Beyond Joseph Needham

Science, Technology, and Medicine in East and Southeast Asia

*By Morris F. Low**

MOST SCHOLARS OF THE HISTORY OF SCIENCE IN EASTERN ASIA grew up reading Joseph Needham's work and are greatly indebted to his scholarship. Thanks to the immense achievement of his multivolume series *Science and Civilisation in China,* Chinese science looms large whenever we think of Asian science. Needham did not equate modern science with Western science. Rather, he saw it as an ecumenical science—one that local traditional sciences, notably those of China, fed into. Needham sought to reveal to us the immense debt Western civilization owed to China by drawing up a balance sheet of machines and devices introduced from Europe to China and vice versa. His histories were rooted in a worldview oriented away from the present. They delved into the past and revealed a legacy that even Westerners would find difficult to ignore. But as Yung Sik **Kim** has pointed out, Needham believed in a unitary science that had a single history and a single, ever-growing structure.[1]

Needham's work arose from a clear need to recognize a great tradition, but there is science and civilization in Asia beyond China, even if the flagship journal of the International Society for the History of East Asian Science, Technology, and Medicine is still called *Chinese Science.* The globalization of R&D today has made Needham's way of portraying science more problematic than ever. In the post–Cold War world, China's image is much changed, and the rationale for *Science and Civilisation in China* is not so obvious.

Before Needham's work, historians of science often interpreted "science" as "Western science." The contributions of other producers of knowledge, especially in Asia, tended to be marginalized. Needham opened the door to the study of non-Western science. This volume of *Osiris* is devoted to continuing the process of renegotiating what constitutes knowledge and to redrawing the intellectual map. By advocating multiple approaches to understanding the production of knowledge, techniques, and machines, we can break down the barriers between science and the

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[1] **Kim** Yung Sik, "Natural Knowledge in a Traditional Culture: Problems in the Study of the History of Chinese Science," *Minerva,* 1982, *20*(1–2):83–104. For an indication of the legacy Needham leaves see Francesca Bray, "An Appreciation of Joseph Needham," *Chinese Science,* 1995, no. 12, pp. 164–165; Bray, "Joseph Needham, 9 December 1900–24 March 1995," *Isis,* 1996, *87*:312–317; and Gregory Blue, "Joseph Needham: A Publication History," *Chin. Sci.,* 1997, no. 14, pp. 90–132.

social, high technologies and domestic technologies, Western centers and the Asian periphery. The essays in this volume explore several countries—China, Japan, Indonesia, South Korea, Taiwan, Thailand, and the Philippines. They cover a broad period of time, but there is an emphasis on the nineteenth and twentieth centuries. Most are concerned with the historical and cultural circumstances of encounters between European and Asian people in the transfer of knowledge.

It is useful to gain a sense of the big picture and acknowledge the dominant forms of knowledge in Asia (whether they be Western or Chinese in origin) and their development, but much can be gained from understanding how local cultures adapted ideas to create their own systems of knowledge. The essays in the first part of this volume attempt to provide a sense of the bigger picture. In addition to Francesca Bray's piece, we have papers on science in Korea, Thailand, and Indonesia. The later essays on Japan, Korea, China, the Philippines, and Taiwan are of a more specialized nature. A number of the papers involve research partnerships, one way in which scholars can overcome the isolation that Yung Sik **Kim** describes so well in his contribution. Historians of non-Western science experience difficulties in reaching a larger audience. This is sometimes due to the highly specialized nature of their research, language difficulties, paradigmatic differences, and political contexts that can be uncongenial to critical scholarship. For such reasons, bringing together a diverse collection of essays on Asian science has, at times, been an editorial challenge; but I hope that readers will agree that, cumulatively, they provide an exciting glimpse into state-of-the-art scholarship on the history of science, technology, and medicine in East and Southeast Asia.

LOCALIZING SCIENCE

While wandering through the exhibition "China: 5000 Years" in the Guggenheim Museum in New York, I was reminded of how Asian people have long used ideas both from their own traditions and from outside to help them solve particular problems.[2] The exhibition—and its linear approach to the history of Chinese art—demonstrated how useful getting a sense of the big picture can be. Its focus was very much on one country; but science, technology, and medicine, like art, can be thought of as drawing on a variety of cultures. There has long been a transfer of ideas, knowledge, skills, and techniques both within Eastern Asia (East Asia and Southeast Asia) and with various countries in the West. Different knowledge systems can coexist and may not necessarily converge.

