The American Style of Science

The Formation of the American Scientific Community. The American Association for the Advancement of Science, 1848–60. SALLY GREGORY KOHLSTEDT. University of Illinois Press, Urbana, 1976. xiv, 264 pp. + appendix + plates. $10.95.

The Emergence of Agricultural Science. Justus Liebig and the Americans, 1840–1880. MARGARET W. ROSSITER. Yale University Press, New Haven, Conn., 1975. xiv, 276 pp. + plates. $15. Yale Studies in the History of Science and Medicine, 9.

Snoop for a moment among the private correspondence of the Harvard faculty. Over here the holder of the Perkins chair is writing to the most powerful scientist in Washington. The subject is the AAAS. Does the distinguished astronomer look with favor on its contributions to American science? No. He rather suggests that the initials must stand for Amazing Asses Adverse to Science. Over there the professor of chemistry—established and respected but still young and ambitious—is writing to his wife. Does he speak of hoped-for publications, prizes, and international recognition? No. He rather inquires, "What do you say my beloved? Do we not need comforts and privileges for our children more than we need honors?" His coming turn from research is foreshadowed in the determined declaration that "my health and independence are of more moment than anything in the way of wordly name and place."

These two letters of 1854—the one quoted by Kohlstedt, the other by Rossiter—vividly indicate how American science in the mid-19th century was different from what we now know. Yet the two decades before the Civil War were a seminal time. They saw not only the first foundation of but also direction-setting developments in key institutions of American professional science such as the National Academy of Sciences, the Lawrence (Harvard) and Sheffield (Yale) Scientific Schools, the Smithsonian Institution, and the AAAS. At the time the structures of such institutions appeared fragile, precarious, and unsatisfactory to participants and observers alike. However, the community of science born of those years and sustained by those institutions has not only endured but prospered mightily. In the process, professional scientists have continuously reshaped the institutions to their ends—but symbiotically, for the institutions have also shaped the scientists.

With the hindsight of a matured tradition we can now look back and see a rich vein of significance, awaiting its historical miners. There is for a start the obvious fascination associated with origins and beginnings. Other, more fundamental questions come to mind. The transitions, uncertainties, hopes, frustrations, and unfulfilled expectations associated with a time of founding and establishing may allow rewarding perspectives on the values built into American professional science. The clash of amateur ambitions and career realities promises illuminating insights. The familiar tension between a wish to emulate cultural modes proven in European climes, a desire to transcend those modes, and a need to accommodate to a new world can help explain the course of American science. Developments in the United States may also give us purchase on a further significant problem. How much of modern science may usefully be understood in terms of an international community of scholars, and how much is better construed in categories specific to the nation, the culture, the period under examination? Rhetoric, received ideas, and familiar teaching would give most if not all to the former claimant. A better acquaintance with the historical record might transform our notions on this point. At the very least it would sensitize us to certain subtle interplays between professional groupings, the cognitive systems and subsystems they find congenial, the national cultures in which they function, and those elites of other nations to whom they make symbolic and literal appeals. Historical knowledge of this sort might also lead toward an understanding of how conceptions about nature may serve both as common coin for complex cultural transactions and as agent by which to gain purchase on the veiled realities of the material universe.

Given this inventory of possibilities it is not surprising that able students have begun to be attracted to the institutional origins of American professional science as a strategic site for research. The books under review offer suitably revised, extended, and matured versions of two pioneer dissertations. These studies do not directly confront the questions outlined above. Instead they proceed by the hallowed historical method of detailed, meticulous archival work on limited problems in tightly defined periods. Yet because the authors are intelligent, thoughtful, and thorough their investigations necessarily shed much light on broader issues.

