When Science Became Western

Historiographical Reflections

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ABSTRACT

While thinking about the notion of the "global" in the history of the history of science, this essay examines a related but equally basic concept: the idea of "Western science." Tracing its rise in the nineteenth century, it shows how it developed as much outside the Western world as within it. Ironically, while the idea itself was crucial for the disciplinary formation of the history of science, the global history behind this story has not been much attended to. Drawing on examples from nineteenth-century Egypt and China, the essay begins by looking at how international vectors of knowledge production (viz., missionaries and technocrats) created new global histories of science through the construction of novel genealogies and through a process of conceptual syncretism. Turning next to the work of early professional historians of science, it shows how Arabic and Chinese knowledge traditions were similarly reinterpreted in light of the modern sciences, now viewed as part of a diachronic and universalist teleology ending in "Western science." It concludes by arguing that examining the global emergence of the idea of Western science in this way highlights key questions pertaining to the relation of the history of science to knowledge traditions across the world and the continuing search for global histories of science.

THE CONTINGENCY OF THE TERM "SCIENCE"—shaped by different eras, geographies, and epistemological traditions—means that it is not always clear what historians of science are or even should be studying. This is a point that medievalists and early modernists have long debated, and it has lent the discipline methodological depth by historicizing the very subject of its inquiry and by suggesting, in particular, what is modern about modern science.[1] Yet some contingencies have mattered more than others. Imagine a map of the world as represented by the profession: it would be a largely Anglo-American and Eurasian one, with a severely truncated southern hemisphere and the Atlantic world predominating in the northern one.

Ironically, this wasn't the picture of the world that the discipline began with: indeed,

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[1] For the best example see Peter Dear, "What Is the History of Science the History *Of*? Early Modern Roots of the Ideology of Modern Science," *Isis*, 2005, *96*:390–406.

Isis, 2010, 101:98–109

0021-1753/2010/10001-0005$10.00

early professional historians of science often made much of the fact that they were taking the ecumenical view. But the price of such geographic capaciousness was a serious narrowing of the very idea of science itself. The "many rivers, one sea" of modern science analogy of the early historian of science Joseph Needham—who himself did much to introduce China to the wider world—meant that science was said to have a distinct coherence and flow after all.[2]

Nowhere is the problem of contingency and disciplinary cohesiveness more acute than across the entire range of studies often classed as "non-Western" science (or sometimes "extra-European" or "non-European" science). The division of the world into the West and the rest has a long history, of course—and the history of science has played a major part in that too. Indeed, in many ways the history of science itself started off by asking if science was the specific product of Western civilization or—in the language of a slightly later era—of the West. Early scholars argued that it was not, while current historians don't bother to ask the question at all and would probably recoil at the antiquated Eurocentrism embedded in it. Some, though perhaps not as many today as a few decades ago, might even challenge the singularity of the term "science." Once one begins to speak of a plurality of sciences the question has much less bite—though perhaps also less meaning. The specter of recurring "relativistic nightmares" meant that the postmodern turn never really caught on in the history of science—or, rather, that it did not ultimately impact our epistemological and disciplinary categories in the way that it has for other disciplines.

This essay attempts to offer another way out of the twin predicaments of constructivism and relativism by asking how the very concept of "Western science" as the equivalent of "modern science" got established in the first place.[3] Concomitantly, it asks how the "history of [*this*] science"—as opposed to the "history of the sciences"—has shaped our disciplinary categories and range. In order to do this, it will consider the corollary: What did people outside Europe make of the idea of "Western" science? How did their understanding of this change ideas, practices, and disparate categories of knowledge—as well as belief—more broadly?[4]

I begin by examining nineteenth-century conceptions of modern European sciences in Egypt and China, as seen in particular by Western Christian missionaries and local technocrats. Both Ottoman Egyptian and Qing centers of learning underwent rapid transformations in their communities and institutions of knowledge. Both also had venerable traditions of learning of their own that would later come to occupy an important role in the disciplinary origins of the history of science itself.

While playing an increasingly important role in official curricula, early discussions of modern sciences did not so much replace older disciplines or traditions of knowledge as redefine them. The very translation of the terms and concepts of these sciences, after all, involved a kind of conceptual syncreticism. Nevertheless, a new notion—and narrative—of Western science was also gradually emerging.

[2] Joseph Needham, *Science and Civilisation in China* (Cambridge: Cambridge Univ. Press, 1954–), Vol. 1: *Introductory Orientations*, p. 16. See also Roger Hart, "Beyond Science and Civilization: A Post-Needham Critique," *East Asian Science, Technology, and Medicine*, 1999, *16*:88–114.

[3] These points—and the reference to "relativistic nightmares"—are building on Peter Dear's discussion; see Dear, "What Is the History of Science the History *Of*?" (cit. n. 1), pp. 392, 406.

[4] For more on the distinction between knowledge and belief—and its relevance for the history of science, which I will here touch upon only briefly—see Mary Baine Campbell, Lorraine Daston, Arnold Davidson, John Forrester, and Simon Goldhill, "Enlightenment Now: Concluding Reflections on Knowledge and Belief," *Common Knowledge*, 2007, *13*:429–450.

