Reception of the Idea

EMMA CALLED IT “nervous exhaustion.” MIT’s mathematics professor John D. Runkle dubbed Rogers’s illness “Institute on the brain.” Rogers himself said he was “liable to much nervous perturbation.” When the stroke hit, leaving him with partial but temporary paralysis, he broke off all engagements in Boston and decided to stay with his brother Robert in Philadelphia. From fall 1868 to summer 1871 William spent his winters with his brother and his summers on the coast in Newport, Rhode Island. The time away must have affected him for the better, for by 1871 he began spending his winters in Boston, while continuing to rest in Newport during the summer. He and Emma enjoyed Newport enough to build a summer home there, which they called “Morningside.” His visits to the coast offered some relief from demands in Boston where obvious loads on his health had included the war, scientific and professional appointments, and the founding of MIT.¹

Although Rogers’s sudden decline forced him to leave behind his official commitments at MIT, he followed and kept a hand in significant decisions made in his absence. Since its inception, he’d held the Institute’s first presidency as well as the professorships of geology and physics. In the summer before the onset of his illness he hired an assistant professor to take over the physics duties. When the stroke left him, as Emma put it, “unable to walk more than a few steps in his room, to read or to listen to reading, or to do any mental work,” the Institute responded by granting Rogers a leave of absence. His friend Runkle served as MIT’s interim president for the first eighteen months. When Rogers officially resigned, Runkle continued as MIT’s second president until 1878. All the while, during this period of illness and transition, the Institute faced fundamental questions about its future, which made their way back to Rogers’s bedside.²

The dilemmas raised during MIT’s formative period cannot be divorced from the general reception of technological institutes in the 1860s and 1870s. Public discourse over the idea of MIT and like-minded establishments germinated from two long-standing academic feuds. Within one forum of debate, advocates of culture continued to spar with scientists over the curriculum. In the other, heated exchanges
intensified between members of the science community over defining the proper approach to scientific studies. The pages of popular and scientific periodicals were increasingly consumed by both feuds. “In the matter of ‘technical education,’ which now forms a prominent topic of discussion on both sides of the Atlantic,” protested the Scientific American, “there has been, hitherto, altogether too much talking.” Despite such protestations, how and where college students studied science and technology commanded a growing share of the public interest.3

The founding of institutes such as MIT rekindled hot partisan embers that had glowed since the appearance of the Yale Report in 1828. For many culture advocates of the 1860s and 1870s the report outlined essential arguments for maintaining a curriculum based on the ancient languages that applied in part or in whole to the developments of the postbellum era. Yale president Noah Porter led among those who reintroduced the principal ideas of the report. “We assert that the study of the classical languages,” he reminded colleagues, “should be universally preferred to any other as a means of discipline in every course of liberal education.” He agreed with “the theory of education . . . that certain studies (among which the classics and mathematics are prominent) are best fitted to prepare a man for the most efficient and successful discharge of public duty.” In his view the classics disciplined (that is, exercised the mind) and offered the best of human culture (that is, literature and “knowledge of man”) more effectively than any other form of liberal studies. As such, the traditional curriculum prepared students for the “commanding position” deserved by the “thoroughly cultured man.” The increasing attention to scientific and practical studies as well as to research at the expense of teaching had all weakened the college’s ability to serve its traditional cultural mission. Faculty, according to Porter, should pay nearly exclusive attention to instruction over original investigations. “No mistake can be greater,” he emphasized, “than to suppose that a college gains very largely by adding to its corps of professors eminent personages who have little or no concern with the business of instruction, or who come rarely in contact with the students.” Porter hoped that by restating the Yale Report’s ideals he could slow the changes then occurring in mid-nineteenth-century American higher education.4

The rise of schools of science, institutes of technology, and the emergence of the modern university certainly figured into Porter’s concerns. Sometime in the distant future, he speculated, universities may indeed be “desirable and possible with enterprise, patience, time, and energy.” But, as he saw it, the 1860s and 1870s were not an opportune time for such an undertaking in America.5

Porter hardly stood alone in expressing these convictions. Other culture advo-
cates joined in defending the classics as the bedrock of college-level education. George Park Fisher, a professor at Yale’s Divinity School and editor of the *New Englander*, considered Latin and Greek the basis of a true undergraduate course of studies. “The study of the classical languages and literature,” he insisted, “is a leading, essential, indispensable part of such a scheme of education.” T. W. Higginson, a Massachusetts Unitarian minister and contributor to the *Atlantic Monthly*, repeated the same in a “plea for culture.” What these languages offered was a buffer against “the strong tendency to make all American education hasty and superficial.” His idea of culture meant, at bottom, “the training and finishing of the whole man, until he sees physical demands to be secondary, and pursues science and art as objects of intrinsic worth.” He made clear that practical or useful studies obfuscated higher education’s cultural mission.⁶

Some culture advocates, such as James Jackson Jarves and Paul Ansel Chadbourne, faulted science for leading American higher education astray. Jarves, a well-known art collector and author, questioned the impact of philanthropy that aided the new education at the expense of the old. “Rich men contribute liberally to support a college, institute of technology, or museum of natural history,” he ruminated, “on the general principle of their usefulness . . . without comprehending specifically anything of their studies or doctrines.” He called on philanthropists to redirect their resources toward museums of art rather than museums of natural history. Like Jarves, University of Wisconsin president Paul Ansel Chadbourne raised concerns about financing scientific and technological education. “We are losing vastly, absolutely wasting our means,” decried Chadbourne, “especially in our attempts at industrial education, while so many colleges are attempting to teach everything without having the means of thoroughly teaching anything.” His solution to the problem was division of labor. Institutes of technology should meet the demand for practical education without concerning themselves with “liberal provisions for college or scholastic studies.” Colleges, on the other hand, should restrict their offerings to the traditional curriculum for those “who are seeking knowledge for some other purpose than as mere multipliers of dollars and cents.” Chadbourne urged that the division of labor would keep the traditional course from becoming distracted by practical studies.⁷

In large measure Porter and the circle of culture advocates directed their statements, all of which appeared in the late 1860s and early 1870s, to general movements in higher education. While they may have cited specific examples, their main point was to defend the merits of the classical curriculum and call attention to the increasing emphasis on science, or certain forms of science, over the study of culture.
One of the most lively points of contention between culture advocates and scientists, however, originated with the founding of MIT itself.

MIT’s founding and establishment in the 1860s gave Jacob Bigelow and William P. Atkinson an occasion for a series of addresses related to the idea of institutes of technology. The addresses, whatever their accuracy in representing the values that had led to the creation of MIT, played a central role in the Institute’s initial reception. Their ideals and aspirations as well as their concerns and provocations became fused with the institution, at least in public discourse, and influenced public perceptions of MIT. When Bigelow spoke at the Institute, he was hardly an unknown figure to Boston-Cambridge intellectuals. He had led a successful private practice as a physician, authored several studies in botany, worked as a part-time chemist, and held the professorship of materia medica at Harvard’s Medical School. When, in 1816, Harvard established the Rumford Professorship on the Application of Science to Useful Arts, they turned to Bigelow to fill the position. His interests in both practical and theoretical sciences matched the requirements of the professorship. By the time he turned his attention to MIT, he had served for over fifteen years as president of the American Academy of Arts and Sciences. The younger, lesser-known Atkinson organized his thoughts about the Institute from the perspective of a humanist. After receiving an A.M. degree from Harvard, Atkinson was drawn to the idea of MIT because of its attention to modern, as opposed to classical, humanistic studies. The institution’s interest in experimenting with instructional methods also attracted him. “I have had much to say,” he remarked about the recitation method, “against the absurdity of learning by rote that which should be reserved till it can be intelligently grasped and comprehended.” For Bigelow and Atkinson the Institute offered a corrective to the traditional collegiate model. Yet their approach to promoting the idea differed as greatly as their backgrounds.