Margaret Rossiter seeks to elucidate the mechanisms by which a fundamental attribute of professional science—induction into the guild through pupillage in organized research—was brought to America. Her study is restricted to one key subject, agricultural chemistry. The focus is quite properly on the impetuous, charming, bombastic, engaging and enraging figure of Justus Liebig and his direct and indirect effect on American developments. In the period from the late 1820's to 1852 Liebig held a professorship in Giessen, Germany. From this obscure but advantageous niche he conceptualized and created through bullying, flattery, intellectual energy, and force of personality a research laboratory without precedent or peer in German or other universities. His books, his students, and the journal that he edited gradually made him known far beyond the confines of Giessen. Liebig had six Russian, one Mexican, and 16 British students before the first visionary visitor from the United States entered his laboratory. We know nothing beyond the name of that initial American, who presumably wandered out much as he wandered in. Number two, Eben Horsford, hardly seemed made of sterner stuff. Horsford dabbled in medicine, law, and theology before he turned to chemistry. He took off for Giessen in 1844 when he not only had failed to gain the chemistry chair at the University of Pennsylvania but also had been forbidden by her irate father to see anything more of Mary Gardiner, his heart's desire. Mary was soon to be cousin of the First Lady, and an unsuccessful chemist was thus no match for her. However, emergent specialties are even more prone to vagaries than love itself. Within three years Horsford was installed as a Harvard professor and awaiting not only the long-delayed marriage to his Mary but the prospect of creating a "Giessen on the Charles" in the form of the new, endowed Lawrence School.

Horsford soon discovered by experiment that farmers' wishes for quick chemical methods of solving complex ag-

ricultural problems were something wholly distinct from the social, cultural, intellectual, and populational infrastructures necessary to support the mode of the research professor, German style. Hopes for an annual lecture audience of over a hundred did not materialize. No more did a stream of publications or of pupils committed to the analytical laboratory. Horsford abandoned his European-induced ambitions, though not the Rumford chair. The young Charles W. Eliot was called in as assistant professor while Horsford sought and found material prosperity in patent activity and as industrial entrepreneur. Indigenous values thus triumphed in his case.

At Yale, John Pitkin Norton survived somewhat better—perhaps because he was able to forgo the ungentlemanly necessity of a salary. A hostility toward Liebig led him to espouse less ambitious British theories and modes. His tragic early death cut short his influence, however, while also opening the way for John Addison Porter. Porter was an orthodox disciple of the German master, and he was not the sort to go without remuneration. With commendable prudence he fell in love with the daughter of a local railroad magnate, Joseph Sheffield. He was thus able to influence the structure and enjoy the facilities of the Scientific School that quickly resulted from Sheffield's benefactions (the greatest in Yale's history to that date). Sheffield's largesse also allowed an assistant chemist to be hired. The assistant was Samuel W. Johnson, the most gifted of Liebig's American students and the most ambivalent about the master. Johnson in his turn secured the line that led on to agricultural experiment stations and a burgeoning of institutionalized research.

In describing these developments Rossiter writes deftly and with an agreeable humor. Her analysis includes many other good things, including a fine portrayal of the problem of "worn-out soil." The overriding message, though, is the gap between private vision and social reality, between European norms and American forms. Liebig could call upon a protector-prince, symbolizing and incarnating the powers of an enclosed high culture. In the United States Horsford and Norton were dependent on the whims of self-made men and perpetually subject to the temptation to try to make themselves also. The difference of context points both to the limitations inherent in cultural borrowing and to the emergence of authentically American styles of professional science: open, optimistic, and entrepreneur-

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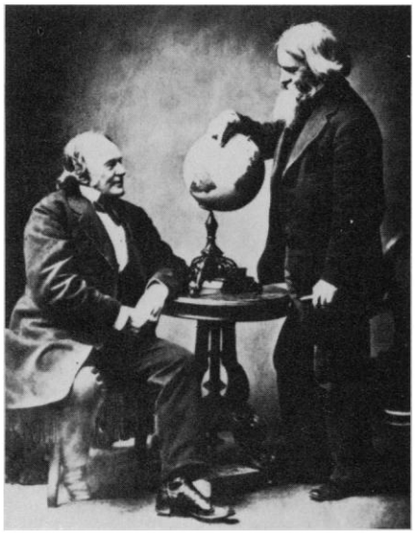
ial but always precarious, unfinished, and subject to fashion.

