Purists

In a rousing address delivered to incoming students in 1875, Harvard professor of chemistry and mineralogy Josiah Cooke readied his charges for the painful life that lay before them. To grapple with nature, Cooke insisted, one must be prepared to “labor long in the dark before the day begins to dawn.” The toil of scientific work, however, wouldn’t end with mere deprivation of slumber. Ideally, one should strive to exceed in zeal that “student who would cut off his right hand rather than be guilty of a conscious untruth.” Reprinted in Popular Science Monthly, Cooke’s interweaving of devotion, truth, and suffering presaged themes that would soon reverberate through the writings of university-based researchers. Drawing on well-worn images of ignorance and wildness, Cooke’s Harvard colleague Charles Gross described in 1894 how the investigator’s singular “zeal for truth” drove him into “the dark forest of the unknown,” a “love of patient, disinterested, conscientious labor” overwhelming any fear of danger. Similar allusions permeate the essays of psychologist G. Stanley Hall, who regularly proposed that the “great edifice” of science had been built by men “content to spend laborious lives, to become laboratory hermits, to explore with great hardship, labor and risk and even in inhospitable lands, to deny themselves.” Beginning in the 1870s and extending into the first years of the twentieth century, commentators such as Cooke, Gross, and Hall explicitly tied an embrace of suffering to a special love of truth. Arguing that the true aims of scientific inquiry had become confused with the vulgar, materialistic ends of practical application and financial advancement, such reformers promoted “pure science” as an ennobling antidote to the masses’ preoccupations with utility, profit, and ease.

Such promotion was hardly inevitable. In 1835, Alexis de Tocqueville famously declared that “the pure desire to know” was utterly absent in America and confessed his skepticism that a passion for truth might ever arise in a democratic nation, particularly one so “addicted” to practicality. Although Alexander Dallas
Bache and some members of the Lazzaroni began promoting truth for truth’s sake as early as the 1850s, these calls remained exceptional until later in the century. Instead, unflattering comparisons between U.S. science and the “higher interests” of continental Europe remained standard fare in the writings of foreign visitors for nearly forty years. Yet by the mid-1880s, advocates of pure science could be found in governmental organizations, learned societies, colleges, universities, museums, and private funding agencies. In freshly revamped ecclesiastical colleges and new research universities, advocates of “science for science’s sake” held increasing influence. The generation of scientists born after 1840 saw support for pure science materializing in new institutions, such as Columbia’s School of Pure Science (1890), and in new endowments for research, such as Elizabeth Thompson’s large donation to the American Association for the Advancement of Science in 1873.

Historians have long discussed late nineteenth-century investigators’ infatuation with pure science and have described the “emotional resonance” that themes of purity held for the first generation of university-based scientists. These scholars have illustrated how proponents of pure research, under the influence of German academic fashion, expressed disdain for commercialism, exhibited conviction in the moral significance of labor, and promoted inquiry as a path to professional and national advancement. Their work has shown not only that advocates of pure science steered the course of developing research universities but also that these universities, in turn, altered the shape and scope of scientific research. This chapter complements and extends that work by revealing the centrality of voluntary suffering to these developments.

Pure science, its advocates proposed, was distinguished by its refusal of utility and practicality, by its removal of men from the more “sordid things of the world.” Unlike applied science, which generates “comfort, pleasure and happiness,” the “modern spirit of pure science . . . elevates man’s ideals.” As we will see, this elevation was effected by demonstrations of hardship: the purist’s embodied displays of deprivation testified to his emancipation from material concerns. Through voluntary suffering, proponents of pure science incorporated endeavors increasingly marked by institutional specialization and fragmentation, claiming diverse and disparate practices as part of the single, demanding body of science.

This deliberate embrace of toil, poverty, and fasting, and the understandings of purity it enacted, reveal the characteristic paradoxes and exclusions of the sacrificial self. For while the will to suffer helped to demonstrate the purity of the investigator’s devotion to science, the fleshly evidence of this suffering was conditioned by existing systems of privilege. Only the fully self-possessed scientist might indulge the call to sacrifice.