By the interwar era, what was nascent would soon become more concrete: at the hands of early historians of science, the global reach of "science" was equally emphasized. But it was intended for the sake of a universal humanism that might bridge worlds, "East" and "West." In the process, a much more specific and, in turn, a more universalizing notion of Western science was forged. This conception proved highly resilient, as the use of geographically dichotomous terms like "Western" and "non-Western" demonstrates. This division, moreover, goes well beyond mere expediency; rather, it has a very concrete history of its own, and it is one that may ultimately help us to define what has come to count as science and what has not.

Only by setting the history of the sciences in a comparative perspective in this way can we come to appreciate how the concept of "science" gained its particular meaning and power around the world. Viewing the European sciences from outside Europe also allows us to learn something of the ways in which mutual claims on and engagements with the idea of science helped concepts to move across geographic and communal boundaries with astonishing rapidity and, at times, with unexpected synchronicity. After all, one of the main paradoxes in this story is that it was outside "the West" that the concept of "Western science" was itself first developed.[5]

SCIENCE GLOBALIZED

How, then, was the idea of science as simultaneously "modern," "universal," and "Western" generated—and this despite the fact that there exist some seeming contradictions between these qualifiers? In the nineteenth century an entirely new global discourse around the idea of science emerged. As in Europe itself at this time, this new conception was plagued by a conflation of the view of science as a body of techniques, on the one hand, and as a natural philosophy, on the other. It was the appeal to the latter view that helped to legitimize it and, ultimately, to bring it in line with older traditions of knowledge and belief around the world. With the expansion of Western power, Europe's military and technological supremacy was often seen as evidence of the efficacy of the "European sciences." Their introduction outside Europe, too, was very much shaped by this attitude, but it also involved—at least initially—various forms of institutional appropriations that entailed what might best be described as a kind of conceptual syncretism, bridging new conceptions of "Western science" with older forms of knowledge.

The consequent transformation of traditions of knowledge and learning can be seen in the treaty ports of China and in the urban centers of Egypt, where technical arts and sciences such as ballistics, engineering, and medicine formed an important part of new practices of statecraft. The expansion of Western-style schools, academies, and other

[5] Of course, this claim depends on which "West" is under consideration. Although further research on the etymology of the term is still needed, early references to "Western science" in English suggest that prior to the nineteenth century the term was used primarily to refer to ancient Greek science. Beginning in the eighteenth century it was sometimes used interchangeably with "European science," particularly in French, as part of the debate between the Ancients and the Moderns. But as Roshdi Rashed has pointed out, with the turn of the nineteenth century the term "changed in nature and extent." This essay therefore refers to the term largely in its modern incarnation—from the early nineteenth century and after. See Roshdi Rashed, "Science as a Western Phenomenon," in *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*, ed. Helaine Selin, 2nd ed. (New York: Springer, 2008), pp. 1927–1933. As an illustration of this point, see, e.g., one of the first references to the term in the 1818 manual *College for the Instruction of Asiatic Christian and Other Youth in Eastern Literature and European Science* (Serampore, 1818), p. 15, which claimed that "knowledge of the English language would lay open the treasure of Western science."

establishments—such as mission colleges, polytechnics, naval and military academies, and arsenals—also helped to transform the landscape of learning. Whereas communities of knowledge previously served religious (or scholastic) functions first and bureaucratic functions second, these new institutions were directed mainly to the needs of the state. Nevertheless, students were initially drawn from these same and older knowledge communities, and fields of study initially classed under the broad rubric of "Western learning" typically accompanied rather than replaced traditional ones.[6] Partly for this reason—and despite the highly technocratic nature of these newly institutionalized disciplines—they were easily brought in line with older philosophies of nature and traditions of learning.

Take the case of Egypt, for instance. Beginning in 1815, the Ottoman-khedival state was undergoing a process of rapid military and bureaucratic reform. Schools of medicine, music, geography, and translation helped educate the New Armies and technocratic elite, providing a model for later Ottoman reformers. These subjects were taught by instructors, technical experts, or military officers from France, Italy, and England. Other instructors were classically trained scholars or *'ulama* from al-Azhar, the oldest and most prestigious *madrasa* in the Sunni world; and some of these were also sent abroad for training. Alongside a variety of new and largely technical fields, their pupils therefore also received an education in more classical subjects of learning—particularly through the study of language and grammar (though these too would come to be studied in new ways).[7] The arts and sciences brought in from Europe thus sat alongside older disciplinary and discursive traditions, and they were seen as fitting in with the former.[8] By the Eastern Crisis of 1876–1878, Egypt's officials and missionary- or foreign-trained literati began to speak of science along rather different lines: in this context, much was made of its specific methodology and history, even as they continued to appeal to older subjects and categories of learning so as to make the new comprehensible in the language of the old. The translations and primers they produced emphasized the rise of a scientific method and made much of the historical importance of the rise of experimental and reasoned, rather than scholastic, knowledge. The British occupation in 1882 led to a further transformation of Egypt's information economy, and by the turn of the century a new generation of intellectuals was ready to champion the introduction of science on entirely new terms.[9]

[6] On China see Benjamin Elman, "From Pre-Modern Chinese Natural Studies to Modern Science in China," in *Mapping Meanings: The Field of New Learning in Late Qing China*, ed. Michael Lackner and Natascha Vittinghoff (Leiden: Brill, 2004), pp. 25–74. On Egypt see J. Heyworth-Dunne, *An Introduction to the History of Education in Modern Egypt* (London: Cass, 1968); and A. Chris Eccel, *Egypt, Islam, and Social Change: Al-Azhar in Conflict and Accommodation* (Berlin: Schwartz, 1984).