Bigelow had a polarizing effect on opinion makers when he gave a pair of addresses on MIT’s founding in 1865. In the first address, On the Limits of Education. Read before the Massachusetts Institute of Technology, November 16, 1865, he emphasized that a knowledge explosion had occurred in the first half of the nineteenth century. As a result of this expansion in knowledge, particularly in areas of science and technology, Bigelow declared the era of the “general scholar” as finished. “No individual,” he stated, “can expect to grasp in the limits of a lifetime even an elementary knowledge of the many provinces of old learning, augmented as they now are by the vast annexation of modern discovery.” Given the revolution in intellectual life, he considered it unreasonable to devote four to five years of collegiate study to the classical curriculum. The old college brought students to “the many doors of the tem
ple of knowledge, without effecting an entrance to any of them.” The purpose of MIT, as he understood it, was to address this explosion of knowledge with a course of study that allowed for specialization and the exploration of useful knowledge.9

Bigelow’s second address, On Classical and Utilitarian Studies, spoke directly to the merits (or demerits) of the classical curriculum. Defining education as a combination of mental discipline and useful knowledge, he declared ancient studies as inadequate on both counts. Antiquity had failed to produce “any solid and lasting good” because the culture had been “extensively given to fictions, words, and profitless abstractions, rather than to the augmentation of permanent knowledge.” The modern era, by contrast, had expanded knowledge for social and material utility, for improving the human condition. When it came to mental discipline and useful knowledge, he continued, any subjects of the modern age compared favorably or better to those of the ancient. While conceding that “classical literature . . . may well enter into the foundation of the most liberal forms of education,” he reaffirmed his belief that the languages alone failed to address “the intellectual demands of the present.”10

Despite his bold claims, it’d be reductive to call Bigelow’s views mere anticlassicism. It’s true that he used inflammatory language when describing the classics as “heathen mythology,” rife with “savage attributes, brute instincts, and exceptional morality, [that] override the more modern sentiments of humanity, honor, and Christian charity.” But he also acknowledged the “copious, majestic, expressive, and musical” qualities of classical literature. Holding both views conformed with his belief that the curricular landscape could support more than one model. His addresses looked to situate the MIT ideal within this landscape set in the modern world.11

With equal conviction, although less provocatively, Atkinson pursued the same ends. Having witnessed rancorous debates between scientists and classicists over such institutions as MIT, he sought “to place the merits of both sides of the question in dispute in a juster light than is done by the extreme partisans of either.” With this goal in mind he addressed members of the Institute with a lecture on Classical and Scientific Studies, and the Great Schools of England (1865). His focus on English systems of education offered an indirect appraisal of midcentury American higher education. By dealing comparatively with educational problems across the Atlantic, he could raise prickly issues at home without implicating specific institutions. Drawing upon a study commissioned by the English Parliament in the early 1860s, he discussed examples of antiscience and antimodern sentiment among England’s educational leadership. Administrators surveyed revealed signs of antiscience sentiment when they stated that “physical science is not taught” at their institutions or that
they “hardly know what their [scientific studies] value is.” Antimodern expressions revealed a similar resistance to modern languages and the fine arts. Without science or modern humanistic studies, he stated, English students received mostly Greek, Latin, and some mathematics. According to the report, students, when evaluated, showed embarrassingly little command of even these classical studies.

Having described the unbalanced character of English education, Atkinson followed with what he believed were the root causes. On the one hand, advocates of science misrepresented the nature of their work to their critics. Scientists “have been too prone to confound education with information,” mistaking the development of the mind with practical knowledge. “They have lost sight of that liberalizing development of all mental powers which constitute a true education, and which no mere pouring in of any amount of useful information can ever accomplish.” Similarly, classicists unnecessarily restricted the range of acceptable collegiate studies. They contradicted their own belief in the broad and “symmetrical” purposes of education. Classicists themselves should concede that the means to a true liberal education “must be something of far wider application and greater power than the grammar of two dead languages.” He recommended that partisans of each side should avoid mutually exclusive models and consider a balance between extremes.

The Bigelow-Atkinson addresses caused a stir, and, not surprisingly, it was Bigelow rather than Atkinson who drew the sharpest responses. Some critics leveled general charges against them, while others produced detailed counterpoints to the published lectures. Culture advocates at the *New Englander*, for example, made general remarks about Bigelow’s partisan spirit. They took issue with his “extreme ground in favor of giving very great prominence to the study of the sciences and the modern languages, at the expense of the classics.” Critics differed with the author “upon almost every position which he takes and seeks to defend.” By association MIT came under fire. “The advocates of Dr. Bigelow’s system,” they concluded, “are . . . one-sided men.” In this sense perceptions about Bigelow and the Institute became linked.

The *North American Review* ran a series of articles in the two years immediately following Bigelow’s address that continued along the same lines, offering specific rebuttals to the idea of the Institute. The Review’s commentators contended that “what Dr. Bigelow means by Education is not education at all but elementary instruction.” To them he had misconstrued higher learning to mean “the imparting of information useful for some purpose other than education.” Information transfer is not the point of a true education, they responded. Colleges should aim toward a higher goal that would encourage students to ask why something is done rather than how. That Bigelow held such misguided ideas, they maintained, revealed the need for scientists
and technologists to receive a liberal, classical education. The idea of MIT thus fell under similar scrutiny for having a potentially ill-conceived curriculum: “If it is men and not machines, that are to be turned out by the new Institute the methods and the test of success will have to be something beyond a rigid adaptation to the performances of particular tasks.” The MIT addresses, as such, raised concerns over what kind of graduates the program would produce.\(^\text{15}\)

In contrast to the attention given to Bigelow, Atkinson received fewer and less heated replies. Atkinson’s address nevertheless also raised eyebrows and thus figured into MIT’s reception. Critical commentary from the *North American Review* challenged his claims that England’s overemphasis on the classics could inform America’s educational dilemmas. The failure of the English to educate their students fully in the classics, argued the *Review*, spoke volumes about English instruction and little about classical education. While conceding that science might teach certain powers of observation, the *Review* maintained that no empirical evidence existed to confirm that this indeed was so. Using the principles of science against Atkinson, the commentary remarked that “this ought to be shown in detail and by experiment. . . . What we want to know is the comparative effect of different studies upon the same faculties.” The tenor of the remarks matched the tone of Atkinson’s address. Whereas Bigelow’s abrasive rhetoric generated equally abrasive replies, Atkinson had attempted a balanced review of classical and scientific education, drawing a like response from critics. In the end, however, the *Review* disagreed with Atkinson’s conclusion that science may have an equal educational value to that of the classics. Because no “experiment” had studied the effects of classical or scientific education on students, its authors left open the possibility that both may offer “highly important” modes of mental activity. Until such experiments conclude otherwise, the argument continued, the classical curriculum should remain undisturbed as the basis for American higher education.\(^\text{16}\)

From William Barton Rogers’s perspective the idea of MIT had taken on a life and meaning of its own independent of the original intent. Rogers regretted, in fact, the impact and distortions created by the inaugural lectures at the Institute. “The recent discussion here and elsewhere,” he reflected, “on the relative value of scientific and classical culture in our schools and universities seem to threaten an antagonism which has no proper foundation in experience or philosophy.” When E. L. Youmans, popularizer of science and an itinerant science lecturer, offered to deliver a talk at MIT on “the superiority of the sciences over the classics,” Rogers had had enough. Youmans, who was then editing a volume of essays by leading British scientists on the merits of scientific education, wanted to talk about how the classics offered the “lowest kind” of mental discipline, that “advocates of the dead languages
have failed to prove” their worth. His point was that the languages promoted passive learning, as in the uncritical acceptance of ancient knowledge, while science stimulated the faculties of observation and independent judgment.17

