FOCUS: SCIENCE AND MODERN CHINA

New Directions in the History of Modern Science in China

Global Science and Comparative History

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ABSTRACT

These essays collectively present new perspectives on the history of modern science in China since 1900. Fa-ti Fan describes how science under the Republic of China after 1911 exhibited a complex local and international character that straddled both imperialism and colonialism. Danian Hu focuses on the fate of relativity in the physics community in China after 1917. Zuoyue Wang hopes that a less nationalist political atmosphere in China will stimulate more transnational studies of modern science, which will in turn reveal the underlying commonalities in different national contexts. Sigrid Schmalzer compares the socialist and the capitalist contexts for science in China and reopens the sensitive question of the "mass line" during the Cultural Revolution. Grace Shen describes the tensions early Chinese scientists felt when choosing between foreign models for modern geology and their own professional identities in China. Taken together, these accounts present us with a comparative history of modern science in China that is both globally and locally informed.

IT IS REMARKABLE HOW LITTLE WE KNOW about modern science in contemporary China. Until recently, historians of "Chinese science" in China, Japan, Europe, and the United States spent much of their time researching issues in premodern natural studies and, usually, trying to explain why modern science, technology, and medicine

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This Focus section was organized by Grace Shen.

Isis, 2007, 98:517–523

0021-1753/2007/9803-0004$10.00

arrived so late in China.[1] The "Needham Question"—Why did a divided Europe, and not imperial China, develop modern science first?—until recently remained preeminent. This question was paralleled by scholarly efforts in other fields to explain why China did not develop capitalism or democracy before Europe.[2] The papers in this Focus section reveal, however, that things are rapidly changing and that we have already entered a new era that explores modern science in contemporary China in more active rather than simply receptive terms. Each author here addresses modern science in China from a comparative point of view and includes it in the story of global science.[3]

The lack of studies of modern science in China has not been due to the burden of historiography alone, however. As the authors here also show, historians have used the potential sources for modern Chinese science, when available, to focus on individual Chinese scientists or representative scientific institutions in the Republic of China (1911–1949) and the People's Republic of China (1949–), rather than exploring the larger problems of how science has been practiced in the modern context of nationalism, state-building, and socialism. The need to use all available sources to illuminate the broader practice of science in its full modern context is obvious, but the political limits placed on sensitive topics, such as modern physics, remain in place in contemporary China. We certainly need a second Bruno Latour to do for socialist science—in China and elsewhere in Asia and Eastern Europe—what he did for capitalist science in his pioneering fieldwork. The articles here begin to make that step forward possible.[4]

All the authors in this Focus section stress the decisive role of the Chinese state in modern science. They also acknowledge, however, the limits of such a statist perspective: it misses the global and comparative issues involved in the mastery of modern science by Chinese scientists. Too often, we have called attention to the political rhetoric and philosophical theory enunciated by Chinese publicists of science since the 1919 May Fourth Movement. As a consequence, we have overlooked the advent of early Chinese scientists themselves as spokespersons for modern science. Others have stressed the priority of artisanal practice in the Chinese setting and have naively assumed that past Chinese successes in technology were purely practical. The problem laid out in these essays is how best to combine both sides of these formulations, to recognize that the Chinese interest in modern science was simultaneously theoretical and practical. The widespread use of the term *keji* 科技 (lit., "science and technology") to describe contemporary "technoscience" in Chinese universities and research institutes is a case in point.

Similarly, the essays problematize post-Mao efforts to distinguish Chinese socialism from scientific progress. Most Euro-American and Chinese accounts have indicted Maoist mass science and its rhetoric of science's role in class struggle as a smokescreen for power politics. We have elided what socialist ideals were about during the Great Proletarian Cultural Revolution from 1966 to 1976. Although the victimization of many scientists during this period and the role of Maoist ideology in leading some Chinese scientists to

[1] Nathan Sivin, *Traditional Medicine in Contemporary China* (Ann Arbor: Center for Chinese Studies, Univ. Michigan, 1987), is a pleasant exception. This Focus section, however, does not tell us very much new about the story of modern medicine in contemporary China.

[2] See Joseph Needham, *Science and Civilisation in China,* Vol. 3 (Cambridge: Cambridge Univ. Press, 1959), pp. 150–168.

[3] Roger Hart, "Beyond Science and Civilization: A Post-Needham Critique," *East Asian Science, Technology, and Medicine,* 1999, *16:*88–114.