[7] See Alain Silvera, "The First Egyptian Student Mission to France under Muhammad Ali," *Middle Eastern Studies*, 1980, *16*:1–22; Khaled Fahmy, *All the Pasha's Men: Mehmed Ali, His Army, and the Making of Modern Egypt* (Cambridge: Cambridge Univ. Press, 1997); and Pascal Crozet, *Les sciences modernes en Egypte: Transfert et appropriation, 1805–1902* (Paris: Guethner, 2008). Many of the early records for these schools were classed under the Ministry of War department, now at the Dar al-watha'iq al-qawmiyya (National Archives) in Cairo.

[8] The works of Rifa'ah Rafi'a al-Tahtawi are a prime example here. For more on Tahtawi see J. Heyworth-Dunne, "Rifa'ah Badawi Rafi'at-Tahtawi: The Egyptian Revivalist," *Bulletin of the School of Oriental and African Studies*, 1937–1939, *9*:961–967, 1939–1942, *10*:399–415; John Livingstone, "Western Science and Educational Reform in the Thought of Shaykh Rifaa al-Tahtawi," *International Journal of Middle East Studies*, 1996, *10*:517–541; and Juan Cole, "Rifa'a al-Tahtawi and the Revival of Practical Philosophy," *Muslim World*, 1980, *70*:29–46. For a translation of the travel narrative describing his visit to Paris in the 1820s—and his thoughts on the classification of knowledge among the French—see Rifa'ah Rafi'a al-Tahtawi, *An Imam in Paris*, trans. Daniel Newman (London: Saqi, 2004).

[9] I will return to the increasing emphasis on the scientific method and experimental or reasoned knowledge later in this essay. I elaborate on the turn-of-the-century intellectuals' introduction of science on new terms in Marwa Elshakry, "Knowledge in Motion," *Isis*, 2008, *99*:701–730.

In China, too, Western intervention accelerated debates over disciplinary innovation and transformed the intellectual and institutional nexus of traditional learning. It was the Opium War of 1849–1852, in particular, that coincided with a new interest in Western science as "useful knowledge." As in Egypt, this involved a broader process of legitimation and conceptual appropriation. Similar, too, was the way those new sciences classed under "Western learning" were in fact initially regarded as reinforcing traditions and disciplines of knowledge for which Chinese scholars and pedagogues—like many other global intellectuals—created their own highly local genealogies. Take the example of one of the discussion topics in the postreform 1903 Civil Examination, which read: "Much of European science originates from China; we need to stress what became a lost learning as the basis for wealth and power." Another asked: "Prove in detail the theory that Western science studies mainly were based on theories of China's pre-Han masters."[10]

These discussions echoed debates over the nature of "Western science" that had been initiated by missionaries, particularly British and American Protestants, who enlisted science in the service of their proselytizing efforts; they were also among the first to use the term "Western science" itself.[11] The British Protestant missionary John Fryer, for example, helped to found one of the earliest science magazines in China: the *Chinese Scientific Magazine*, begun in 1876. He set up a Chinese Polytechnic Institute in Shanghai that organized a "Chinese Prize Essay Contest" to popularize Western sciences and proposed such themes as "Compare the sciences of China and the West, showing their points of similarity" in 1887 and "With respect to the 'Science' referred to in the 'Great Learning' from Ching-kang-ching downwards . . . do any of them happen to agree with Western scientists?" in 1889.[12] Building conceptual bridges between "Chinese" and "Western" science proved a recurrent concern for missionaries like Fryer. That this should have been so is not surprising: working in translation, they had to explain the new both *against* and *in the language of* the old. Perhaps because conversion is itself a kind of translation, missionaries played a key role in vernacular science translations around the world in just this way.

And yet, while missionaries were important vectors for the globalization of the modern sciences from the seventeenth to the nineteenth centuries, the ambiguities and paradoxes in their enterprise meant that they promoted a very particular vision of "science."[13] In the Arabic-speaking lands, for instance, their school primers on natural philosophy and on

[10] Benjamin Elman, "'Universal Science' versus 'Chinese Science': The Changing Identity of Natural Studies in China, 1850–1930," *Historiography East and West*, 2003, *1*:70–116; for the examination topics see p. 91.

[11] See note 5, above.