Rogers turned down the offer and described to Youmans the spirit with which the Institute had been founded. “Some advocates of the Old System,” explained Rogers,

are trying to make the impression that friends of progress in education are as a matter of course the enemies of classical studies—while as you know we would have such studies not excluded but only subordinated in a complete curriculum of training and instruction. The intellectual and aesthetic discipline obtained in the Study of Languages, Modern as well as ancient, is of undoubted value and might be provided for in every comprehensive course of education. But this training can in no degree replace the invigorating exercise of the observing and logical faculties so peculiarly the function of scientific studies. Let the classics have their place among the instruments of intellectual culture, but in general education let them be kept within the modest limits appropriate to them, in which they shall not as they now so often do stand in the way of the broader, higher, and more practical instruction and discipline of the natural, mental, and social sciences.18

Youmans’s offer to lecture at the Institute represented a current of public perceptions about MIT. The Institute, some assumed, was a bastion of anticlassicism. In such instances Rogers attempted to correct misperceptions by reminding observers of MIT’s original intent. According to him, who devoted the institution’s founding documents—such as Objects and Plan (1860), Scope and Plan (1864), and the inaugural Catalog (1865)—to the useful arts ideal, the Institute aimed toward both breadth and depth in science instruction. Most institutions of the era addressed either one or the other but rarely both in the same institution. Technical and engineering training institutes (such as West Point or Rensselaer) served largely practical interests, while the Scientific Schools (such as Harvard’s Lawrence or Yale’s Sheffield) emphasized nonpractical areas. The attempt to bring breadth and depth under one roof reflected Rogers’s own style of research, which contributed to and made sharp distinctions between practical and theoretical knowledge. His early work as director of the Virginia Geological Survey in the 1830s and 1840s (largely practical) and later debates over evolution with Harvard zoologist and geologist Agassiz in 1860s Boston (largely theoretical) grounded his ideas about the nature of the Institute and its purpose in American higher education.19

Rogers’s intentions, therefore, were not to antagonize classicists. Far from it, for he had received training in the ancient languages as a student at William and Mary
and lauded the benefits gained from humanistic studies broadly conceived. At the Institute the humanities (modern languages, history, philosophy), while “subordinated,” nevertheless accounted for a substantive part of the original curriculum as well. Rogers believed a broad, deep, and humanities-infused program was vital to the advancement of the scientific community in the United States and for preparing of the next generation of scientists. “The most truly practical education even in an industrial point of view,” he stated, “is one founded on a thorough knowledge of scientific laws and principles, and which unites with habits of close observation and exact reasoning . . . the highest grade of scientific culture would not be too high as a preparation for the labors of the mechanic and manufacturer.” While Rogers might have attempted to correct misconceptions, the addresses and the responses they elicited attracted far more attention and shaped public opinion about the new institution.

The crux of the classicists’ position centered on the belief that the ancient languages should continue as the dominant force in undergraduate studies. They believed that the time wasn’t yet ripe for financing the expansion of scientific instruction. If anything, science education posed a serious distraction to the true cultural purposes of American higher education. Vocal critics of institutes of technology often interpreted such institutions as a threat to the classical college ideal, rather than as a complementary form of higher learning. Bigelow’s outspoken denunciation of Greek and Latin studies likely encouraged the perception that MIT’s founding represented the fruits of an anticlassicist movement. Science supporters of the 1860s and 1870s spent a great deal of energy responding to the varied criticisms from culture advocates; just as important, however, they also engaged in squabbles among themselves over proper modes of science instruction. Differing views about separate schools of science and technological institutes, in particular, divided the scientific community. Their debates centered on the degree to which higher education should emphasize abstract versus practical scientific studies.

As for scientists who responded to classicists, the knowledge explosion argument provided reformers with a broad-based rationale for modifying the undergraduate course of study. With a tone of impatience the editor of the Scientific American, for example, responded directly to those classicists who argued that the time was not ripe for change. The impatience, in this case, stemmed from the assumption that the entire discourse against scientific and technological education delayed an inevitable march toward progress. “If we are willing to look and wait,” argued the editor, “till the philosophers have ceased to wrangle on this subject and have come to an agreement among themselves, the day of judgment will certainly dawn on an earth un-
provided with technical institutions.” With the founding of technological institutes construed as inevitable, the bickering over whether or not to have them “is of minor importance.” The editor urged immediate action for higher educational reform.21

While calling attention to the expanding base of knowledge, the Scientific American, when presenting the topic of “Scientific versus Classical Education,” conceded that some study in the classical languages could help prepare those interested in science. A few months of Latin and Greek, at best, would serve the purpose. Four years of ancient languages, on the other hand, would make sense only “if our lives lasted a thousand years. . . . But at the present time, it can only be acquired at the expense of other information.” No longer could the classical curriculum suit the needs of scientists, for “the accumulation of knowledge” demanded that “a choice must be made between different kinds of learning.” Students faced a choice between ancient languages, with their myths and “delusions,” and the “positive and accurate knowledge” assembled by scientists. In chemistry alone, argued the Scientific American, the field is “enormous” and “constantly spreading.” For these reasons the editor advocated a college-level reform with two specific points: the classics could still play a role in the college admissions process, but colleges themselves should abandon the teaching of Latin and Greek entirely. Reformers with such beliefs insisted that only change of this kind would overcome the “trammels of this prejudice,” which called the classics “the most valuable knowledge of all.” The “rational” and “proper” course for higher education would be to teach science through the use of instruments and experiments.22

Much like the Scientific American, the Manufacturer and Builder also invoked the knowledge explosion argument when calling into question the study of Latin and Greek. Although the ancient languages were once considered “all-sufficient,” the age of industry required a change in such thinking. Reminiscent of Bigelow’s challenge to classicists, the Manufacturer and Builder cited that “the ancients were by no means the best physicians, having generally the most absurd notions about anatomy, physiology, pathology, materia medica, etc.” For physicians to spend time on the classics would violate “common sense.” The preparation of scientists, and physicians in particular, should, according to the periodical, avoid “the absurdity of the ordinary course of study” and focus on “the superior result of such training in which observation and experience are the basis.” Rather than depicting the dilemma as a choice between scientific and classical education, culture critics of this view cast the conflict as one between “common sense versus classical education.”23

In addition to claims about an expanding knowledge base, the Manufacturer and Builder used nationalism to defend the appropriateness of scientific studies with regard to its timing and financing. The argument invoked nationalistic arguments that
used nativism to fuel interest in the promotion of science in colleges and universities. “If we ever intend to become independent of foreign-skilled labor” remarked the publication, “some more strenuous means must be adopted to afford a proper mechanical and technical education to the young men.” Science education, in this light, served the politics of independence and national competition in an age of industrialization. “There is no reason why educated foreigners should be induced to emigrate by the offer of enormous salaries to superintend our manufacturers,” continued the argument, “when these positions might and should be held by our own country.” Citing the state-supported polytechnic universities of Germany, scientists could claim that in America “we want, and must have, such institutions . . . schools free if possible, and which will open their doors to the youth who, though poor, thirsts to that knowledge.” Only then, the Manufacturer and Builder suggested, could the nation compete with the influx of highly trained scientists, technologists, and artisans from Europe.

When not engaging in debates with classicists, some scientists began to defend the need for applied studies to their colleagues who favored abstract science. Prominent scientists of the period, men such as Harvard’s Louis Agassiz and University of California geologist Joseph LeConte, made this a difficult task. Agassiz rejected the “practical” bent of the MIT ideal and used his prestige to oppose efforts to introduce similar tendencies at Harvard’s Lawrence School. LeConte also vigorously challenged those who supported applied studies as a means to enhance “material comfort and happiness.” Rather, “the highest end of science is not to lead us downward to art, but upward to the fountain of all wisdom.” This tension within the scientific community led to a rift between science school advocates and technological institute supporters, although in each kind of institution both applied and abstract branches of science were represented. Practical science advocates employed the same arguments used against classicists—the inadequacy of existing systems, nationalism, and the knowledge explosion—to sway their colleagues.