[4] Bruno Latour, *Science in Action: How to Follow Scientists and Engineers through Society* (Cambridge, Mass.: Harvard Univ. Press, 1987).

oppose relativity in the name of dialectical materialism, for example, are important issues in the unmasking of Maoism after 1976, the broader aspects of understanding why mass science appealed to many Chinese and some Euro-Americans in the 1960s force us to question the easy separation of scientific practice from social and political agendas. More "Bruno Latours" in socialist laboratories will likely reveal the peculiar nature of socialist rhetoric and communist institutions in forging myths about science that enhance its revolutionary status in China and elsewhere in the increasingly postsocialist world. After all, liberal capitalist ideals informed our own Euro-American notions of modern science as the *sine qua non* for the rise of the middle classes via science and engineering since the industrial revolution, a development that elitist Oxbridge dons and their Harvard-Yale-Princeton counterparts initially opposed. The 1880s debate of Matthew Arnold and Thomas Huxley over the importance of literature and culture versus that of science is a telling example for Great Britain.

In the opening article, Fa-ti Fan seeks new ways to study modern science in twentieth-century China. He questions many past historiographical assumptions and categories that underlay the traditional historical narrative of science in China, particularly the typical binaries of traditional/modern, Chinese/Western, and national/transnational. Fan rightly problematizes the traditional chronology for the history of science in China, which he attributes to earlier modernization narratives that dated the beginning of modern science in China to the Opium War (1839–1842). This approach has tended to underestimate the early modern European sciences brought to China by the Jesuits between 1600 and 1750, which served in both mathematics and astronomy as a prelude to modern science after 1850. Fan wishes to break free of the tunnel vision of national science and to focus instead on the reception of fields such as Darwinism or genetics in China and, for instance, on comparing the situation of the latter to the Lysenko affair in the Soviet Union. He urges us to follow the internal and external development of other fields such as chemistry, eugenics, Einstein's relativity, and archaeology. Many Chinese archaeologists tied their technical research to a political quest to establish the national origins of the Chinese people, he notes.

In addition, Fan challenges the rigid model of "center versus periphery" and "metropole versus colony." He asks whether modern science in China is in any way "Chinese" and how scientific practices translate from the local to the global. China and the West were not exclusive categories, Fan argues, and thus early Chinese scientists made many boundary crossings while training in Japan, Europe, and the United States. Science under the Republic of China after 1911, in particular, exhibited a complex local and international character that straddled both imperialism and colonialism. The role of Japanese science in early Republican China, Fan points out, was also pivotal. Early on, the international geology community in Republican China cooperated and competed to develop seismology in a global context so as to provide a viable earthquake warning system. In contrast, during the era of the Cultural Revolution politics kept socialist science relatively isolated from global science. Hence, the story of the Chinese scientists who trained in Europe and the United States in the 1920s and 1930s can be compared to and contrasted with that of those who trained in the Soviet Union in the 1950s and 1960s.

Danian Hu draws on his well-received book on Einstein and China to provide a useful case study in the reception history of modern science in China by focusing on the fate of relativity in the physics community in China after 1917.[5] He shows that Chinese scientists

[5] Some background here: The New Culture Movement began in 1915, by most accounts, and the May Fourth Movement, which Hu sees as vital for the reception accorded relativity, grew out of Chinese reactions against

embraced Einstein's theory in the 1920s without any major controversy. Hu explains this in part by contending that the Chinese were not in a position to offer a critical response because they had not developed a tradition of classical physics, which kept them from resisting or knowing how to attack relativity. Western opposition, for example, came from Europeans who were entrenched in classical physics and supported competing concepts. Because Japan was ahead of China in physics by three decades, Hu maintains, Japanese scientists also were more critical. We should add that the reception history of physics in China differed considerably from that in Japan in the late nineteenth century.[6]

Chinese criticism of relativity began in the 1970s, when—under the banner of Marxism-Leninism—Qin Yuanxun argued for the "symmetry between space and time." Even when other physicists exposed Qin's misunderstandings of relativity in 1974, they still attacked Einstein for his idealism and saw him as a subjective theorist of relativism who was simply producing a new form of theoretically based metaphysics. They called on Chinese physicists to use Lenin's and Mao's dialectical materialism to overcome Einstein's relativity as part of what Hu describes as the "antiscientific campaigns during the Cultural Revolution." Hu also addresses how such socialist opposition to relativity theory in China played out in the Soviet Union. It might be useful, as well, to compare the German Nazi response to relativity in the 1930s to the Chinese case during the Cultural Revolution. After the Cultural Revolution, Xu Liangying and others rehabilitated relativity at a grand ceremony for the centennial anniversary of Einstein's birth in 1979, a celebration that was approved by Deng Xiaoping.

