S. Graham, *Great Britain in the Indian Ocean: A Study of Maritime Enterprise, 1810–1850* (Oxford, 1968); Paul M. Kennedy, 'Imperial Cable Communications and Strategy, 1870–1914', *English Historical Review*, LXXXVI (1971), pp. 728–75; L. Brockway, *Science and Colonial Expansion: The Role of the British Botanic Gardens* (New York, 1979).

³¹ Daniel R. Headrick, *Tools of Empire: Technology and European Imperialism in the Nineteenth Century* (New York, 1981) and *Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850–1940* (London, 1988).

³² Immanuel Wallerstein, *The Modern World System* (New York, 1974).

³³ Edward W. Said, *Orientalism* (New York, 1978); Michael Adas, *Machines As the Measure of Men: Science, Technology, and Ideologies of Western Dominance* (Ithaca, NY, 1989).

³⁴ David J. Arnold, ed., *Imperial Medicine and Indigenous Societies* (Manchester, 1988); Roy M. MacLeod and Milton James Lewis, eds., *Disease, Medicine, and Empire: Perspectives on Western Medicine and the Experience of European Expansion* (London, 1988).

³⁵ Lesley Doyal, *The Political Economy of Health* (London, 1979).

Radhika Ramasubbin and Mark Harrison, for example, examined the colonial origins of the Indian public health system, and suggested that neither for the British nor Indian élites was the well-being of poor people a priority.³⁶ Roy MacLeod, Donald Denoon, and Randall Packard offered comparable studies for Tanzania, the Pacific, and South Africa.³⁷ Parallel to this, others investigated the 'social construction' of medical knowledge.³⁸ Under the coincident influence of Frantz Fanon and Michel Foucault, historians began to think of medicine as a set of discourses and practices through which control was exerted over non-Europeans.³⁹ Megan Vaughan and David Arnold, for example, showed that disease and healing shaped the colonial process by creating Western medical ideas of the 'African' and 'Indian' as through affecting mortality.⁴⁰

The last frontier was the imperial centre itself. For if by the beginning of the 1980s many understood the contributions of science and medicine to expansion, almost none had asked how empire shaped science. A 'diffusionist' perspective, with which the age of high imperialism would have been comfortable still prevailed.⁴¹ By its lights, while science in Africa or India might have been imbricated with colonial policy and circumstance, its history within Britain remained wholly separate. These old certainties have begun to disintegrate. Roy MacLeod and Michael Worboys began the process by showing how British science had responded to Imperial responsibilities it had undertaken in the age of Chamberlain.⁴²

³⁶ R. Ramasubbin, *Public Health and Medical Research in India: Their Origins Under the Impact of British Colonial Policy* (Stockholm, 1982); Mark Harrison, *Public Health in British India: Anglo-Indian Preventive Medicine, 1859–1914* (Cambridge, 1994).

³⁷ Roy M. MacLeod and Donald Denoon, *Health and Healing in Tropical Australia and Papua New Guinea* (Townsville, 1981); Donald Denoon, *Public Health in Papua New Guinea, 1884–1984* (Cambridge, 1989); Randall Packard, *White Plague, Black Labour: Tuberculosis and the Political Economy of Health and Disease in South Africa* (Berkeley, 1989).

³⁸ See Peter Wright and Andrew Treacher, eds., *The Problem of Medical Knowledge: Examining the Social Construction of Medicine* (Edinburgh, 1982).

³⁹ Frantz Fanon, *Les Damnés de la terre* (Paris, 1961; *The Wretched of the Earth*), chap. 5; Michel Foucault, *Histoire de la Folie* (Paris, 1961) and *Naissance de la Clinique* (Paris, 1963; *The Birth of the Clinic: An Archaeology of Medical Perception*, London 1975).

⁴⁰ Megan Vaughan, *Curing Their Ills: Colonial Power and African Illness* (Stanford Calif., 1991), and David Wylie Arnold, *Colonizing the Body: State Medicine and Epidemic Disease in Nineteenth-Century India* (Berkeley, 1993). See chap. by Diana Wylie.