On the inadequacies of existing American science instruction, the leading statement of this debate during the 1860s and 1870s came from Charles W. Eliot, then a professor at MIT. Eliot’s well-known “New Education” article in the Atlantic Monthly of 1869 gave several reasons why schools of science and parallel courses would never satisfy the needs of the scientific community. Most important to him, science schools and parallel courses could not escape their “ugly duckling” role on American campuses. The tried experiments suffered from an inferior position with regard to “property, numbers, and confidence of the community.” Enrollments remained low, observed Eliot, at the most prestigious science programs as a result. He referred to low entrance requirements, low graduation requirements, and an unco-
ordinated curriculum as additional reasons for the absence of progress in the separate schools as well as in parallel courses. The solution for science in higher learning, as far as Eliot was concerned, rested in the idea of MIT and similar technological institutes. In such independently established organizations, he believed, the freedom to pursue the pure and applied sciences would be left unhindered by traditions or inferior status.26

Other advocates of the Institute ideal focused on nationalism and knowledge expansion to further their claims. Charles G. Leland, founder, editor, and contributor to the Continental Monthly, supported the idea of MIT, as presented in Rogers’s Objects and Plans, because it offered an alternative to science instruction of “the old literary regime.” Leland had developed an understanding of educational reforms occurring abroad during his early years, having studied in Heidelberg and Munich and having lived in Paris before graduating from Princeton. Believing that “the time has come for the establishment of such Institutes,” Leland argued for the need to compete with European science and industry that benefited from such programs. While the whole of American higher education languished under a “feudal” order, the idea of MIT offered “the application of generous, intelligent culture to practical pursuits—the whole to be based on exact science.” Leland also looked to institutes to deal with the knowledge explosion in science. “The growth of science,” he remarked, “has... so vastly increased, that the proposition to reform the old system of study is really not to tear it down, but to build it up, to extend it and develop it on a grand scale.” Disillusioned with separate schools such as Harvard’s Lawrence School, critics looked to places like MIT to undertake the study of science and “technological information of every kind” with equal vigor. Leland urged readers to consider MIT as the first “thoroughly scientific university” in America.27

Returning to the inadequacies of existing science instruction, Horace E. Scudder, a science enthusiast and manuscript editor for several presses, wrote on the merits of “Education by Hand” for Harper’s Monthly readers. He was concerned about the dislocation of workers in an age transformed by industrialization. Scudder surveyed the decline of the apprenticeship system and the potential for technological institutes to fill the void. The process of industrialization and “other changes in our more complex society,” he explained, have rendered the apprenticeship system obsolete. MIT and similar institutes offered an “education of the hand... with the education of the mind” for those interested in the industrial and scientific branches of knowledge. For would-be apprentices the Institute provided experience with tools and instruments that could be found both in the machine shop and the scientist’s laboratory. For aspiring scientists, he continued, the program gave a theoretical foundation for the pure and applied sciences.28
Not all reformers believed that MIT could address the practical and theoretical needs of the scientific community. Some, like Edward Atkinson, found MIT’s course of study suited for advanced students of science but not as appropriate for the would-be laborer or mechanic. Atkinson was an industrialist and economist who had started his career as a textile factory floor-sweep at the age of fifteen. To him, a fervent MIT supporter, the instruction offered by the Institute for those interested in the mechanic arts was “suitable for a graduate of a [college preparatory] grammar school.” For others who lacked such preparation, another system would be needed to advance “primary instruction in the use of the hand.” Many agreed with the kind of observations made by Atkinson, observations that led to the founding of applied studies programs. New Jersey’s Stevens Institute, established in 1867, directed its focus to “the boy who has a positive talent” in the mechanic arts. According to those who visited the institution, few could match “the same facilities as the Stevens Institute” for practical studies. The Worcester Free Institute, which appeared in the 1870s, was designed for the same purpose: to address the demand in applied courses of study. “The distinguishing feature of the school,” applauded practical studies advocates, “is the practical part of the course of mechanical instruction.” The machine shop used by students followed a structured, formalized apprenticeship. With its practical emphasis the Worcester Free Institute was “working out one of the most important questions of technical education . . . namely, whether theoretical and practical instruction can, to any great extent, be successfully combined in a technical school.” Cornell University joined the applied science fervor when it created a program of civil engineering designed to meet the practical needs of industry and science. Together with the “numerous special schools of technology” founded in the 1860s and 1870s, Cornell’s program, its supporters claimed, helped staunch the tide of “students seeking instruction in the higher branches of applied science” who would have left for “the polytechnic schools of Germany or France.”

Pressed between abstract and applied factions within the scientific community, MIT faced a dilemma. Science schools claimed priority to abstract science, and emerging programs of applied science offered exclusive attention to practical studies. The idea of MIT, which aimed to offer both branches of science, faced criticism from the most abstract- as well as practice-oriented scientists. Observers waited to see whether MIT could fulfill the needs of both theory and practice within one institution.

While the feuds between classicists and scientists as well as those within the scientific community provided a general indication of how technological institutes were received, developments at MIT offered a case study. The status of MIT’s stu-
dent body, curriculum, and relationship to Harvard generated basic measures of the
Institute's reception.

During most of William Barton Rogers’s absence in the late 1860s and 1870s, the
Institute drew large numbers of students who would have sought scientific studies
in other programs in the United States or Europe. A mere three years after its found-
ing, MIT had three times the number of students enrolled in Harvard’s Lawrence
Scientific School. The Institute’s enrollment numbers steadily increased, widening
the gap between the two schools, until the economic panic of 1873. The panic and
ensuing depression slowed the gains they had made and for a time preoccupied the
schools’ officials. When the economic downturn passed, however, so, too, did the
cause for their concern. Initially, students came for the most part from within

Fig. 8.1. Comparison of enrollments at MIT and Harvard’s Lawrence Scientific School,
1866–1886. These figures are based on a review of the enrollment figures listed in
MIT’s Course Catalog and Harvard’s Presidential Reports for the dates surveyed. MIT
enrollments were: 1866, 69; 1867, 137; 1868, 167; 1869, 172; 1870, 206; 1871, 224; 1872,
264; 1873, 356; 1874, 303; 1875, 283; 1870, 280; 1877, 293; 1878, 267; 1879, 264; 1880,
279; 1881, 335; 1882, 390; 1883, 516; 1884, 561; 1885, 706; 1886, 730. Harvard enrollments
at the Lawrence School of Science were: 1866, 75; 1867, 61; 1868, 49; 1869, 41; 1870, 52;
1871, 41; 1872, 32; 1873, 40; 1874, 42; 1875, 29; 1876, 34; 1877, 29; 1878, 22; 1879, 17;
1880, 16; 1881, 37; 1882, 30; 1883, 25; 1884, 26; 1885, 28; 1886, 22.
the state. As the Institute became more widely known, the population broadened and attracted those from regional, national, and international locales. During the first five years the number of students from outside of Massachusetts rose from five to forty-three. The total enrollment figures included regular and special students. Students who had an interest in science but perhaps did not want to complete a full course of study were drawn to MIT. 

Fig. 8.2. Comparison of degree awarded at MIT and Harvard’s Lawrence Scientific School, 1868–1886. Records for degrees awarded can be found in MIT’s Course Catalog and Harvard’s Presidential Reports for the dates surveyed. By year MIT degrees awarded were: 1868, 14; 1869, 5; 1870, 10; 1871, 17; 1872, 12; 1873, 26; 1874, 18; 1875, 27; 1876, 43; 1877, 32; 1878, 19; 1879, 23; 1880, 8; 1881, 28; 1882, 24; 1883, 18; 1884, 36; 1885, 27; 1886, 59. By year Harvard Lawrence School of Science degrees awarded were: 1868, 8; 1869, 5; 1870, 7; 1871, 3; 1872, 1; 1873, 7; 1874, 5; 1875, 4; 1876, 3; 1877, 1; 1878, 5; 1879, 2; 1880, 0; 1881, 1; 1882, 1; 1883, 5; 1884, 1; 1885, 1; 1886, 2.