[12] The "extra theme" question for 1889 continued this obsession with tracing a "Western" genealogy: "Western science began with Aristotle in Greece; then came Bacon in England who changed the previous system and made it more complete. In later years, Darwin's and Spencer's writings have made it still more comprehensible. Give a full sketch of the history and bearings of this whole subject." Fryer also wrote a history of the Sino-Japanese war that placed the blame for China's defeat on her lack of understanding of the "true principles of science": John Fryer, "An Account of the Department for the Translation of Foreign Books at the Kiangnan Arsenal, Shanghai," *North-China Herald and Supreme Court and Consular Gazette*, 29 Jan. 1880, pp. 77–81; Fryer, "Chinese Prize Essays: Report of the Chinese Prize Essay Scheme in Connection with the Chinese Polytechnic Institution and Reading Room, Shanghai, for 1886 and 1887," *ibid.*, 25 Jan. 1888, pp. 100–101; and Fryer, "Science in China," *Nature*, 1881, *601*:9–11, 54–57. I have taken these citations from Elman, "'Universal Science' versus 'Chinese Science'" (cit. n. 10), pp. 76–77.

[13] On the former point see, e.g., Benjamin Elman, *A Cultural History of Modern Science* (Cambridge, Mass.: Harvard Univ. Press, 2006); and Nicolas Standaert, "The Classification of Sciences and the Jesuit Mission in Late Ming China," in *Linked Faiths: Essays on Chinese Religions and Traditional Culture*, ed. Jan De Meyer and Peter Engelfriet (Leiden: Brill, 2000), pp. 287–317. For the latter see Marwa Elshakry, "The Gospel of Science," *Past and Present*, 2007, *196*:173–214.

logic—found under such titles as "Lessons in Rational Philosophy"—espoused a broadly empirical, neo-Baconian and yet doxological view of science and its modes of reasoning.[14] And while they made much of the scientific method in their discussions, their use of science and that version of it that they promoted in their schools were, ironically, largely textual and discursive rather than experimental or practical: this was another reason, perhaps, that the sciences they taught were initially seen as fitting in so easily with older traditions of natural philosophy.[15] Of course, the nature of the particular discursive traditions they were working with also mattered: faced with largely vernacular traditions, for example, the missionaries' focus tended to be more instrumental, concentrating on artisanal techniques or agrarian practices and eschewing earlier natural philosophical concerns.[16] Yet whether their view of science emphasized technical or philosophical systems, the point remains: it was through a broad process of syncretism—as much in methodological or theoretical amalgams as in irrigation technologies that utilized local practices—that missionaries helped to transmit what they counted as Western science.

Semantics offers perhaps the best example. In the Chinese case, the term "*gezhixue*," literally "investigating things and extending knowledge," was initially sometimes used to refer to both the traditional Chinese *and* the Western sciences; it was borrowed from earlier Jesuit translations that used it as a term for "natural philosophy." Later, sharper distinctions between "Western science" and "traditional learning" or "Chinese learning" would be made. By the interwar era—a period of global political and intellectual change of some significance in this context, as we shall see—"science" was more frequently translated as "*kexue*" (literally, "classified learning based on technical training"), while "*gewu*" ("investigation of things") was reserved for "natural philosophy."[17]

In the case of the Arabic term for "science" ("*'ilm*"), missionaries in Ottoman Beirut were among the first to reorient categories of knowledge—shifting, adding to, or subtracting from the common meanings of allied terms like "*'ilm*," "*ma'arifa*," and "*hikma'*," which they helped to popularize as "science," "knowledge," and "wisdom," respectively. In this formulation, knowledge was equated with matters of fact; science represented a higher order of truth in that it was the systematization of these facts through the derivation of natural laws; and, finally, wisdom, which was established by suprarational means, involved the Ultimate Truth.[18] Missionaries thus effectively cleaved off a notion of "science" from broader categories of knowledge and made sharper distinctions between

[14] See, e.g., Daniel Bliss, *al-Durus al-awlayya fi al-'ilm al-'aqliyya* [Primary Lessons in Rational Philosophy] (Beirut: American Mission Press, 1877). See also Theodore Dwight Bozeman, *Protestants in an Age of Science: The Baconian Ideal and Antebellum American Religious Thought* (Chapel Hill: Univ. North Carolina Press, 1977).

[15] For more on this see Elman, "'Universal Science' versus 'Chinese Science'" (cit. n. 10), p. 78 and the references in note 13.

[16] See, e.g., Sujit Sivasundaram, *Nature and the Godly Empire: Science and Evangelical Mission in the Pacific, 1795–1850* (Cambridge: Cambridge Univ. Press, 2005).

[17] Nicolas Standaert, "The Investigation of Things and the Fathoming of Principles (*Gewu qiongli*) in the Seventeenth Century Contact between Jesuits and Chinese Scholars," in *Ferdinand Verbiest (1622–1688): Jesuit Missionary, Scientist, Engineer, and Diplomat*, ed. John Witek (Nettetal: Steyler, 1994), pp. 395–420; Elman, "'Universal Science' versus 'Chinese Science'" (cit. n. 10), pp. 71, 92; and Elman, "From Pre-Modern Chinese Natural Studies to Modern Science in China" (cit. n. 6).

