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# Benjamin A. Elman, On Their Own Terms: Science in China, 1550–1900.

**Cambridge: Harvard University Press, 2005. xxxviii + 567 pages. ISBN: 9780674016859**

# Benjamin A. Elman, A Cultural History of Modern Science in China.

**Cambridge: Harvard University Press, 2006. xv + 308 pages. ISBN: 9780674023062**

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The two books under review, both by the American scholar Benjamin Elman, mark an epoch in the history of Chinese science: the former book is dedicated to Elman's teachers, Nathan Sivin and Susan Naquin (and to Elman's mother), and the latter to his students. Both works detour around Joseph Needham's famous question about China's alleged failure to develop modern science, instead incorporating a half-century's scholarship into a narrative that covers four centuries of achievements.

While Needham's training in biochemistry led him to emphasize mathematized and testable hypotheses and experiments, Elman views science as a body of knowledge produced through the systematic study of nature and universe. Where Needham saw no indigenous development, Elman speaks of lively engagement with the Jesuits from 1550 to 1800 and the Protestant missionaries from 1840 to 1900.

The defeat of Qing China by Japan in the first Sino-Japanese War convinced many of the members of the May Fourth generation that Chinese civilization had ended in failure. Consider, for instance, the comments made by Liang Qichao in *Ou you xin ying lu* 歐遊心影錄 (*A Record of My Impressions of a European Tour*) in 1920 and the lecture given by Hu Shi at the University of Chicago in 1933: they agreed that their homeland had produced no indigenous science despite the scientific spirit noticeable in a number of areas. The zigzag views of "what China is and is not" have constituted one of the field's defining problematics.

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Since *A Cultural History of Modern Science in China* is a textbook adapted from *On Their Own Terms*, this review focuses on the latter book. *On Their Own Terms* consists of five parts, made up of 11 chapters. Part 1 depicts the reactions of Chinese literati to the learning imported by the Jesuits, as many tried to absorb the elements of Western science without upsetting the indigenous theory of knowledge. In the wake of improvements to printing technology and commercial networks in the late Ming, encyclopedias of natural studies not only functioned as repositories and practical manuals of popular science but also maintained the categories of knowledge into which Western learning was forced.

Part 2 explores Chinese astronomy through the late Ming calendar crisis. With the consent of the Chongzhen emperor, the Jesuits contributed their expertise to the Astronomical Bureau, improving the prediction of eclipses and explaining other celestial anomalies. Literati interest in these new techniques drew them close to the Jesuits, who employed a strategy of adaptation and indigenization in the vain hope of gaining converts. For the Chinese, Western learning was, to quote Elman, "an alternate form of the investigation of things and a confirmation of Chinese ancient learning."

The dynastic shift from Ming to Qing did not immediately interrupt the cultural exchanges between elite officials and Jesuit missionaries, but with time, fierce competition broke out between the staff of the Astronomical Bureau and the Jesuits. The formal disputes between Ferdinand Verbiest and Yang Guangxian motivated the Kangxi emperor to learn mathematical astronomy from his French guests. In addition to mathematical astronomy, the Jesuits also contributed their expertise in mensuration, artillery, geography, cartography, clockmaking, glassware, medicine, anatomy, architecture, and other areas. A series of controversies over ancestor worship and Confucian rites pitted the Vatican against the Qing court, and in 1827, the court confiscated all missionary property.

Part 3 shows how Qing scholars who excelled in evidential research incorporated Jesuit learning into their effort to restore ancient medical and mathematical classics. Elman depicts this as an inward turn, comparing it with the shift that was then taking place in the Qing court's military ambitions, as naval expansion ceased and the country's terrestrial frontier was expanded. Scholars explored the fields of medicine and astronomy, rejecting the Song-Ming interpretation of mastering principle to pursue the Han concept of extended knowledge, an idea all the nobler for having arisen closer in time to the golden age of Confucian philosophy. The novel alliance of a quasi-scientific commitment to investigating things with evidential studies could provide a way back to that bygone time, and even the Kangxi emperor, so fond of foreign toys, "became convinced that European learning was derivative and that ancient learning in China was the source of all reliable knowledge" (236). The subsequent compilation of encyclopedias based on this epistemological stance confirmed scholars already believed.