Zuoyue Wang laments the early paucity of science studies in modern China by professional historians of science. In addition, he describes the political taboo that still attaches to historical studies in China that try to get at sensitive social and political aspects of modern science. The taboo redirects scholars to the safer, less politicized study of ancient science. Consequently, the Chinese literature focuses on "protected" subjects such as the experiences of scientists or the evolution of scientific institutions, such as the Chinese Academy of Sciences. Chinese scholars thus refrain from critical evaluation of the Chinese Communist Party and its science policies.

Wang also makes the important point that one of the key problems in English scholarship on modern science in China is that most authors in the United States and Europe lack access to the primary source materials available in China; moreover, there are few historians who have the professional training needed to go through such primary sources. Until recently, most general historians have relegated science studies to secondary importance in their accounts of modern Chinese history. Wang nevertheless credits the rise of the Kuhnian, external approach to the history of science with encouraging historians such as James Reardon-Anderson to focus on relations between science and the state in the late nineteenth and early twentieth centuries.[7] Wang hopes that a less nationalist political atmosphere will stimulate more transnational studies of modern science, which will in turn

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the 1919 Versailles Treaty ending World War I. For the Communist versus Guomindang interpretations of this seminal period see Tse-tsung Chou, *The May Fourth Movement: Intellectual Revolution in Modern China* (Cambridge, Mass.: Harvard Univ. Press, 1960).

[6] Iwo Amelung, "Naming Physics: The Strife to Delineate a Field of Modern Science in Late Imperial China," in *Mapping Meanings: The Field of New Learning in Late Qing China,* ed. Michael Lackner and Natascha Vittinghoff (Leiden: Brill, 2004), pp. 381–422.

[7] James Reardon-Anderson, *The Study of Change: Chemistry in China, 1840–1949* (Cambridge: Cambridge Univ. Press, 1991).

reveal the underlying commonalities in different national contexts. China under socialism and the United States under capitalism, for instance, have both seen scientific debates that reflect the scientific community's preference for basic research versus the state's political focus on applied research.

Sigrid Schmalzer's article reopens the sensitive question of the nature of the infamous "mass line" in modern Chinese science during the Cultural Revolution. She compares the socialist and the capitalist contexts for science, a focus that certainly needs more attention if we are to understand how modern science evolved under socialism in China, Russia, North Korea, Vietnam, and Eastern Europe after 1950. During the Maoist era, the role modern science played in defining the higher social character of expertise and authority was criticized by those who, following Mao, contended that science should help overcome—not perpetuate—the divisions between mental and manual labor.

Schmalzer usefully describes the contemporary ridicule the Maoist agenda often provokes but also notes the occasional nostalgia for its aspirations. To complement post-1976 accounts of how science went wrong under Mao during the Cultural Revolution, Schmalzer invokes her own personal credo of "science for the people" and its "relevance for fellow activists working to realize this vision." She does not quite seek to overturn our currently darker views of Maoism with her more positive views of the socialist "Chinese model" for an egalitarian and antielitist society. While Hu critiques the Cultural Revolution's ideological policies toward science, Schmalzer's sympathies lie instead with a once rosier version of Maoism that sought to transform science in the name of the broad masses who supported the Communist revolution.

Schmalzer also details how a second, Western narrative about science in Maoist China emerged in the 1960s, based on eyewitness accounts prepared by sympathetic foreign visitors, many of them enthusiastic European and American physicians and scientists. In addition to the Maoist rhetoric about science that Schmalzer successfully restores, it would be useful to compile a more comprehensive account of science under Mao that would gather together the voices of many more Chinese scientists. We could then see how the struggle over the value system of science, which privileged elites, played out not only in revolutionary politics but also in the sciences themselves. Which sciences, if any, were largely unaffected by Cultural Revolution politics?

Grace Shen, who organized this Focus section and pulled it together, describes the tensions early Chinese scientists felt when choosing between foreign models for modern science and their own professional identities in China. Shen's account problematizes past accounts of the reception history of geology in China via returned overseas Chinese students and foreign scholars in China. She goes beyond passive reception history by asking, for instance: Why did Chinese desire science? What did they see in geology? Shen also notes that most accounts of this early era of modern science have unduly emphasized theoretical issues at the expense of their practical relevance. Historians have prioritized the polemicists who favored "scientism" in the early twentieth century and have marginalized the voices of Chinese scientists themselves.

By focusing on Ding Wenjiang, a leading geologist trained in Europe who saw modern science as the model for modern values, Shen reverses the early Republican stress on the philosophical over the material contributions of science in China. She describes the rise of anti-Manchu Chinese nationalism, for example, as part of the pro-science rhetoric that was intended to save China and restore Chinese self-determination and self-reliance after the Qing dynasty's debacle during the Sino–Japanese War of 1894–1895.