⁴¹ See the trilogy by Lewis Pyenson, *Cultural Imperialism and the Exact Sciences: German Expansion Overseas, 1900–1930* (New York, 1985), *Empire of Reason: Exact Sciences in Indonesia, 1840–1940* (Leiden, 1989), and *Civilizing Mission: Exact Sciences and French Overseas Expansion, 1830–1940* (Baltimore, 1993). See also the critiques offered in Paulo Palladino and Michael Worboys, 'Science and Imperialism', *Isis*, LXXXIV (1993), pp. 91–102, and Richard Drayton, 'Science and the European Empires', *Journal of Imperial and Commonwealth History*, XXIII (1995), pp. 503–10.

⁴² R. M. MacLeod, 'Scientific Advice for British India', *Modern Asian Studies*, IX (1975), pp. 343–84; Michael Worboys, 'Science and British Colonial Imperialism, 1895–1940', unpublished D.Phil. thesis, Sussex, 1980. See also Robert V. Kubicek, *The Administration of Imperialism: Joseph Chamberlain at the Colonial Office* (Durham, NC, 1972).

Later studies suggested that science and medicine, rather than merely profiting from the fashions of Edwardian policy, had enjoyed an old and fundamental connection to the Imperial enterprise. From the mid-1980s onwards, work by David Mackay on Sir Joseph Banks, Robert A. Stafford on geography and the Royal Geographical Society, Matthew Edney on surveying and geodesy, Crosbie Smith and Norton Wise on electrodynamics, Richard H. Grove on conservation, Richard Drayton on botany, and John Clark on entomology, has illustrated how Imperial outreach shaped the life of the sciences within Britain.⁴³ Much as P. J. Cain and A. G. Hopkins show, *mutatis mutandis*, the impact of the banking profession on imperialism, these scholars have suggested how scientists parasitized the apparatus of imperialism: fattening their disciplines on its opportunities, while pushing it to serve their purposes.⁴⁴ As Stafford has suggested, Victorian scientists were an important category of 'sub-imperialist', often leading rather than following the flag. The history of Imperial science, which once took encouragement from the post-1960 'regional' turn in Commonwealth history, is thus helping to refocus attention on British imperialism as a whole. Similarly, these historians are assisting in the discovery—being made, at the same time, by Linda Colley, Kathleen Wilson, and others—that the 'Mother Country' was as much the child of Empire as India, Nigeria, or Barbados.⁴⁵

This inclusion of Britain (and Europe generally) into the space of Imperial history will have important consequences. In particular, by addressing how the 'indigenous' negotiated with the exotic, whether in Bombay or Bristol, we are now going beyond thinking of empire or science as crimes inflicted by Britain on its colonies. Michael Bravo and C. A. Bayly, for example, have shown, respectively, how Inuit and Indians entered into sophisticated dialogues with British geography, physics, and physics.⁴⁶ Their attempt to examine the surface of contact

⁴³ David MacKay, *In the Wake of Cook: Exploration, Science, and Empire, 1780–1801* (London, 1985); Robert A. Stafford, *Scientist of Empire: Sir Roderick Murchison, Scientific Exploration, and Victorian Imperialism* (Cambridge, 1989); Edney, *Mapping and Empire*; Crosbie Smith and M. Norton Wise, *Energy and Empire: A Biographical Study of Lord Kelvin* (Cambridge, 1989); Richard H. Grove, *Green Imperialism: Colonial Expansion, Tropical Island Edens and the Origins of Environmentalism, 1600–1860* (Cambridge, 1995); Richard Drayton, *Nature's Government: Kew Gardens, Science, and Imperial Britain* (forthcoming); J. F. M. Clark, 'Science, Secularization and Social Change: The Metamorphosis of Entomology in Nineteenth-Century England', unpublished D.Phil. thesis, Oxford, 1994. See also John M. MacKenzie, ed., *Imperialism and the Natural World* (Manchester, 1990).