Those limitations and the emerging American styles are also apparent in Kohlstedt's richly detailed study of the early days of the American Association for the Advancement of Science. This time the borrowing was not from Germany but from Britain. The British Association for the Advancement of Science was founded in 1831. With no language barrier and a mere ocean to surmount, more than 40 Americans found their way to its annual meetings within the first half-dozen years. A "deference toward England" which Louis Agassiz was quick to note as "a curious fact in the life of the American people" made it comparatively straightforward to build the AAAS not only on the precedent but on the precise model of the British Association (even to the wholesale copying of clauses from the latter's constitution). However, as some of its founders were acutely aware and experience quickly confirmed, the conditions of American science were radically different from those prevailing in Britain.

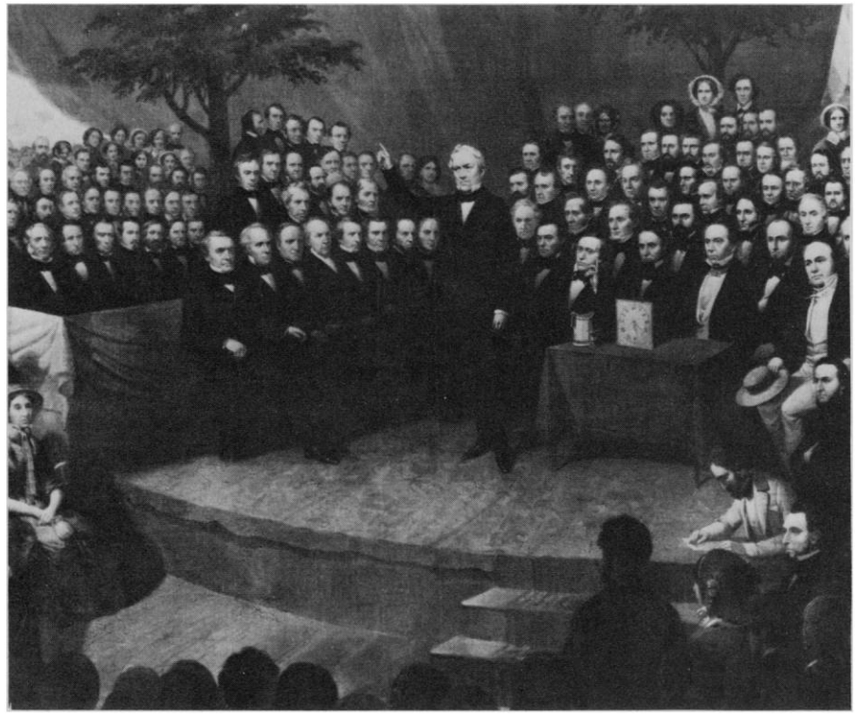
The British Association related to a stable network of entrenched provincial institutions, had a strong central core representing the undisputed elites in British scientific culture, and fitted into and helped reinforce a society of close communications, hierarchies, and explicit deference. To adapt the model to American realities was no simple task. The very founding of the AAAS was mooted and postponed several times before 1848. In practice the Association was created and controlled by the urban professional scientists of the "Bos-Wash" axis—already feeling their oats as a power in the land. Among the means she utilizes to demonstrate this control, Kohlstedt includes an informative prosopographic study of the early members of the AAAS. This study plainly reveals the leadership role of a Harvard- and Yale-based elite, represented by Norton and Horsford among others. The members of that elite were closely connected by kinship and marriage to dominant groups in the nation's commerce, politics, and law. Other categories of actor, for instance M.D.'s, loom large in the Association's rank and file. It would have been rewarding to know more of their activities and influence.