The actual number of those who enrolled and those who finished a program of study varied from year to year, and substantive differences existed between the Institute and Harvard’s Lawrence School in this regard as well. From the start Rogers had an idea of what kind of student would be successful at the Institute. His experiences with students at William and Mary and the University of Virginia would have reminded him that student behavior had a central role to play in the operations of any institution. Naturally, this meant that he wanted MIT students who would be “amiable and correct” in behavior. The Institute could not afford any reckless be-
havior given the expense of laboratory equipment and other apparatus used by students at MIT. Good behavior, however, was hardly enough, for students also needed to have a “decided aptitude and taste for scientific studies” in addition to a “sufficient capacity” for the coursework. Those with better preparation, which often meant better family standing, would likely have these traits. But Rogers was sensitive to reaching beyond any single class of student. He actively searched for those with aptitude, taste, and capacity from the laboring and industrial classes as much as any other, establishing connections with the Massachusetts Charitable Mechanic’s Association, an organization that supported the advancement of working-class youth in trade and technical work. Their discussions were aimed at supporting and enrolling a small number of students aided by the association. Whatever the social background, any student wishing to complete the requirements for the degree, according to Rogers, must have “zeal and energy.” Rogers, often described by others as a man “incessantly busy” and of “irrepressible activity,” didn’t look favorably on indolence and encouraged faculty members to identify students who did not have the vitality to complete the program.\textsuperscript{32}

Rogers also hoped that students would approach their studies with an appreciation of the Institute’s useful arts mission. Given its commitment to both practical and theoretical studies, students had extensive opportunities to engage in topics of both kinds of knowledge. This mission, according to student Charles R. Crop, gave the Institute one of its most attractive qualities. Crop, later a member of MIT’s alumni association, appreciated the efforts the institution had made in “fostering the highest scientific attainment and endeavors, and at the same time, in consequence of this, be a source from which the whole community may draw its most practical workers and teachers.” Students drawn to both the applied and the abstract would find a curriculum aligned with their interests. When students didn’t agree with or understand this mission, Rogers sometimes took it upon himself to meet with them individually. He kept a log of these meetings to assess student concerns and the state of the Institute’s instruction. In one such case, when a handful of students sent an open letter to the MIT Corporation about being deprived of a “thorough, complete and systematic instruction” in mechanical engineering, Rogers responded within days. Upon interviewing them, he discovered concerns common to students of any era: that the textbook was “too difficult to understand”; that the professor, in this case Channing Whitaker, breezed through topics too rapidly and “attempted too many subjects”; and that classroom exercises were “not practical enough.” Other students interviewed commented that complaints from this handful were “too sweeping and strongly expressed.” From these meetings Rogers concluded that delays and problems with laboratory facilities had impeded thermodynamics instruction and
had given the impression that the subject was unimportant. While understanding the students’ criticism, he also recognized that one student, who represented a few of his peers, only partially understood the useful arts approach taken by the Institute: “They were impatient to get to what they sought—more practical work, although in the opinion of himself and others—this [theoretical] subject was a fundamental one.” If these practical-minded students recognized the significance of fundamental principles of science, then they were one step closer to the useful arts ideal Rogers had in mind.\(^{33}\)

As he kept an eye on enrollments and the perceptions of students, Rogers also followed one of the great and pressing student-related concerns facing institutions of the era: coeducation. “Scientific” studies appeared in the 1870s that tended to support long-held ideas about separate spheres, the notion that men (in the world of work) and women (in the place of the home) best operated in separate domains. During MIT’s first decade, one in which the Institute’s members were considering the question of coeducation, Harvard professor of medicine Edward Clarke offered what were then considered evolutionary-based theories on why women and men shouldn’t receive the same education. The physical and physiological constitutions of each had evolved and differed to such an extent, he argued, that separate forms of education were essential for the proper development of both. While his specific scientific interpretations received a mixed reception, Clarke’s theories and those of others who followed, such as psychologist G. Stanley Hall, reflected broader social and cultural values that implicitly resisted equal forms of education for both sexes.\(^{34}\)

In this context the members of the MIT community asked themselves whether they would admit women into their regular program. Internal discussions among faculty and MIT’s government revealed a wide range of views. Although as recent scholarship suggests, it was common for young women to receive science and mathematics education at the precollegiate level, some at MIT held firm opinions against the idea of full coeducation; others who wanted to diversify the student population treated the topic gingerly. Rogers had already made clear that the Institute’s popular, evening scientific courses would be open to both sexes. He met little resistance in making the case for this part of the instructional program. If he chose to expand the idea to regular courses of instruction, that would be a different matter. In many ways he stood between two competing interests, for some MIT supporters, donors, and influential government members had little appetite for changing the composition of the student body; others on the faculty pressed for precisely such changes. Rogers leaned toward inclusivity, as he had with his antebellum reform proposals, but he also struck a delicate political balance to avoid alienating major sources of support.
When four women who had attended evening classes in the late 1860s approached the Institute about taking regular classes in chemistry, Nathanial Thayer, a major donor, caught wind of the development and inquired about what the institution planned to do. Rogers responded to both Thayer and the students by saying that full coeducation couldn't happen “without seriously embarrassing the organization of the laboratory and other departments of the school as connected with the regular courses now in progress” and closed off the option for the time being. With the Institute only a few years old at the time, Rogers dodged a challenge that was likely to complicate the school's standing in an era unaccustomed to coeducation. How he responded to Thayer and others suggests that he was torn between ensuring the economic foundation of MIT and his democratic ideas about science.35

Rogers's initial move against coeducation stood in contradiction to his views on women in science more broadly. At the Boston Society of Natural History discussions in the 1870s surrounded whether the admittance of women should be entertained. Should they be allowed into the meetings? Would there be topics discussed that were unsuitable to women? The society's president at the time, Thomas T. Bouve, was of the opinion that women were “not at all interested, or but slightly so, in science,” as he brought forward the question of admitting women. Rogers, knowing women had shown strong interest in the Institute, advocated that the society should adopt a system of grading membership without considering the sex of applicants. Although the proposal met with resistance and ultimately came to nothing, it reflected his ideas about women, science, education, and professionalization. On this count Rogers saw no reason to exclude merely on the basis of sex.36

After the Institute had survived its first five years in operation, Rogers began to encourage greater involvement of women in the Institute’s regular program. Of the women who attended the evening lectures, many continued to ask about the daytime laboratory experience offered only to men. Ellen Swallow was one of those who wanted such experience and applied for regular student status for the fall of 1870. At the time President Runkle knew that trying the coeducational experiment, with safeguards in place, wouldn't conflict with Rogers's plans, for he led the institution guided by the belief that Rogers had the “final word” on substantive decisions. Runkle admitted Swallow without tuition for the spring of 1871. “I thought the President of MIT,” wrote Swallow of her acceptance, “remitted my fee out of the goodness of his heart, but later I learned that it was because he could say I was not a student, if anyone should raise a fuss about my presence in the laboratories.” Her admittance nevertheless paved the way for additional female students. In 1876 the Women’s Educational Association offered funds to MIT for the foundation of the Women’s Laboratory. The laboratory aimed to meet the needs of MIT’s female
student population, which had increased since Swallow had been admitted, graduated, and become an instructor there. Once Runkle, Rogers, and the faculty agreed to the new laboratory, Swallow remarked that “the only separation of the sexes is in the lab work. I believe no other scientific school in the world can say as much.”