But for many Qing scholars, Jesuit learning was far more than a tool for making calendars. Part 4 shows that by the nineteenth century they developed their own form of modern science by merging ancient Chinese insights with European knowledge. Calculus, anatomy, medical theories and therapies, and so forth were translated into Chinese by European and Chinese collaborators, such as Alexander Wylie and Wang Tao, who produced a Protestant journal called the *Shanghai Serial*;

Wylie and Li Shanlan, who worked together on mathematics textbooks; Joseph Edkins and Li Shanlan for biology textbooks; and many others associated with the Jiangnan Arsenal in Shanghai. The linguistic gestalt merging neologisms and classical terminology provided Chinese readers a transitional passage to an indigenous modernity. Such translation efforts were sponsored either by the westernization campaigns of central and regional governments, or by Christian organizations for evangelical purposes.

Part 5 shows that the Qing government's investment in science and technology secured it military domination in Asia for three decades after 1860. The project included arsenals, shipyards, machine shops, iron mines, and iron workshops nationwide, and for all these, thousands of Chinese and foreign administrative experts, translators, and advisors were needed. The series of national strengthening campaigns advanced under the slogan "Chinese studies as fundamental and Western learning as useful." In this process, a new group of artisans, technicians, and engineers emerged, "whose expertise no longer depended on the field of classical learning monopolized by the customary scholar-officials" (389–390).

Another wave of reforms followed the humiliating defeat at the hands of Japan in 1895, as China found a new model to emulate. From political campaign devoted to "learning from Japan" to technology transfer across the China Sea, Protestant phrases were out and Japanese scientific terminology was in. The result was a merger of Jesuit knowledge, Chinese classics, and neologisms from Japanese translations of Western learning. Japanese terms were that much easier to absorb since they appeared as familiar Chinese characters.

As a student of Nathan Sivin, Elman has gone beyond previous scholarship in explaining why China did not develop science or modern science. In these two books, Elman complies with Sivin's request for an analysis of the inherent strengths and weakness of the Chinese system of natural studies, for a picture of the Sino-Jesuit encounter as a network of knowledge for pragmatic problem solving and for the modifying of theories. As for Sivin's suggestion that the social consequences of the mid-seventeenth-century scientific revolution were negligible, Elman presents a broad portrait of Chinese scholarly curiosity during this period.

In addition, Elman documents the social transmission of Jesuit knowledge through advances in printing and publishing—without, though, presenting the overall contours of this market of knowledge. As we learn about Western learning slipping into the book market, the policy essays in the civil service examinations, and the scientific essay contests that sprang up, we long for some systematic discussion of the mechanism of knowledge reproduction in general and in particular the way in which Chinese literati were transformed from *scientia*, translators, and essay contestants into professional scientists. Elman's narrative also leaves out what had been exchanged in the encounters between China and the West. The focus on textual discussion and the synthesis of secondary literature is insufficient to provide a thick description of science as culture—the "cultural manifold" Sivin has theorized that integrates material conditions, mechanisms of knowledge production, political maneuvers, individual endeavors and competitions, and sociohistorical contingencies.

*A Cultural History of Modern Science in China* and *On Their Own Terms* provide a coherent narrative of how Chinese science developed in the modern era. But

without lengthy quotations from the key texts of the day and some sense of how Chinese scholars made modern science their own, the common reader to whom these books are addressed may not get a strong feeling for the historical transformation as it was lived. If professionals have a hard time tracking down the sources Elman relied on, then beginners will run into a blank wall. The book's title "On Their Own Terms" without any Chinese characters in the section of glossary and index is an ironic commentary on the book's contents, the author's intention and practice, and the gap between historical experience and scholarly presentation.