Elite networks might condition much of the texture of American science, but democratic aspirations and the opinions and suspicions of those in the hinterland were not ignored as easily as in Britain. An Association committed to move between widely spaced cities in which the veneer of culture was thin found itself open to confusion and attack. Splits were the harder to cope with or conceal when they surfaced in terms of preferences for the physical (laboratory, urban, sophisticated, and Eastern) or the earth (individual, small-town, empiric, and "interior") sciences.

By the time of the Civil War ominous feuds had developed in the AAAS. There were to be no meetings between 1860 and 1866. It seemed that the Association might vanish. "It is I suppose intended to suppress the American Association" wrote one geologist in 1863, when the National Academy of Sciences was founded to serve more satisfactorily the needs of the professional elite. The same observer added, "I think it cannot be done. This new organization is too much of a close corporation or Oligarchy to be tolerated by the men of science in America." He spoke shrewdly. The AAAS revived and American developments were confirmed in modes that were at once pluralistic, democratic, and quite distinct from those of the European models.



Louis Agassiz and Benjamin Peirce. In 1847, with Henry D. Rogers, Agassiz and Peirce were selected to revise the constitution and rules of the Association of American Geologists and Naturalists in preparation for its transformation into the AAAS. The three men—a chemist-geologist, a naturalist, and a mathematician-astronomer, respectively—"represented among themselves all major areas of scientific research in America." Agassiz and Peirce each subsequently (1851 and 1852) served as president of the AAAS. [Reproduced in *The Formation of the American Scientific Community*, courtesy of Museum of Comparative Zoology, Harvard University]



Dedication of the Dudley Observatory, held while the AAAS was in session in Albany in 1856. "At the Albany meeting . . . the local committee . . . planned a comprehensive program for the AAAS. Not only did they arrange for a group portrait of the leading scientists by R. Van Dein, but they also prepared to dedicate the State Geological Hall and the Dudley Observatory while the distinguished savants were all present." The painting reproduced in part here was done by Thomkins H. Matteson in 1857. [Reproduced in *The Formation of the American Scientific Community*, courtesy of the Albany Institute of History and Art]

Together these two books begin to provide a novel and important account of how American professional science was formed. If the high elites of that science found models and inspiration in Europe, the experience of a sparsely settled continent of endless diversity was equally important in defining American realities. The rich history of American professional science—itself a kind of last frontier—is now beginning to be opened up. The works under review conclusively show how important and unexplored is the terrain of the mid-19th century. In the bicentennial year it would be churlish to welcome too loudly this move away from traditional preoccupations with colonial science. One may perhaps be allowed to hope that these pioneering reports will encourage other historians to venture into the real virgin territory—that of American science *since* the Civil War. It is after all not outrageous to claim that it is only in the 20th century that American professional science has found its true significance. Today both the German universities and the British Association have long ceased to offer tempting models to a professional community deeply absorbed in the elaboration and defense of its own styles of complex enterprise. As yet we understand little of how those styles evolved. We possess not one scholarly general history focused on the period since the Civil War. Still, there's much to recommend beginning history at the beginning. And now, thanks to Kohlstedt and Rossiter, we can do that for American professional science.

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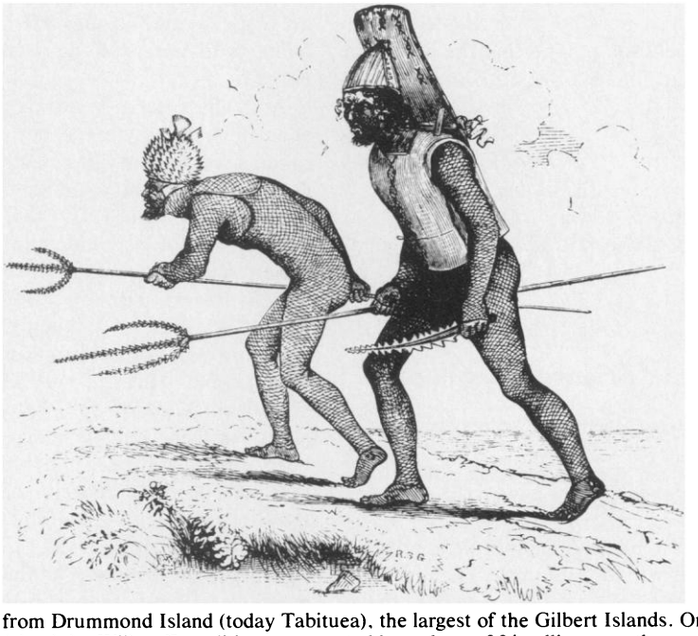
An Unlikely Success