[18] Edwin Lewis, "Science, Knowledge, and Wisdom," *al-Muqtataf*, 1881, *7*:158–167. The new classification was also quickly promoted by Arab science enthusiasts themselves: missionary disciples—men like Ya'qub Sarruf and Faris Nimr, who founded the American mission–supported popular *Journal of Science and Industry* in 1876—were in fact among those most successful in broadly promoting transcendental positivism in Arabic along these lines. For more on the journal see Dagmar Glass, *Der Muqtataf und seine Öffentlichkeit* (Würzburg: Ergon, 2004).

sensory or empirical knowledge and matters of belief. In the classical lexicon, in contrast, "'*ilm*"—the broadest word for knowledge and one of the words most frequently found in the verses of the Qur'an—encompassed what would count as both knowledge and belief in their terms.

But the syncretic nature of these early encounters meant that, as in the case of translation generally, the forging of new meanings did not necessarily imply a complete break with older ones. In both the Arabic and Chinese cases, for instance, new categories and disciplines of knowledge were often simply understood in terms and indeed as extensions of longer-standing traditions of knowledge *and* belief. This is illustrated clearly in the many examples of how Darwin—the most visible global icon of "the scientist" in the nineteenth century—was read internationally. In China, for example, Yen Fu, a scholar and translator of some renown, presented T. H. Huxley's *Evolution and Ethics* as merely the latest incarnation of much older Confucian and Daoist ethical debates.[19] Arabic readings of Darwin did much the same thing: appealing to older, medieval discussions of transformism both helped pave the way for the new evolutionary sciences and shaped the very way in which they were understood.[20] In all these cases, the new is once again explained in reference to the old, whether through language, conceptual categories, or genealogical constructions. But as these brief examples also show, no particular history of science was implied.

THE UNDIVIDED TRUTH

The new discipline of the history of science, by contrast, while drawing on these global encounters, cast them in a very different light. Starting before World War I and extending through the interwar years, a new global ideology of science was constructed in the search for a universal knowledge and an impartial Truth that might unite all humanity. By World War I, science had indeed acquired a more completely universal history, and in England, America, and France a new academic discipline of the history of science was conceived around it. This early historiography built on the globalized image of "science" established throughout the long nineteenth century, as discussed above. But unlike earlier appropriations, science was no longer utilized to appeal to any particular religious or even national objective: rather, rising above particularisms, it was now to be promoted in the service of a very specific ideology—the new internationalism of the immediate pre– and post–World War I era. The earlier syncretic approach of missionaries and technocrats gave way to the construction of a new linear history of science. This was then consolidated and sharpened with the idea of the Scientific Revolution. Taken together, these developments marked the coming into being of modern science, now undeniably dubbed as Western in

[19] For more on this see James Reeve Pusey, *China and Charles Darwin* (Cambridge, Mass.: Harvard Univ. Press, 1983).

[20] This was a common refrain: in India, the Bengali Bhadralok community similarly read Darwin in light of older philosophical and religious ideas. For instance, many initially promoted the idea that evolution was merely the latest illustration of one of the principles of Samkhya, an enumerationist and dualist school of Hinduism whose emphasis on a cosmic process of progression and dissolution, they argued, extended the very principle of evolution. See Dhruv Raina and S. Irfan Habib, "The Moral Legitimation of Modern Science: Bhadralok Reflections on Theories of Evolution," *Social Studies of Science*, 1996, *26*:9–42; David Gosling, *Science and the Indian Tradition* (London: Routledge, 2007), pp. 21–22; and Mark Singleton, "Yoga, Eugenics, and Spiritual Darwinism in the Early Twentieth Century," *International Journal of Hindu Studies*, 2007, *11*:125–146. See also Giuseppe Flora, *The Evolution of Positivism in Bengal: Jogendra Chandra Ghosh, Bakimchandra Chattopadhyay, Benoy Kumar Sarkar* (Naples: Istituto Universitario Orientale, 1993).

its inception and signaling through its own new history a radical break with knowledge traditions of the past.

The Belgian George Sarton was the first to institutionalize the discipline in the United States, and his promotion of the history of science as the "New Humanism" best exemplifies this approach. Sarton saw science as holding huge promise for humanity as a whole—in particular, he argued that it might offer political emancipation for the benighted: "Science tends to destroy the darkness where evil and injustice breed." His vision was tied to his quest for a true internationalism: attracted to socialism in his youth, he developed his own version of an internationalist movement through the history of science itself, or what he dubbed the "New Humanism." It would tie together different cultures of men, both geographically and disciplinarily. "Between the old humanist and the scientist there is but one bridge," he wrote: "the history of science."[21]

Sarton's history of science was intended to train the scientist in the value of history as much as to inform the public of the value of science, cast as a testimony of the collective human spirit. "The unity of science and the unity of mankind are one," Sarton declared. For him, science represented the path to universal truths shared by all men who were members of the community of rational beings. As he put it: "I can reject Islam or Buddhism without making myself ridiculous, but I cannot deny the sphericity of the earth without ruling myself out of the community of rational beings, irrespective of race, nationality or religion."[22] In this way, the search for the cosmic spirit, for all its apparent idealism, ended up as a reaffirmation of the virtues of rationalism.