According to Shen, the relations between science and the state revealed the gap between the high ideals of modern science and local social and political contexts. The Guomindang's political agenda for scientism, for instance, required expert geologists trained abroad, such as Ding, to survey the composition of China's natural resources nationwide. Shen concludes that early Chinese advocates never entertained a purely idealistic concept of science as an end in itself. If we ask what the Chinese themselves wanted from modern science, we find that it was not necessarily what foreigners expected—namely, "paths of progress" that would enable them to be more like "us."

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These accounts, taken together, suggest a number of ways that a comparative history of science can lead us in new directions. First and foremost, historicizing the Western scientific revolution in a global context makes it possible to compare other, non-Western approaches to modern science without reducing such efforts to simple reception history. Second, differential studies that wield appropriate concepts and categories for comparing precise historical situations are mandatory. In particular, case studies can successfully integrate scientific contents and the historically dynamic contexts as the key to moving from the local to the global and back again.[8] A global account of science that is misinformed about local or regional realities will not get it right. We should explore Chinese interests in modern science as scientists there articulated and practiced them, rather than speculate about why they did not act the way Americans and Europeans expected them to act. Future research on the active careers of modern Chinese scientists, both individually and as a group, will allow us to supersede past accounts of the passive reception history of modern science in China.

Whenever appropriate, we should also compare the lingering vitality of the premodern "Chinese sciences" with the decisive turn toward modern science and industry in China after 1860. The story of the demise of traditional natural studies and the rise of modern science in China was more complicated than just the demise of traditional learning and the rise of modern education, which prioritized modern science. A social, political, and cultural nexus of traditional values among elites (within which natural studies were embedded) unraveled; one result was the Maoist Communist revolution. Chinese radicals linked political, social, and economic revolution to their perception that a scientific revolution was also required. Those who were educated abroad at Western universities such as Cornell or sponsored by the Rockefeller Foundation for medical study in the United States after 1914, as well as those trained locally at higher-level missionary schools in China, often regarded modern science as a revolutionary application of scientific methods and objective learning to solve all modern problems.

Many others—including scientists—protested such May Fourth iconoclasm, however. One by-product of the Republican government's increasing involvement in public health, for instance, was that Western-style physicians and classically trained Chinese doctors organized into separate medical associations. They drew the state into a contest over whose medical theory and practices were legitimate. The Republican state initially was tied to

[8] Nathan Sivin, "A Multi-Dimensional Approach to Research on Ancient Science," in *Studies on Ancient Chinese Scientific and Technical Texts: Proceedings of the Third International Symposium on Ancient Chinese Books and Records of Science and Technology, Held in 2003 in Tübingen, Germany,* ed. Fu Hansi *et al.* (Zhengzhou: Daxiang, 2006), pp. 153–160, is critical of contextualization if it does not bind "technical work and its circumstances" together as "parts of a single complex phenomenon" (p. 154).

Western medical theories and institutions, while Western-style doctors controlled the new Ministry of Public Health. When the Guomindang-sponsored Health Commission proposed to abolish classical Chinese medicine (*Zhongyi*) in February 1929, however, traditional Chinese doctors immediately responded by calling for a national convention in Shanghai on 17 March 1929, which was supported by a strike of pharmacies and surgeries nationwide. The protest succeeded in getting the proposed abolition withdrawn, and the Institute for National Medicine (*Guoyi guan*) was subsequently established. After 1929, the government established two parallel but politically and educationally distinctive institutions, one Western and one Chinese. This dichotomy should not be overemphasized, since "traditional Chinese medicine" as it is practiced today represents an active response to the inroads of modern Western medicine, but this division has survived both the Guomindang Republic and the Communist People's Republic.[9]

If there has been one constant in China since the middle of the nineteenth century, it is that imperial reformers, early Republicans, and Chinese Communists have all prioritized modern science and technology. We can no longer afford to undervalue the place of science in modern and contemporary China. China's plans to send space expeditions to the moon and Mars in the twenty-first century are in part a response to the shock of heavy-handed Western and Japanese imperialism since 1850. It is therefore important that the role of modern science, technology, and medicine in contemporary China is properly understood by historians of science. The papers in this Focus group cumulatively head us in the right direction.

[9] See Hsiang-lin Lei, "When Chinese Medicine Encountered the State: 1910–1949" (Ph.D. diss., Univ. Chicago, 1999), pp. 1–24. See also Bridie Andrews, "Traditional Chinese Medicine as Invented Tradition," *Bulletin of the British Association for Chinese Studies,* 1995, *6:*6–15. Cf. Ralph Crozier, *Traditional Medicine in Modern China: Science, Nationalism, and the Tensions of Cultural Change* (Cambridge, Mass.: Harvard Univ. Press, 1968), pp. 151–209.