The Great United States Exploring Expedition of 1838–1842. WILLIAM STANTON. University of California Press, Berkeley, 1975. x, 434 pp., illus. $14.95.

The United States Exploring Expedition of 1838–1842, often called the Wilkes expedition after its commander, Charles Wilkes, was America's first attempt at systematic scientific exploration. In this book Stanton has provided a splendidly readable account of the expedition's four-year circumnavigation of the globe. The book originated in self-indulgence, he says, and he claims for it only that it should be seen as "an exercise in the picaresque." But that is all false modesty. Stanton is instead absorbed with the dynamics of able leadership and with presenting history in a manner that is both vigorous and urbane. To see what he is really about, one has only to compare his version of any given event during the expedition's cruise with the same event in David B. Tyler's *The Wilkes Expedition* (published by the American Philosophical Society in 1968 and, except as the source for a single illustration, curiously unnoticed by Stanton). The urge for strong characterization and a fast-moving narrative occasionally leads Stanton astray, but he tells the story very well and I regretted coming to the end.

The motivations for a scientific expedition to the Pacific Ocean formed a curious medley. In the first instance, the voyage was proposed to verify the idea, put forth by John Cleves Symmes, Jr., a former army captain from Ohio who was regarded by his supporters as "the Newton of the West" and promoted as "a standing refutation to the notion that Americans who went West reverted to 'savagism,' " that the earth might be hollow at the poles. But there were also commercial interests to be served; the China trade and the whaling industry, in particular, demanded a better knowledge of the Pacific basin. And where business pursuits led, political concern followed—especially in the major island groups and on the northwest coast of North America. Finally, and the loudest of the arguments, there was the matter of national pride. Could the United States continue its slavish dependence on British sea charts? Did not equal standing in the family of nations call for an American contribution to the world's store of knowledge? In an era when government support of science in the United States was a novelty, all these ambitions were required to defend such an unparalleled raid on the public treasury.

The cast of characters was a similarly strange mixture of foot-dragging politicians, jealous naval officers, and frustrated scientists. Charles Wilkes, the protagonist, is described as a Captain Queeg type—a martinet of limited talents who feared that others were always plotting against him. He imagined himself better suited than more experienced officers to command the expedition because of greater scientific knowledge, but in the judgment of the enterprise's civilian scientists, he displayed an outright con-



Warriors from Drummond Island (today Tabituea), the largest of the Gilbert Islands. On arriving at the island the Wilkes Expedition was greeted by a show of friendliness on the part of the natives. Later, however, a shore party was "promiscuously huddled" by a crowd of natives: "The women were decidedly pretty and their gestures alarmingly provocative as they sought to attach themselves to the explorers. . . . One could hardly take offense at this sort of welcome, but the explorers soon discovered that while the women dallied, the men were efficiently picking their pockets." A battle ensued. The native warriors retreated, but only after standing their ground "with a boldness that astonished all." The visit to Drummond Island was not without its satisfactions for the explorers, however. For navigating the archipelago they had had only an incomplete chart based on Duperrey's exploration of the area in the *Coquille* in 1824. On making their own survey they discovered that the chart "was a poor piece of work. The Frenchman had somehow got the lagoon on the wrong side of the island."[From *The Great United States Exploring Expedition of 1838–1842*]