⁴⁴ P. J. Cain and A. G. Hopkins, *British Imperialism*, 2 vols. (London, 1993). See in this context, S. Ravi Rajan, 'Imperial Environmentalism: The Agendas and Ideologies of Natural Resource Management in Colonial Forestry', unpublished D.Phil. thesis, Oxford, 1994.

⁴⁵ Linda Colley, *Britons: Forging the Nation, 1707–1837* (London, 1992); Kathleen Wilson, *The Sense of the People: Politics, Culture, and Imperialism in England, 1715–1785* (Cambridge, 1995).

⁴⁶ Michael T. Bravo, *The Accuracy of Ethnoscience: A Study of Inuit Cartography and Cross-Cultural Commensurability* (Manchester, 1996) and 'Science and Discovery in the Admiralty Voyages to the Arctic Regions in Search of a North-West Passage', unpublished Ph.D. thesis, Cambridge, 1992;

between the 'imperial' and the local illustrates two new and important trends. First, much notice is now being paid to how different knowledge systems, understood in their own terms, encounter both nature and each other at the many peripheries of empire. Secondly, there is philosophical interest in how science and medicine assimilate knowledge specific to particular places into universal categories.⁴⁷ The gloomy invocation of science's involvement in domination is giving way to research into how empire produced the creolization of different intellectual traditions. The story of riches lost in the horrors of invasion, expropriation, slavery, and the many variants of the 'Middle Passage', is thus being punctuated gradually by discoveries of persisting tradition, exchange, and trans-culturation. This happier theme will ultimately have more enlightening, and subversive, consequences than the old narrative of the once-heroic, and now demonic, West submitting the world to its manners, with the Bible in one hand and the *Novum Organum* in the other.

C. A. Bayly, *Empire and Information Intelligence Gathering and Social Communication in India, 1780–1870* (Cambridge, 1996).

⁴⁷ For two attempts to address this problem see Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Milton Keynes, 1987), and in Volume II, chap. by Richard Drayton.

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Disease, Diet, and Gender: Late Twentieth-Century Perspectives on Empire

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For nearly three-quarters of the twentieth century, historical writing on the British Empire concentrated on political and economic issues—on the way the Empire was administered, policy-making, the economic consequences of Imperial rule, and the emergence of political movements in opposition to British rule. Perhaps inevitably, in times when the Empire generated ideological controversy in Britain and on the periphery, historians tended to be either apologists for or opponents of Empire. But a more analytical and broadly encompassing genre of historical writing has now developed, partly with the emergence of scholars too young to have been personally involved in the colonial experience, and partly because of the influence on the history of the British Empire of wider trends in thinking and historical scholarship. These influences have included the seminal thought of the French philosopher Michel Foucault, the Italian socialist Antonio Gramsci, and literary theorists such as Edward W. Said.¹ Inspired by their writings, many historians of Empire have developed a far more subtle conceptualization of the nature and modes of power of British rule. In particular, historians have begun to examine how power was exercised through skills and disciplines which were once thought to be 'apolitical', such as medicine and other aspects of modern science; and how a range of social identities, such as race and gender, were constructed in the complex processes of British imperialism.

It is particularly striking how the human body has become a focus for historical enquiry in quite new ways. Discussions of the nature and meaning of tropical and colonial medicine have broken new ground. British rulers had, of course, sought to control disease and lower mortality, and many had pursued effective

¹ Michel Foucault, *The Birth of the Clinic: An Archaeology of Medical Perception* (Paris, 1963; English trans. London, 1975); Antonio Gramsci, *Selections from Prison Notebooks* (London, 1971). See esp. the comment by Perry Anderson in 'The Antinomies of Antonio Gramsci', *New Left Review*, C (1976–77), pp. 5–36; Edward W. Said, *Orientalism* (New York, 1978). On their influence see also the chap. by D. A. Washbrook.