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BENJAMIN A. ELMAN, **On Their Own Terms: Science in China, 1550–1900**. Cambridge, MA and London: Harvard University Press, 2005. Pp. xxxviii + 567. ISBN 0-674-01685-8. £35.95 (hardback).

BENJAMIN A. ELMAN, **A Cultural History of Modern Science in China**. Cambridge, MA and London: Harvard University Press, 2006. Pp. xv + 308. ISBN 0-674-02306-4. \$35.00, £22.95, €29.80 (hardback).

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When China and Japan went to war in 1894 many foreigners predicted a Chinese victory. Both governments were vigorously pursuing policies of modernization and self-strengthening,

including the acquisition of Western scientific and technical expertise. China's forces were well equipped with modern weaponry built in Western-style arsenals founded in the 1860s; their navy, which included two new German-built battleships as well as Chinese-built ships and artillery, was twice the size of that of Japan. But the Chinese forces were poorly coordinated and supplied. The Japanese sank or captured twelve Chinese battleships, marched into key territories and claimed a rapid and decisive victory. As Benjamin Elman explains, the Treaty of Shimonoseki, signed in 1895, marked a dramatic watershed in Chinese self-image and international reputation. The huge indemnity imposed upon the Qing government stalled reconstruction in China while boosting industrialization in Japan. Japan displaced China as East Asia's leading nation, a growing industrial and military power respected by Westerners. China was now labelled 'the sick man of Asia'. The Qing government had attempted to fuse what it saw as the strengths of two civilizations, accommodating Western innovations within a Chinese framework of governance. After 1895 many Chinese lost confidence in a heritage they now saw as degenerate. Only by extirpating Chinese intellectual and social traditions and implanting Western scientific ideas and institutions could China hope to become a healthy modern nation. Chinese and foreigners alike came to view Chinese culture as inimical to progress and incompatible with scientific rationality. China was thus written out of the history of science, while science was written out of the history of China.

Joseph Needham's great enterprise, *Science and Civilisation in China*, paved the way for a fundamental rethinking of China's intellectual heritage and its contributions to the modern world. Yet, as Elman remarks, the work is famous but little read; furthermore, Needham decided that his studies should terminate at the point where local sciences supposedly fused into universal science – in the Chinese case, when Western science was introduced by the Jesuits in the late Ming dynasty. Since the publication of Needham's first volume in 1954 many fine studies of natural knowledge in China have been produced in East Asia and the West, and studies of the encounter between Jesuits and Chinese savants now amount to an academic industry. Most, however, are specialist studies, not readily accessible to non-sinologists. What Elman proposes in these two books is an ambitious survey of the full period (1550 to 1900, late Ming to late Qing) during which Chinese intellectuals believed that Chinese natural studies and Western *scientia* or sciences could communicate fruitfully.

Post-colonial critiques of scientific imperialism stress that Western science was never introduced into a vacuum. Even where it was imposed on conquered peoples by colonial regimes, it could function only through complex processes of translation, appropriation and accommodation. As Elman convincingly demonstrates, the case of China is of particular interest for anyone interested in the creolization of Western science(s). Contextual materials, including works of 'native' natural studies and documentation of debates concerning the reception of Western knowledge, are extremely rich. Furthermore, China was not a colony under Western rule – until the debacle of the Sino-Japanese War the intrinsic superiority of Western knowledge remained open to debate among its Chinese interlocutors.

Western sciences came to imperial China in two waves, each associated with Christian missions. The Jesuits worked at the Astronomical Bureau of the imperial court from the early 1600s until the dissolution of the order in 1773. In the early nineteenth century Protestant missions gained a foothold in China and began translating works on medicine, technology and science as well as the Gospels; certain key figures later took employment with the Chinese government as advisers, trainers or administrators in its self-strengthening campaign. These two encounters have usually been treated as separate episodes, but Elman argues persuasively for treating the period from 1550 to 1900 as a continuum marked by sustained creative dialogue between knowledge systems. First Elman lays out the intellectual and material landscapes of the late Ming, mapping 'native' natural studies to show how Chinese epistemologies and interests

shaped Jesuit tactics for presenting Western learning (notably mathematics and astronomy) in forms that were both useful and acceptable. He then describes the mobilization and selective appropriation of Western learning through the ensuing period of critical classical studies. Rather than coining neologisms Jesuit translators and their Chinese colleagues chose to render Western concepts using existing Chinese terminology; consequently, in their reconstitutions of ancient texts, Chinese scholars often saw prefigurations of Western learning, inclining them to see Western and Chinese sciences as intertwining traditions rather than incommensurable world views.

Doctrinal constraints cut the Jesuits off from cutting-edge scientific advances in Europe. They offered the Chinese Tychonic but not Galilean astronomy, algebra but not calculus. Yet they undoubtedly catalysed the growing status of mathematical skills, increasingly seen as a key to understanding natural phenomena, and the extension of these skills through the restoration and study of sophisticated mathematical texts dating back to the Song and Yuan dynasties. The Qing mathematical revival helped build a cognitive framework that allowed nineteenth-century Chinese intellectuals to recognize the significance of calculus and other advanced mathematics introduced by Protestant missionaries, and to collaborate in translating the new sciences into Chinese. Indeed, contrary to received opinion, a significant number of nineteenth-century Chinese intellectuals engaged positively, and still largely 'on their own terms', with the new science initially introduced by the Protestant missionaries.

Throughout the last three centuries of imperial history, Elman argues, 'science' was at the foreground of intellectual and political concerns in China, and if we wish to understand what science signifies in China today, we should know this history. *On Their Own Terms* is a complex and ambitious work which synthesizes a vast corpus of scholarship on the evolution of science in early modern China, Japan and Europe. Minor criticisms can certainly be levelled. Elman tends, for example, to present a one-way flow of people and ideas into China. Joanna Waley-Cohen's *Sextants of Beijing* (New York, 1999) shows the importance of nineteenth-century Chinese travels abroad in search of skills, knowledge and contacts, while Fa-ti Fan's recent work documents the impact of Chinese data and Chinese collaborators on nineteenth-century Western botany. Such observations, however, in no way detract from Elman's immense achievements. *A Cultural History* is an abridgement of *On Their Own Terms* intended to be readily accessible to historians of Western science as well as students in Asian studies, but I am not sure it provides enough background information in the right order to make for an easy read. I would rather recommend tackling *On Their Own Terms* directly. Although even sinologists will find its length and complexity challenging, its passionate and provocative arguments and perceptive vignettes leave one with a vivid sense of why, and how, Elman's Chinese thinkers 'produced their own science'.

FRANCESCA BRAY
University of Edinburgh

BENEDIKT STUCHTEY (ed.), *Science across the European Empires, 1800–1950*. Oxford and New York: Oxford University Press/German Historical Institute London, 2005. Pp. viii + 376. ISBN 0-19-927629-2. £60.00 (hardback).

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Science across the European Empires is a commendable but flawed effort to bring a comparative European perspective into the fashionable historiographical field of imperial science. Now thirty years old, the premises of that historiography are familiar but still vital: science was an active protagonist in imperial adventures, providing both technological capacity and ideological justifications for the rule of one people by another. This volume brings original material on