Science, technology, and medicine in Asia can be viewed as multicultural, drawing on a variety of sources that are not only Western in origin. The synthesis of ideas, technologies, and know-how has not been confined to Japan and China. Greater recognition of how people create or develop new ideas, technologies, and products by combining and improving on what already exists is overdue. Tessa Morris-Suzuki has shown elsewhere that such processes have gone on in Japan for a long time.[3] In this volume, Graeme Gooday and Morris Low describe how the Japanese translated

[2] Thomas Krens, "Introduction and Acknowledgements," in *China: 5000 Years: Selected by Sherman Lee,* ed. Howard Rogers (New York: Guggenheim Museum, 1998), pp. 20–27, esp. p. 27.

[3] Tessa Morris-Suzuki, "The Great Translation: Traditional and Modern Science in Japan's Industrialisation," *Historia Scientiarum,* 1995, *5*(2):103–116, esp. p. 104.

British and European best practice into a local form of engineering education—and then exported it for consumption in England.

This volume questions the linear approach that informs Needham's ecumenical view of science and argues for multiple histories. The fact that we are now interested in what occurs at the local level and in the periphery suggests that scholarship has reached a level of maturity. While it would be unwise to lose sight of the forest while scrutinizing individual trees, we need to strike a balance. Critical studies of the relationship between science and imperialism have served to shift the focus away from Europe and the United States and broaden it to encompass Asia. The international diplomacy that Susan Lindee discusses in detail shows one form of colonial science at work. But **Chin** Hsien-yu also interrogates Asian imperialism by exploring medicine and medical care under Japanese rule in Taiwan.

Lewis Pyenson's essay illustrates how the Indonesians have long adapted foreign ideas to suit their own needs and desires, sometimes arriving at a syncretic whole. We can extend this approach by examining how cultures have come to terms with Western science in their own language and with the help of other countries in the region.[4] Such a strategy would highlight the active role of the local people rather than privileging the part played by those transmitting the know-how, as tends to be the norm. Even the Nobel Prizes can be understood as connected to politics at various levels—local to international—as James Bartholomew shows in his trailblazing essay in this volume. And, as **Kim** Dong-Won and Stuart Leslie's paper suggests, by examining societies not yet at the center of things (here, South Korea), we can come to realize that other countries might entertain goals and values different from those that predominate in the United States. In Korea, economic development takes priority over winning Nobel Prizes.

By looking at countries, such as Siam (present-day Thailand), where the infrastructure to support the spread of Western learning and new technologies was lacking, we can identify factors that influence the processes of modernization. Ian Hodges's essay suggests that it was not until the nineteenth century that a setting conducive to modern Western science emerged in Siam. It could be that slowness to adopt Western know-how is evidence of "dissenting" sciences that do not fit the Western norm. Such knowledge systems should not merely be dismissed as obstacles.[5] There is a need to trace the history of medical beliefs—as Scott Bamber has done for Thailand and Margaret Lock for contemporary Japan—even if they fail to conform to what is understood as medicine in the West. Both Bamber and Lock suggest that in some countries cultural beliefs underlie attitudes to the body to this day. Medical practices based on such traditional beliefs may coexist with the more universal forms of knowledge Pyenson writes of. We often find pluralistic systems where local forms of knowledge exist side by side with more global forms. It is possible to view Western science, technology, and medicine as contributing to the homogenization of knowledge in Asian societies, but it will be plain to see that each country adapts such knowledge to serve its own needs.

It is inevitable that many of the papers in this volume make broad generalizations

[4] See Paolo Palladino and Michael Worboys, "Science and Imperialism," *Isis,* 1993, *84:*91–102.

[5] See, e.g., Kathryn Pyne Addelson, "Dissenting Sciences and Our Place within Them," paper presented at the conference "Sex/Gender in Techno-Science Worlds," University of Melbourne, 26 June–1 July 1993.

about time and space. Pyenson's essay, for example, provides a sweeping history of learning and the introduction of Western ideas in Indonesia. But other papers, such as TJ Hinrichs's piece on Chinese medicine and Bamber's on Thai medicine, focus more on regional diversity.[6] To assist nonspecialists, I have appended short chronological tables to this essay. Such chronologies are but a first approximation, as they focus on only a small number of mainly political developments. Interested readers should turn to histories of each country.