The *Atlantic Monthly* followed the developments in MIT’s student body and interpreted the new laboratory as a way to accommodate larger numbers of students. “A guaranty,” reported the magazine’s education editor, “was added that in any laboratories which might be built for the Institute in the future, provisions should be made for advanced instruction without distinction of sex.” The Woman’s Laboratory therefore meant not only new equipment and a building, but also a revision in the Institute’s policy on coeducation.

Delighted by these developments, local philanthropist and women’s rights supporter Marian Hovey contacted Rogers to see what she could do in support of the coeducational movement at MIT. The idea of the Women’s Laboratory caught her imagination and led to her decision to offer the Institute a gift of ten thousand dollars. She explained to him that, given MIT’s direction, she saw no need to word the offer “as to include women. . . . it seemed better not to use any exclusive phrase.” The purpose of the donation, to her mind, was to give “appreciation of the great practical work which the Institute is doing as well as from admiration for the justice and common sense with which women students are treated.” Rogers thus found a way to merge a broader, democratic vision of American science with local philanthropic support.

He also knew that he must proceed carefully if the coeducational movement were to last. His cautiousness came to the fore when discussing coeducation with Edward Atkinson, a prominent Boston financier, original MIT incorporator, and longtime government member. Atkinson’s voice was one that Rogers couldn’t ignore, given his standing in the community and his impassioned support for the institution. While some viewed his voice as mere “meddling” in Institute affairs, Rogers tended to take it seriously. Such was the case when it came to the issue of coeducation.

Atkinson and Rogers had differing views about when and where to permit female students. Following the Hovey donation, Rogers proposed expanding the rights of women who attended during regular classes. He noted to colleagues and government members that women at the Institute were engaged in activities beyond traditional student functions. Women also served as faculty assistants, conducting work in departments and in connection with the library. The question he put before them was one regarding the separation of sexes between laboratories. Although both have been admitted as regular students, “is there any special action needed for determining the
status of women as regular students?” “Having been regularly admitted,” he con-
tinued, “should they not have all the privileges of regular students?” He implied that
the distinction between labs seemed untenable in the long run and that the charge
of faculty was to teach the same material regardless of place and student popula-
tion.41

Atkinson disagreed. While he had little problem with including female student
names in the catalogue he as regular students, he didn’t think their inclusion as reg-
ular students should mean that they also receive all of the same privileges. “I think
it is not expedient that the women should go into the regular laboratory,” he ex-
plained, “[for] we have provided fitly for them.” By “fitly,” he was referring to the
Women’s Laboratory and, most likely, supplies and support generated from the
Hovey donation. If Rogers saw the distinction as artificial, however, he still went
along with it. Exactly why he followed this direction and what purpose he had for
doing so isn’t clear. The common concerns—maintaining economic security and
pleasing influential supporters—likely stood at the center of his decision to keep the
status quo. “The young women entering as regular students in the chemical courses,”
he informed faculty, “shall be expected to pursue their chemical work in the women’s
lab under the direction of the Professors in charge of the same, who shall arrange
their studies and examinations and judge their proficiency.” But in the end Rogers
won only a partial victory. On the one hand, he had witnessed the regular student
body change from single-sex to coeducation and an expansion of laboratory facili-
ties. On the other hand, the rights of regular female students to work side by side
with men in their chemical work still stood in the distance.42

Whatever their background or gender, all students began to see developments in
the curriculum that raised questions about the purpose and mission of the Institute.
Students who enrolled at MIT for the first two years followed a prescribed curricu-
lum in general preparation for advanced scientific study. The first and second years
focused on mathematics, mechanical drawing, freehand drawing, elementary and
experimental mechanics, chemistry, English language and literature, and modern
languages. The second year included extra work in navigation and nautical astron-
omy as well as surveying. “Up to the end of the second year,” read the Institute’s first
catalogue, “the studies are the same for all regular students; each thus obtaining such
an acquaintance with the whole field of practical science as is needed for the further
pursuit of the studies of the School, in any of its departments.” In the third and
fourth years, however, students could select specialized course work for one of six
majors: mechanical engineering, civil and topographical engineering, practical
chemistry, geology and mining, building and architecture, and general science and
literature. With the exception of mechanical engineering, the curriculum included extensive laboratory practice.\footnote{43}

During Rogers's leave of absence, Runkle wrote that mechanical engineering students needed a substantive laboratory in which to learn. As early as 1869, Runkle began to make arrangements for students in this area to gain field experiences off-campus. At first he arranged for them to work in machine shops at the Navy Yard in Boston. In years that followed he offered students professional field trips, but all the while Runkle continued to search for a system of laboratory instruction to match the Institute's theoretical and practical aims. Acknowledging that the Worcester Institute, Cornell University, and Illinois University each had “built up shops, but always from the manufacturing side and idea, and not from the teaching side,” he explained to Rogers that MIT needed something similar.\footnote{44}

In June 1876 Runkle believed he had found the answer to his problem at the Centennial Exhibition held in Philadelphia. Of all the displays at the science fair, the Russian exhibit made the most significant impression on him. “In an instant,” he explained, “the problem I had been seeking to solve was clear to my mind; a plain distinction between a Mechanic Art and its application in some special trade became apparent.” The “plain distinction” he referred to had to do with separating the skills needed in a trade from the skills to be taught at the Institute. In industry various trades employed similar mechanical skills and tools in a variety of sequences for such unrelated purposes as constructing machines for a mill factory and building a steam engine. Rather than teach each mechanical trade, however, the Russian system had constructed a model of training that would provide laboratory experiences for skills required across multiple trades without necessary reference to any particular application. Ecstatic over his finding, Runkle remarked that “making the art and not the trade fundamental, and then teaching the art by purely educational methods is the Russian system.” The Russian model had shown him that “the arts are few, and the trades many.” He immediately undertook an effort to develop the system at MIT and, in doing so, hoped to popularize the method in the United States.\footnote{45}

Runkle first turned to Rogers for support. He told him that “Russia has taught us a grand lesson. You know that the workshop problem as part of the course for Mechanical Engineers has been a difficult one.” The laboratory experience, he argued, had provided satisfactory results in the other fields studied at the Institute. With a similar offering, “our mechanical engineers . . . would be independent when they graduate, instead of being, as now, the most helpless product of any of our departments.” He explained that the work conducted by students in the system emphasized developing knowledge and skills rather than constructing products of marketable value. Runkle projected that students would learn exemplary uses of tools,
materials, and designs as opposed to the manufacture of objects. Rogers and the MIT government found the arguments compelling and agreed to implement the program in 1876.\textsuperscript{46}

MIT’s new program, the School of Mechanic Arts, received considerable publicity. In the wake of such attention Runkle’s plan gained its share of supporters and critics. Supporters cited the efficiency with which the new system would impart skills. Graduates of the program, reported one review, “may not be first-rate journeymen carpenters and machinists, but they are advanced beginners, and have a better general idea of the theory and practice of their trade than the average workman in it.” Another reviewer wondered how the Institute would avoid offering technical education that “is in the direction of a too long, minute, and elaborate preparation.” The Russian system, it was hoped, would be a more efficient means of instruction in this area. “Precious time is lost before theory is aided by practical illustrations and action. This evil of overdoing the preparation for technical instruction is to be avoided by the workshops of the Institute of Technology.”\textsuperscript{47} Still others looked optimistically to the new program as a grand step forward beyond the apprenticeship system. As one reviewer put it: “Herein lies the marked difference between education which the student receives in such a school and that which he receives in a shop—a machinist’s shop, for instance. There, once he has learned to do a thing well, he is kept at work upon it, because his labor is useful to his employer; here, once he has learned a process, he is advanced another degree, because his education, and not his availability, is the primary consideration.”\textsuperscript{48} Runkle’s supporters believed that the plan attempted to satisfy two purposes: efficiently preparing students seeking advanced scientific instruction and of those entering industry after two years of study in the Mechanic Arts school.