Scientific truth was thus contrasted sharply against truth claims that divided men. Sarton's article "Experiments with Truth by Faraday, Darwin, and Gandhi" demonstrates this point clearly. Sarton explicated Gandhi's ideas painstakingly because he felt that it was his conception of "truth" that was "the most confused"; and he held that the source of this confusion was that Gandhi mixed truths, as it were: "One should never speak of religious truth . . . only scientific truth exists." For the very same reason, Sarton even blamed Gandhi—though he nonetheless designated him a kind of "saint"—for the violent partition of India.[23]

Embedded in all this, of course, was a deep antagonism to religious belief, defined as irrational prejudice and standing in stark contrast to the reasoned knowledge acquired by science. This approach would extend through much of the interwar and part of the postwar era, emerging, for instance, in Julian Huxley's "One Worldism" and, later, blending seamlessly with modernization theories in the 1950s and 1960s.[24]

But it was not only in Western Europe and the United States that categories of

[21] George Sarton, *The History of Science and the New Humanism* (New York: Holt, 1931), pp. 58, 72.

[22] *Ibid.*, p. 47; and George Sarton, "Experiments with Truth by Faraday, Darwin, and Gandhi," *Osiris*, 1954, *11*:87–107, on p. 107. Sarton's emphasis on a cosmic, universal human spirit embodied by science formed part of a series of intellectual attempts after 1918 to overcome the divisions of Europe and the weaknesses of classical liberalism: the classicist Gilbert Murray's appeal to the ancient Greeks for evidence of his view of the true source of the unity of the human spirit provides a parallel case. For Sarton, as for Murray, the interwar search for a liberal, humanistic internationalism was motivated by what they saw as the need to combat the worrisome forces of antiliberalism—from chauvinistic nationalisms (all too evident to the Belgian Sarton) to imperialism and, later, fascism. For more on the background to this see Jeanne Morefield, *Covenants without Swords: Idealist Liberalism and the Spirit of Empire* (Princeton, N.J.: Princeton Univ. Press, 2005).

[23] Sarton, "Experiments with Truth by Faraday, Darwin, and Gandhi," pp. 100–107.

[24] See Paul Phillips, "One World, One Faith: The Quest for Unity in Julian Huxley's Religion of Evolutionary Humanism," *Journal of the History of Ideas*, 2007, *68*:613–633. For a classic example of a modernization theory–inspired account of the history of science see George Basalla, "The Spread of Western Science," *Science*, 1967, *156*:611–622, which was modeled on Walt Rostow's tripartite scheme, *Stages of Economic Growth: A*

knowledge and of belief were acquiring new meanings in this way. It was just at this time, too, that in China the notion of a universal "modern" or "Western" science was beginning to be more sharply distinguished from "traditional" science (and medicine). Chinese debates on the "science and philosophy of life" in the 1920s and 1930s, for instance, grew out of contemporary criticisms of a "materialistic philosophy"—now associated in the minds of so many with Germany—or the "dream of the omnipotence of modern science" coupled with the lust for war.[25] They also helped to create sharper conceptual divides between Western and Chinese sciences: by the end of the war Spenglerian pessimism over the fate of Western civilization was combined with a new emphasis on the "spirit"—language borrowed from Henri Bergson and others—and this helped to initiate a broader public debate over whether Western science did indeed have a "philosophy of life" that was suitable for China and her future. Involving as they did many of those behind the movement of New Confucianism, these debates also returned to the idea that "Chinese science"—now given a heuristic value all its own—could complement or supplement Western science.

Something similar was happening in the Middle East: the emergence of *tafsir 'ilmi*, or scientific exegesis as a genre in its own right, in the literature on Arabic interpretations of the Qur'an in the 1920s and 1930s forms an interesting parallel example. Much as in the Chinese case, this involved the search for an indigenous cosmological or natural philosophical tradition to supplement—or, indeed, to reinforce—the modern sciences.[26]

On the whole, after World War I many intellectuals outside (and even inside) Europe and the United States were growing wary of the scientism that had attracted so many in the previous generation, with its curious blend of Comtean positivism and monistic materialism. To be sure, there were those, such as Isma'il Mazhar, a key interwar Egyptian intellectual and science popularizer, who continued to argue for the separation of knowledge and belief. Mazhar was an avid science translator: he was the first to offer a full-length Arabic translation of *The Origin of Species*, and he also translated Sarton's *The History of Science and the New Humanism*. More important, he founded a popular science journal in the late 1920s in which he published a series of articles that found him engaged in a heated debate with rival science popularizers at al-Azhar who had been using science for their own ends—in much the same vein as the newly burgeoning genre of *tafsir 'ilmi*. But the beginning of a populist emphasis on a uniquely "Islamic science" was already under way when Mazhar was writing in the 1930s, and he too would eventually take some steps down that path.[27]

Hence, paradoxically, the creation of a notion of a universalizing "Western science" helped lay the conceptual foundation for "Chinese science," "Arabic science," and even

Non-Communist Manifesto (Cambridge: Cambridge Univ. Press, 1960). See also Nils Gilman, *Mandarins of the Future: Modernization Theory in Cold War America* (Baltimore: Johns Hopkins Univ. Press, 2003).