Why should we value the history of Asian science, technology, and medicine? In the past, one justification has been that Asian science resembles Western science and contributed to it in some way. Certainly scientific knowledge can transcend cultural differences and add to the shared pool of what is known, but social context affects how ideas are taken up and adapted. There is not necessarily a one-way flow from West to East. Gooday and Low suggest that what is called "Western" engineering education owes a debt to encounters between British engineering educators and Japanese students.[7] And the present Asian economic crisis is making us question once again the lessons to be learned from the Asian experience.

LINEAR PROGRESS

If we are indeed to think beyond Needham and a unitary science, we also need to break out of the framework imposed by studies of modernization. Recent experience suggests that progress may not be as linear as the spiral space of the Guggenheim exhibition would have us believe. A better understanding of the process by which foreign know-how is introduced and absorbed, and of the commercial interests such technology transfers have served—see Steven Ericson's paper on railways—enables us to comprehend the requirements of local infrastructure and the ways in which technologies are adapted to suit local needs. Commercial transactions, like the transmission of ideas, are not unidirectional processes.

Underlying the tendency to write linear histories of global science and its progress is a belief that modern Western science has superseded traditional, more localized forms of knowledge. While we might chuckle at Mark Elvin's paper exploring the political ramifications of meteorology in late imperial China, comfortable in the knowledge that we now know better, we need to beware of making simplistic assumptions about an inevitable movement from the "traditional" to the "modern"—where "traditional" attitudes are held to impede the work of catching up with the West.[8] By writing history of Asian science in this manner, we are assuming certain continuities in Western science and discontinuities in Asian science. In Needham's scheme, the significance of local indigenous knowledge has tended to be measured according to how much it contributed to the formation of what we now know as science. Current practices, especially medical practices, feed on past beliefs some

[6] For a broader perspective see Nathan Sivin, "Science and Medicine in Imperial China: The State of the Field," *Journal of Asian Studies,* 1988, *47*(1):41–90.

[7] For cross-fertilization in mathematics see **Zhang** Dianzhou and Joseph W. Dauben, "Mathematical Exchanges between the United States and China: A Concise Overview (1850–1950)," in *The History of Modern Mathematics,* Vol. 3: *Images, Ideas, and Communities,* ed. Eberhard Knobloch and David E. Rowe (Boston: Academic, 1994), pp. 263–297.

[8] This is briefly discussed in **Najita** Tetsuo, "On Culture and Technology in Postmodern Japan," in *Postmodernism and Japan,* ed. Miyoshi **Masao** and H. D. Harootunian (Durham, N.C.: Duke Univ. Press, 1989), pp. 3–20.

people may label as superstition. As Bamber's paper on traditional Thai medicine shows, measuring the efficacy of medicines in terms of their pharmacological properties isolates them from the specific regional culture and environment in which they are immersed. By looking for similarities in Asian and Western medicines, we may end up neglecting how people endow traditional medicine with cultural meaning and make it a part of their everyday lives.

In recent times historians of Japan have set aside the idea that Japan has followed a distinctly Western model of development, as espoused by "modernization theory." They have, instead, stressed the continuities between prewar, wartime, and postwar Japan and considered how the Japanese responded to the dilemmas they found themselves immersed in.[9] Morris-Suzuki's essay in this volume explores continuities in Japanese thinking about race, pointing to diverse ideas in the period leading up to the Pacific War.

This volume argues that we need to see the traditional and the modern as sometimes coexisting. Undue emphasis on the modern may blind us to continuities with the past. As **Park** Seong-Rae has reminded us, there is a long history of cultural exchange between Asian nations such as Korea and Japan that predates recent technology transfer and investment, and even the colonial period.[10] Historians have been slow to acknowledge this in their respective national histories; this volume seeks to redress such neglect.

MULTIPLE SOURCES OF SCIENCE

Breaking out of the modernization framework and writing about scientific exchange can be difficult. Not only is there the problem of how to document technology transfer and international cooperation, but accessing archives in two countries and two different languages can be a challenge. Bartholomew's essay required the use of several languages. Collaborations such as that between Kim and Leslie offer one way of overcoming the language barrier, but writing history in the age of the globalization of R&D, shifting centers, and changing peripheries is challenging work.