Critics were less optimistic about the Russian system. One believed that the MIT school made a start at “a movement in the right direction” but predicted it wouldn’t ultimately succeed. A similar program initiated at Girard College had “utterly failed” and resembled attempts at MIT to carry out the same enterprise. Its success would largely depend on if it received the proper “support” and “sympathy.” The advocates for “real experiences” found that the mechanic arts workshops failed to prepare students for on-the-job realities.\textsuperscript{49}

Runkle’s system, in the end, met neither of the two basic goals it had proposed to address. Students seeking advanced scientific training were uninterested in what the School of Mechanic Arts had to offer. Those seeking basic skills in the two-year program found the training insufficient for anything above entry-level positions in industry. After slightly more than a decade in operation, the MIT Corporation dissolved the Mechanic Arts school.
The freedom to experiment with the curriculum was an important factor that distinguished MIT from established institutions such as Harvard. The Institute, in large measure, stood for this kind of autonomy to start and discontinue programs without interference. The opening and closing of the Mechanic Arts school was part of the process that MIT promoted in trying alternative forms of instruction to meet the needs of abstract and applied sciences. To critics Runkle’s failed experiment with the School of Mechanic Arts meant that the idea of MIT was not yet firmly established. For supporters the expansion of enrollments at the Institute and the perceived decline of Harvard’s Lawrence School provided evidence favorable to the Institute’s standing. More important, the efforts of Charles W. Eliot to alter MIT’s relationship with Harvard provided a conspicuous measure of the Institute’s reception for both critics and supporters. 50

When Eliot resigned from MIT in July 1869, he believed the Institute had established a niche in American higher education by experimenting with instruction and the curriculum. Rogers hoped to keep Eliot on the faculty at MIT, but the chemist had been offered Harvard’s presidency. With Runkle in command at MIT, Eliot looked to Harvard to satisfy his administrative interests. “It will be a loss to us,” mentioned Runkle to Rogers, “but it will also be a gain to have a President at Harvard who believes that the mission of the two institutions is distinct, and that there should be no jealousy or rivalry between them.” At first neither Runkle nor Rogers suspected the merger plans then simmering. Upon leaving for Cambridge, Eliot praised Rogers’s “example and precepts, . . . wisdom and wide experience.” As for relations between MIT and Harvard, Eliot commented, “I mean to see that the Institute enjoys the field it has so honorably won, without competitions or duplication of any sort at Cambridge.” With these assurances the chemistry professor was installed as Harvard’s president in the fall of 1869. Soon after, however, Eliot began his effort to unite the two institutions. He gave every indication of his interest in the type of training offered by the Institute, especially in his inaugural address. Harvard should have “science taught in a rational way, objects and instruments in hand—not from books merely, not through the memory chiefly, but by the seeing eye and the informing fingers.” Much in the spirit of Rogers’s idea for MIT, Eliot emphasized that “the actual problem to be solved is not what to teach, but how to teach.” Even with such allusions, many Institute members missed signs of the coming controversy. 51

By January 1870 Runkle sent Rogers word of merger schemes brewing at Harvard. Runkle described Eliot as “full of the idea of consolidation of the Institute and Harvard University” and warned Rogers to expect a proposal from Harvard about a
merger. Because it wasn’t the first time Rogers faced such a proposal, he had a ready answer. “I can see nothing but injury to the Institute,” he told Runkle, “from the projected change. . . . Those who know our History know that [MIT’s] success is due to the Opportunity we have had under the inspiration of Modern ideas. No kind of co-operation can be admitted by the Institute which trenches in the least degree upon its independence.” Rogers clearly had no interest in having Harvard absorb the Institute.52

Regardless, Eliot continued to press for a merger. From Rogers’s point of view Harvard envied “the Institute [which] has already taken the first place among the Scientific Schools of the U.S.” With the laboratory method squarely at the center of the Institute, MIT had attracted attention for its experimental scientific instruction. For Eliot, Harvard’s Lawrence School seemed in a state of decline, failing to attract students or prestige. When compared to the Institute, one scholar described Harvard’s program as a “dead carcass.” Eliot himself would later bemoan the shabby state of science at his institution. “The reason why the School is dying is simply this,” he wrote to a benefactor, “the Sheffield School at Yale and the Institute of Technology at Boston have many more teachers, a better equipment, and a vastly greater variety of instruction.” Not surprisingly, the Harvard president felt pressure to do something effective with the large Lawrence legacy. His scheme was to transfer the Lawrence funds as well as those of the Bussey bequest to MIT, in return for making the Institute a “Faculty” within Harvard, similar to the Harvard Medical faculty in Boston. Eliot mentioned the plan to Runkle, assuring him of MIT’s independence to run the school as free from Harvard control as the Medical School, a “Completely Independent body.” As for retaining the character of its founder, Eliot suggested, “it would be right to give the combined institution the name of ‘Rogers,’” as in, perhaps, the Rogers School of Science. The composition of the governing bodies of Harvard and MIT, moreover, suggested that the plan might not face much resistance. Three from the Harvard Corporation were also original members of the Institute, and nine of forty government members from the Institute were graduates of Harvard.53

Convinced of the merits of his scheme and the inevitability of its implementation, Eliot began making arrangements to visit Rogers personally in Philadelphia. Runkle, himself a graduate of the Lawrence School, didn’t actively rebuff Eliot’s overtures. But he warned Harvard’s president that “the Inst. is simply what Professor Rogers has made it” and that “no one. . . will hesitate to accept any opinion which he may have in the matter as final.” Rogers still suffered from his “nervous exhaustion” at the time but decided to make his position on the merger perfectly clear. Interrupting Eliot’s plan to visit Philadelphia, Rogers assured him that “no contribu-
tion of funds would justify us in consenting to change.” Rogers had no doubt that a merger between Harvard and MIT “would be a decided disadvantage to the Inst., which owes its success in great measure to the fact that it has stood entirely unconnected with other institutions.” Without hesitation he placed autonomy before all else.54

Eliot didn’t give up. He simply began to talk independence with Rogers, about how the merger would not make MIT any less independent, about how the Institute would retain its property and organization. He replied to Rogers that MIT “would be stronger and more independent than now” if it became “an independent department of . . . [Harvard] University.” Rogers dismissed Eliot’s argument that the merger would preserve the Institute’s autonomy. Runkle and a majority at MIT sided with Rogers, while Eliot positioned the Harvard Board behind the scheme.55

Much of this activity occurred in the few months between Rogers’s resignation from the Institute and Runkle’s official election to the presidency. Eliot saw this period as a window of opportunity to maneuver his plan into action. Almost the instant he assumed the MIT presidency, Runkle agreed to committee meetings with Eliot, each president bringing two officers or faculty from their respective institutions. When Runkle reviewed some of Harvard’s generous offers and detailed plan for autonomy, he asked Rogers, “Shall we take it?”56

Runkle wrote with more enthusiasm for merger than ever following these meetings during the fall of 1870. He knew Rogers would disagree with a provision in the latest merger plan that required all changes to courses, departments, instruction, admission, and graduation to be approved by Harvard. Runkle acknowledged that “this would not leave us much after all.” But he also argued that “if we do not unite, & do not get the means . . . to raise salaries we shall lose all the Professors we have whom we could least afford to spare.” Rogers brushed aside the arguments and, by helping to defeat Eliot’s plans, left little doubt about his desire for MIT to continue as an independent center of science instruction and research.57

The general reception of the Institute, as measured in public discourse as well as the school’s enrollments, curriculum, and relation to Harvard, would continue to preoccupy Rogers. But for a time he turned to matters having to do with science and professional service. As always, he approached work in these areas with both the practical and theoretical in mind—a conviction around which he had organized his idea of the Institute and one he had often presented to the public.