[25] Elman, "'Universal Science' versus 'Chinese Science'" (cit. n. 10), p. 97.

[26] This was done by finding evidence of modern scientific facts and theories in scripture, while returning to an emphasis on religious sentiment—particularly through expressions of reverence and awe, which scientific exegetes like Tantawi Jawhari saw as the essence of religious belief itself—as a complement to the modern study of the sciences. I discuss this further in Marwa Elshakry, "The Exegesis of Science in Modern Arabic Interpretations of the Qur'an," in *Nature and Scripture in the Abrahamic Religions, 1700–Present*, ed. Jitse M. van der Meer and Scott Mandelbrote (Leiden: Brill, 2008), Vol. 2., Ch. 15.

[27] Mazhar's translation of Sarton was commissioned by the U.S. government–funded Franklin Book Program as part of its Cold War effort to counter Soviet influence abroad; see Louise Robbins, "Publishing American Values: The Franklin Book Programs as Cold War Cultural Diplomacy," *Library Trends*, 2007, *55*:638–650. For more on Mazhar see the final chapter of Marwa Elshakry, *Reading Darwin in the Middle East* (Chicago: Univ. Chicago Press, forthcoming).

"Islamic science," among other similar categories. Or, to put it another way: just as the disciplinary history of science gave birth to the idea of a singular and unified "science" in academies in Europe and America, others around the world were beginning to institutionalize their own local versions of a more plural story.

EASTERN DAWNS AND GOLDEN AGES

Helping to assess the Western character of science was not the only way the world figured in the early historiography of science. Early historians of science like Sarton (and Joseph Needham) were driven by the desire to demonstrate the ancient and medieval or early modern contributions of Eastern civilizations. But once the narrative of the rise of Western science was set in place, other counternarratives were implied, with their distinctive vocabulary of stagnation, decline, and dark ages. After all, once one begins to extol the virtues of past Golden Ages, one is left with the inevitable question, "What went wrong?"

Once again, Sarton may serve us well here, for much of his approach to the history of science was marked by the concern with the rise and fall of great civilizations. Sarton counted himself an Arabist and medievalist as much as a historian of science.[28] His publications bear this out, as does the fact that he avidly and regularly corresponded with some of the most prominent orientalists of his day.[29] His approach to the relation between Islam and Europe echoed the concerns of his fellow Belgian, the medievalist Henri Pirenne. In 1937 Pirenne's highly influential *Muhammed and Charlemagne* was published posthumously: in it he proposed that it was the rise of Islam that broke the unity of the Mediterranean and led to the fall of the Roman ecumene.[30] Sarton took a different line. Unlike Pirenne, he emphasized the influx of creative inspiration from the East. From ancient Egypt and Mesopotamia to the medieval Arab and Persian lands, the West itself was shaped by these "wave[s] of oriental wisdom." But as Sarton was quick to point out, Muslim or oriental supremacy was over by about the end of the eleventh century, and with the fall of one Golden Age came the slow rise of another: according to Sarton, once again, if it was thanks to the East that the spirit of science could enjoy a slow incubation, it required the Western spirit to father the modern scientific method. Or, as he put it: "Experimental science is a child not only of the West but also of the East; the East was its mother, the West was its father."[31]

It was, perhaps, above all the invention of the concept of the Scientific Revolution that consolidated this approach.[32] The term was coined in 1939 by Alexandre Koyré—around the time he had been teaching at the King Fuad University in Egypt (now Cairo University)—but the idea of a fundamental transformation in the seventeenth century

[28] Thinking retrospectively about why he titled his journal *Isis*, Sarton wrote in 1953: "At that time, say around 1911–1913, I was deeply enamored with mathematical and physical knowledge—the perfection of knowledge—and cared little about the humanities, least of all oriental humanities. If somebody had told me then that I would become a medievalist and an orientalist, such a statement would have seemed preposterous to me." George Sarton, "Why Isis?" *Isis*, 1953, *44*:232–242, on p. 235.

[29] See Thomas Glick, "George Sarton and the Spanish Arabists," *Isis*, 1985, *76*:487–499.

[30] Henri Pirenne, *Muhammed and Charlemagne* (New York: Norton, 1939).

[31] Sarton, *History of Science and the New Humanism* (cit. n. 21), pp. 94, 119. According to Sarton, the Greek and Hebrew spirits gave rise to two civilizations; in Rome, they proved mutually destructive. Greek science—which he describes as "essentially the western spirit"—was "finally smothered by the combination of Roman utilitarianism and Christian sentimentality" (*ibid.*, pp. 89, 93).