Even when studying the introduction of modern, Western science, we need to look not only at Europe and the United States but at other Asian countries as well.[11]

[9] **Takamae** Eiji concedes that there are important continuities in Japanese history but argues for an interpretation that places an emphasis on Occupation reforms; see **Takamae** Eiji, "Some Questions and Answers," in *Japan Examined: Perspectives on Modern Japanese History,* ed. Harry Wray and Hilary Conroy (Honolulu: Univ. Hawaii Press, 1983), pp. 357–363. **Iriye** Akira suggests that during World War II, American policymakers actually anticipated the extension of the Cold War to Asia and its impact on postwar U.S.–Japan relations; see **Iriye** Akira, "Continuities in U.S.–Japanese Relations, 1941–49," in *The Origins of the Cold War in Asia,* ed. **Nagai** Yonosuke and Iriye (Tokyo: Univ. Tokyo Press, 1977), pp. 378–407. Books on pre–World War II Japan hint at continuities. One example is Michael A. Barnhart, *Japan Prepares for Total War: The Search for Economic Security, 1919–1941* (Ithaca, N.Y.: Cornell Univ. Press, 1987), esp. pp. 272–273. Books that span prewar, wartime, and postwar Japan articulate some of the continuities. See Chalmers Johnson, *M.I.T.I. and the Japanese Miracle: The Growth of Industrial Policy, 1925–1975* (Stanford, Calif.: Stanford Univ. Press, 1982); for science see **Hirosige** Tetu, *Kagaku to rekishi* (Science and history) (Tokyo: Misuzu Shobō, 1965, 1970).

[10] **Park** Seong-Rae, "Korea-Japan Relations and the History of Science and Technology," *Korea Journal,* 1992, *32*(4):80–88.

[11] **Nakaoka** Tetsurō, "The European Industrial Economy and Endogenous Development in Asia," paper presented at the Second Conference on the Transfer of Science and Technology, Kyoto, 3–6 Nov. 1992, p. 27.

Western science did not always go straight from sender to addressee. It was mediated by various cultures and interests and adapted to suit each country's needs.

Kim and Leslie's essay illustrates how certain institutional models found a more receptive environment in parts of Asia than in the United States; the same can be said for the marine technologies discussed by Peter Neushul and Lawrence Badash. How do the processes of the development of science, technology, and medicine differ according to country? Bartholomew's paper suggests that reward systems in the international scientific community may not be as objective as we like to think. Scientists have their own agendas, which influence how they evaluate the research of others. But the politics of science (and Nobel Prizes) may be of secondary importance to countries such as Korea, which have sought other, more immediate rewards from their investment in R&D.

The history of science is, happily, moving toward a more inclusive historiography that values non-Western forms of knowledge and recognizes actors who are not all white and male. Bray makes a major contribution to this adjustment by shifting our attention to the home and viewing architecture as a form of technology. Chin's paper looks at the role of nurses in colonial Taiwan, showing that women may unwittingly be agents of a patriarchal society. As Chin, Lindee, and Lock demonstrate, looking at medical perceptions of the body offers another way of studying the relationship between modernization, gender, and culture.

If this volume is any indication, we are well on our way toward producing histories that transcend traditional divisions and stereotypes and familiar ideas of progress and modernization. There is still, admittedly, a neglect of how differences related to gender, ethnicity, and region have affected science, technology, and medicine in Eastern Asia. Hinrichs attempts to map alternative geographies of medical knowledge, but it is difficult to abandon the genre of the success story (which Kim and Leslie's essay, for example, offers). Alternative viewpoints and interpretations are possible: the economic difficulties facing Korea are a timely reminder.

Western science, technology, and medicine today cannot be understood without reference to the science, technology, and medicine of non-Western societies. These are fluid and absorb ideas and practices from each other. We need to transgress not only national borders but disciplinary boundaries if we are to understand the processes of knowledge formation. The contributors to this volume come from a variety of backgrounds and bring new insights with them. We are the richer for it.

APPENDIX
Chronological Tables

China

Song dynasty, 960–1279
Yuan dynasty, 1279–1368
Ming dynasty, 1368–1644
Qing dynasty, 1644–1912
Republic, 1912–1949
People's Republic, 1949–

Indonesia

Sailendra dynasty founded, eighth century
Majapahit empire founded, 1292
Portuguese conquer Malacca, 1511
VOC (United East India Company) founded, 1602
Dutch conquer Malacca, 1641
British occupy Java, 1811–1816
Republic of Indonesia proclaimed, 1945
Indonesia-Dutch conflict, 1946–1949
Dutch transfer power, 1949

Japan

Tokugawa period (also known as Edo period), ca. 1600–1868
Meiji period, 1868–1912
Taishō period, 1912–1926
Shōwa period, 1926–1989
Heisei period, 1989–