During his ill health between 1868 and the mid-1870s, Rogers revisited his interests in geological research and the professionalization of science. He had never felt finished with his survey work in Virginia after the state declined to publish his final
report. Rogers’s years of notetaking, mapmaking, and laboratory work had not yielded a full and complete public record. During the Civil War the Union army commissioned Thomas Ridgeway, a former assistant on Rogers’s survey, to construct a map of Virginia. Ridgeway produced a map based on notes collected on the geological survey. As the war map fell into obscurity after Appomattox, Rogers planned to prepare a final geological map and report for the state. To this end Jed Hotchkiss became Rogers’s best hope for completing the project. Hotchkiss, a Virginia educator and free-lance engineer, had gained surveying and mapmaking experience as a Confederate soldier. In 1873 Hotchkiss’s work with the Washington College Board of Surveying led him to collaborate with Rogers. The result was published three years later in *Virginia: A Geographical and Political Summary*. Set to a scale of twenty-four miles to one inch, the map brought Rogers closer to his ambition. Yet in subsequent years Rogers and Hotchkiss planned a more detailed map, one with a scale of eight miles to one inch. Because of health reasons, Rogers couldn’t contribute to the completion of a larger map.58

In 1875, and over the next five years, Rogers managed to publish works on Virginia’s deposits, maps, geological formations, and iron ores. In addition, he wrote on the notebook records gathered from field researchers on the survey. Despite these efforts in the twilight of his career, he’d only scratched the surface of producing a thorough survey report, which he had long desired to complete.59

As for professionalization, Rogers focused his efforts on the National Academy of Sciences (NAS) as it continued to serve its function of providing scientific advice to government agencies. Predictably, he fell into conflict with old guard Lazzaroni members at the academy. By controlling of the membership list, some of these members continued to oppose Rogers and the faction he represented. Shortly before the onset of his illness in 1868, he’d failed to attend some of the annual meetings, causing his name to be “stricken from the roll of members.” He suspected foul play when the NAS declared “non-attendance . . . without communicating to the Academy a valid reason for his absence” as the reason for revoking his membership. Upon receiving notice in 1872 of his reelection to the academy, Rogers decided to contact NAS president Joseph Henry directly about a similar matter concerning his brother Robert. William refused the offer of reinstatement if his brother Robert remained a nonmember. “As he became a member of the first organization with me,” explained William, “and was dropped from the list at the same time and for the same cause . . . I could not consent to be the object of any partiality in the matter of reappointment.” With his notice to Henry, William issued his resignation to the academy. Joseph Henry accommodated the request and ultimately installed both brothers as members once again.60
After his reinstatement in the National Academy of Sciences, William’s activities within the organization steadily grew. During his absence the academy had suffered setbacks, including a dwindling membership and a complete halt to government requests for advice. For a time in 1870 some scientists sought to disband the organization. Astronomer Simon Newcomb thought it “increasingly doubtful whether the organization would not be abandoned.” By the time Rogers returned to the NAS, then president Joseph Henry had managed the problems by expanding membership rolls, reducing to one the number of meetings in a year and requiring members to have an established program of published research. With such moves Henry kept together the academy as an honorary society. The first substantial work offered to the NAS came in 1878, when Acting President O. C. Marsh elected Rogers and five other scientists to help resolve survey disputes in the western territories. The project breathed new life into the organization and gave Rogers an opportunity to exercise his geological experience.

Rogers and the committee began a review of five major surveys of western territories that had been commissioned simultaneously in the 1870s. Wrangling and disputes emerged between the expedition parties involved, which included Union Pacific and Central Pacific railroads, the Corps of Engineers, the Department of Interior, the Smithsonian, and the Treasury Department. As their interests clashed, Congress requested the academy to consider potential resolutions to the survey disputes. The committee reported to Congress on plans, methods, and expenses for a survey of the western territories. The recommendations gave direct rise to the U.S. Geological Survey housed by the Department of Interior. The survey also became the first large-scale agency wholly conceived by the academy and acted upon by the federal government. Marsh commended Rogers for his efforts on the report to Congress, noting that it was “as well received in Washington as it was by the Academy.”

Developments with the survey in part paved the way toward the selection of Rogers as the third NAS president, following the presidencies of Bache and Henry. On the day of the election in April 1879, the academy informed Rogers by telegraph from Washington of his election. Surprising attendees such as Harvard’s George J. Brush, who imagined the nearly seventy-five-year-old president in frail health, Rogers arrived the next day to deliver an acceptance address. As a result of health problems, however, Rogers served as the academy’s president for only three years, half the normal term for the office. During his tenure three basic developments occurred. First of all, a recently formed National Board of Health requested the NAS assist in formulating a plan to organize a nationwide public health program. The board had been created to respond to a yellow fever epidemic spreading along the
Mississippi River in 1878. Their request of the academy resulted in a collaborative effort between the two organizations in issuing a report submitted to Congress in 1880. They recommended a plan for organizing both military and civilian health workers to respond to epidemics of the kind witnessed two years earlier. The second development came out of increasing concern over the condition of the original Declaration of Independence. Congress sought advice from the NAS on what to do with the aging, fading document. After determining part of the cause of deterioration—such as the fading of ink, the wear caused by “press copies,” exposure to the elements—the academy ran tests and determined that chemicals wouldn’t preserve the document. Instead, Congress abided by the NAS’s suggestion to secure the document behind a wooden enclosure. The third request came from Rogers, who initiated a movement to restart publication of the organization’s proceedings. He believed that the papers delivered by NAS members at their annual meeting would better serve the advancement and diffusion of science if supported by an annual publication. Out of the movement came the NAS Memoirs, a publication that ran until the opening of World War II.63

Despite his age and flagging health, Rogers received offers to hold other offices during and after his leave of absence from the Institute. The American Association for the Advancement of Science elected him president in the 1870s. Although scheduled to present his research before the AAAS, he had to decline for health reasons. When elected president for the Boston Society of Natural History a few years later, he flatly declined the offer for health reasons as well. The same issue caused him to step down from offices in local Boston societies, such as the Thursday Evening Club and the Saturday Club. By the fall of 1874, however, Rogers had returned to the area and was entertaining club members at his home with Emma.64

What these research and professional appointments suggest is that, whenever possible, Rogers continued to present a public persona for the useful arts ideal. His commitment to the geological studies of Virginia kept him engaged with basic scholarly questions in earth science as well as with practical efforts to develop knowledge of southern natural resources. The professional appointments gave him a platform from which to advocate the interests of both practitioners and theoreticians. He thus managed to turn public perceptions of the Institute from what they had been after the inaugural addresses of Bigelow and Atkinson to what he had envisioned since his first efforts at higher educational reform. By this point in Rogers’s remaining years, he and the Institute had become one and the same in the public eye. In the words of John Runkle, who at the time led the Institute as president, MIT “is simply what Rogers has made it.”65
When Runkle stepped down from the presidency of the Institute in 1878, it’s not surprising that many looked to Rogers to assume the post. Yet the empty coffers at the Institute, not to mention the founder’s physical condition, made a return unlikely. He made clear that the only way he’d take the job would be if the MIT government made a commitment to raise $100,000 to renew the dwindling endowment and begin an immediate search for a successor. They called his bluff.66

Before the Institute had time to settle into a second Rogers presidency, he began conferring with the school about having Francis Amasa Walker as his successor. Walker had achieved distinction as a social scientist at Yale and as the director of the 1880 U.S. Census during President James A. Garfield’s administration. After discussing the opening with Walker, Rogers received authorization from the MIT Corporation to deliver a formal offer. “I now write,” he stated in June 1880, “to offer the position to you, and I need not say my dear Prof. how earnestly I desire that you will accept it.” Delays in Washington prolonged Rogers’s stay at the Institute until November 1881, when he had the opportunity to introduce Walker to the faculty formally. Walker complemented the science faculty with his offerings in political economy, a match that would help broaden the technical training of MIT students. From that point forward Rogers felt “released from the cares of MIT” and free to pursue his unfinished projects.67