[32] This is a subject that has acquired a vast and rich historical body of literature today and that I can only touch upon here. For more on this see Steven Shapin, *The Scientific Revolution* (Chicago: Univ. Chicago Press, 1996).

could be found in Sarton's own 1931 *Introduction to the History of Science: From Rabbi Ben Esra to Roger Bacon*, among other works.[33] In the immediate postwar period it shaped the work of Joseph Needham, whose pivotal question was why—despite centuries of impressive scientific achievements—the Chinese failed to create anything close to the modern science that emerged from Europe after the seventeenth century.[34] The Scientific Revolution sealed off the West from the rest and helped to create a convenient time frame for science's own modern incarnation. It also helped to set the agenda for how the discipline itself would subsequently view the world, as a new emphasis on a universal and unilinear history of science merged seamlessly with postwar modernization theories.[35]

According to this line of argument, moreover, the Eastern sciences under consideration had to have a direct bearing on Western ones. Hence, the emphasis was placed on technical knowledge and not natural philosophical knowledge, which—unlike that previous generation of syncretists—these historians cleaved off, classed as nonscience (e.g., magic), or ignored altogether. In this way, early historians of science tended to count Eastern contributions to science only when they were based on mathematical or empirical methods of demonstration, ignoring all those disciplines that did not fit within this model. Needham, for instance, only touches on the natural philosophical framework behind the Chinese sciences and focuses heavily on what he called the applied sciences or knowledge of techniques, such as navigation and the manufacture of gunpowder, paper, and so forth.[36]

This emphasis has, until recently, helped to shape much of the historiography of the sciences outside Europe as well.[37] To give but one example: there are only a handful of histories written on subjects such as astrology, alchemy, magic, and talismans in the Arabic-speaking lands for much of the medieval and early modern periods, despite the fact that these were among the most popular and most significant of the applied sciences.[38] Perhaps the greatest lesson we can learn from revisiting the construction of global histories of science in this way, then, is why some forms and communities of knowledge have come to matter more than others.

Today one can scarcely ignore discussions of the "global." And yet for all the ambiguity of this umbrella term—and its counterpart, "globalization"—we should not forget that it

[33] George Sarton, *Introduction to the History of Science: From Rabbi Ben Esra to Roger Bacon* (Baltimore: Williams & Wilkins, 1931). Koyré taught in Egypt from 1932 to 1934, 1936 to 1938, and 1940 to 1941.

[34] Joseph Needham's postwar multivolume *Science and Civilisation in China* similarly set the stage for later historiographical discussions of science and the relative contributions of East and West in its development. Posing the question, both implicitly and explicitly, of why modern science developed in Europe and not in China meant that discussing traditions of natural and technical knowledge in the rest of the world could help point the way to what was truly Western about Western science. See Needham, *Science and Civilisation in China* (cit. n. 2); and Joseph Needham, *The Grand Titration: Science and Society in East and West* (London: Allen & Unwin, 1969). For more on Needham's early interest in this quest see Simon Winchester, *The Man Who Invented China* (New York: Penguin, 2009); and "Bibliography of Joseph Needham," in *Changing Perspectives in the History of Science: Essays in Honour of Joseph Needham*, ed. Mikuláš Teich and Robert Young (Boston: Reidel, 1973), pp. 472–478. On Needham's *Science and Civilisation in China* and what is sometimes called the "Needham question" see Nathan Sivin, "Why the Scientific Revolution Did Not Take Place in China—Or Didn't It?" *Chinese Science*, 1982, *5*:45–66; and Sivin, "Max Weber, Joseph Needham, Benjamin Nelson: The Question of Chinese Science," in *Civilizations East and West: A Memorial Volume for Benjamin Nelson*, ed. Eugene Victor Walter (Atlantic Highlands, N.J.: Humanities, 1985), pp. 37–49.

[35] Compare, e.g., Needham's model for the "diffusion of science" with that of the development theorist George Basalla. See also note 24, above.

[36] For more on this see Hart, "Beyond Science and Civilization" (cit. n. 2).

[37] For a recent exception see Carla Nappi, *The Monkey and the Inkpot: Natural History and Its Transformation in Early Modern China* (Cambridge, Mass.: Harvard Univ. Press, 2009).

[38] This point is made by Dimitri Gutas in "Certainty, Doubt, Error: Comments on the Epistemological Foundations of Medieval Arabic Science," *Early Science and Medicine*, 2002, *7*:276–289, on pp. 278–279.

has long shaped our historical narratives about ourselves and about the world around us. That this should be the case is not surprising, given that the notion of the global as we have now come to know it is often simply a mark of an awareness of the interconnectedness of our world built through the forces of capital, trade, and empire.[39] As I hope this essay has supported, the discipline of the history of science itself was very much shaped by the search for a global narrative; but in the process it also invented a notion of Western science that flattened out knowledge communities and traditions and placed them into a single historical teleology. Perhaps by appreciating what was lost in the historicization of the idea of science in this way we may come to see how to write more genuinely global histories in the future.

[39] See, e.g., Paul Hirst and Grahame Thompson, *Globalization in Question* (Cambridge: Polity, 1999); and Michael Lang, "Globalization and Its History," *Journal of Modern History*, 2006, *78*:899–931.