Korea

Three Kingdoms
  Kokuryo dynasty, 37 B.C.–668 A.D.
  Paekche dynasty, 18 B.C.–663 A.D.
  Old Silla dynasty, 57 B.C.–668 A.D.
United Silla Kingdom, 668–ca. 935
Koryo period, 918–1392
Yi dynasty (also known as Choson dynasty), 1392–1910
  King Sejong, reigned 1418–1450
  Protectorate of Japan, 1905–1910
  Formal annexation by Japan, 1910
Japanese colonial period, 1910–1945
Allied Occupation, 1945–1948
Republic of Korea established, 1948
Korean War, 1950–1953

Philippines

Spain colonizes Philippines, 1565
Philippine Revolution, 1896
Emilio Aguinaldo declares Philippine independence, 1898
U.S. Senate votes to annex Philippines, 1899
Aguinaldo captured, 1901
Philippine Commonwealth established, 1935
Japanese attack Clark Airfield, 1941
Independence, 1946
Manuel Roxas, president 1946–1948
Elpidio Quirino, president 1949–1953
Ramon Magsaysay, president 1953–1957
Carlos Garcia, president 1957–1960
Diosdado Macapagal, president 1961–1965
Ferdinand Marcos, president 1965–1986
  Martial law, 1972–1981

Taiwan

Province of China, from 1887
Comes under Japanese control, 1895
Part of Republic of China, from 1945
Taipei becomes provisional capital of Republic of China, 1949
Chiang Kai-shek, president 1950–1975

Thailand

Sukhothai period, 1240–1351
  King Ramkhamheang reigned 1279–1298
Ayutthaya period, 1351–1767
  First fall of Ayutthaya to Burmese, 1569
  Defeat of Burmese by Naresuan and repudiation of Burmese rule over Siam, 1587
  King Narai, reigned 1665–1688
  Second fall of Ayutthaya to Burmese, 1767
  King Taksin defeats Burmese, reunites the kingdom, and moves the capital to Thonburi, 1770
  King Taksin executed, 1782
Bangkok period, 1782–
  Beginning of Chakri dynasty with reign of Rama 1, 1782
  Bowring Treaty signed between Britain and Siam, 1855
  King Mongkut (Rama 4), reigned 1851–1868
  Chulalongkorn (Rama 5), reigned 1868–1910

Ever since Joseph Needham published the first volume of Science and Civilisation in China in 1954, many important works have been produced on East Asian science, technology, and medicine in the pre-modern period. The history of science, technology, and medicine in the nineteenth and twentieth centuries, however, has been largely neglected.Â Morris Lowâ€™s edited volume of Osiris (Volume 13, 1998), with the title of Beyond Joseph Needham: Science, Technology, and Medicine in East and Southeast Asia, was a notable example of the new direction of the field: eleven out of twelve case-studies were about the nineteenth and twentieth century; and five of them were on Japanese science, technology, and medicine. Beyond Joseph Needham: Science, Technology, and Medicine in East and Southeast Asia [Book Review]. Charlotte Furth. Isis 93:660-662 (2002).Â Science and Civilisation in China. Volume V: Chemistry and Chemical Technology. Part VII: Military Technology: The Gunpowder Epic by Joseph Needham. [REVIEW] Jixing Pan - 1988 - Isis 79:725-727. Science and Technology in East Asia. Nathan Sivin - 1979 - Philosophy East and West 29 (4):512-514. The Great Titration: Science and Society in East and West. Earle J. Coleman - 1971 - Philosophy East and West 21 (3):331-332. Science and Civilisation in China. Volume V: Chemistry and Chemical Technology. Part 9: Textile Technology: Spinning and Reeling by Joseph Needham; Dieter Kuhn. Download Citation | On Jan 1, 2002, MF Low and others published Beyond Joseph Needham: Science, technology and medicine in East and Southeast Asia | Find, read and cite all the research you need on ResearchGate.Â Joseph Needham was the greatest and most influential twentieth-century student of premodern Chinese science. In his multivolume Science and Civilisation in China (Needham, J. & others. (1954â€“2004). Science and civilisation in China (Vols. 1â€“7). Cambridge: Cambridge University Press.), he exhaustively documented the interplay of science, technology, philosophy, metaphysics, and Chinese culture. He posed the famous Needham Question: Why did Chinese science always remain empirical and restricted to theories of primitive or medieval type?