PURITY IS AN ancient concept, and the coupling of purity and suffering promoted by late nineteenth-century university reformers had deep roots. The
term *Puritan*, first used as a term of opprobrium by early critics, evokes the sect’s torturous efforts to regain the all-encompassing religiosity of the first-century church. As Puritanism took hold in the New World, its creed of moral elevation through toil and renunciation grew into the splintering branches of American Protestantism. The dominant motifs of Christ’s sacrifice, including its valorization of transcendence through suffering, remained central to New England theological traditions through the nineteenth century.

Most late nineteenth-century proponents of pure science imbibed while still in childhood this brew of suffering, moral uplift, and worldly labor. G. Stanley Hall was taught to affiliate suffering with spiritual zeal as a member of his deeply religious western Massachusetts family. When his maternal aunt died in adolescence, Hall’s grandfather stood with his hand on his daughter’s coffin and declared it “the happiest day” of his life since he “felt the love of God so shed abroad in his heart.” Other advocates of pure science shared similar backgrounds. Of the men who entered scientific fields between 1861 and 1876, more than 27 percent had fathers employed in ministry, a greater percentage than in any other occupation. The eminent botanist John Coulter was born in China to missionary parents, while geologist Thomas C. Chamberlin was the son of the well-known Methodist minister John Chamberlin. Hall, Ira Remsen, Henry Rowland, and other vociferous proponents of pure science all studied for the ministry before choosing scientific careers. While they moved away from religious service, they maintained Protestant ideals of purification through worldly labor.

Such ancient religious ideals of purity took particular shape in the unsteady political context of post-Reconstruction America, as those contesting the boundaries of the nation and the rights of individual citizens tapped into inherited Christian ideals. In the period of pure science’s ascendance, no political and economic controversy evoked the language of purity and pollution more than the issue of Chinese immigration discussed in chapter 1. Debates over anti-Chinese exclusion laws focused on the threatened purity of American civilization, a purity understood as simultaneously moral, intellectual, and physiological. In an influential 1862 treatise on Chinese immigration, California physician Arthur B. Stout laid out the themes of defilement and infestation that would become increasingly prevalent over in the 1870s and 1880s. The “great West,” Stout proclaimed,

is overwhelmed with a Chinese immigration. Once permitted it must be forever endured. The work of degeneration once commenced, its progress must pursue its insidious and empoisoning influence, not for a few years, but for centuries to come. The legislation now enacted is less for our own that for generations which, in the future, by their purity shall bless, or in their degeneration shall curse, their ancestral stock.
Such calls for legislative prophylaxis were soon heeded: the special taxes on foreign miners in place since the 1850s were followed by more overt prohibitions and restrictions, including the Page Law of 1875 and the first of several Chinese Exclusion Acts in 1882. In the 1870s and 1880s, references to “purity” invariably conjured ongoing dispute over race and civic participation.\footnote{15}

Indeed, the entanglement of moral, physiological, economic, and racial norms recurs in the writings of proponents of pure science. These entanglements are helpfully pronounced in physicist Henry Augustus Rowland’s famous 1883 “Plea for Pure Science” before the American Association for the Advancement of Science, an address that one historian aptly dubs the “ne plus ultra of pure science rhetoric” in the nineteenth century.\footnote{16} Widely cited by university reformers, Rowland’s speech displays the role of voluntary suffering in emerging definitions of pure science, including the familiar exclusions and paradoxes which that suffering entailed. The remarks at once reflected the period’s racialized discussions of purity and civilization and invigorated the links between these discussions and the imagined body of science.

As a child, Rowland seemed destined for a life in the clergy: he was the son and grandson of Congregational ministers and the alleged descendent of Jonathan Edwards. Yet by the age of twenty, Rowland abandoned a future in the ministry and declared it his “duty and vocation to be an investigator in science.” “I intend to devote myself hereafter entirely to science,” he wrote to his mother in 1868. “If she gives me wealth I will receive it as coming from a friend but if not I will not murmur.”\footnote{17} Particularly talented in optics, magnetism, and electricity, Rowland pursued his interests first at Wooster University, then at Rensselaer Polytechnic Institute, and finally as a faculty member of the new Johns Hopkins University. Described by a former colleague as “supercharged with new ideas,” he quickly became one of the foremost investigators of his generation, known in both the United States and Europe for his work with spectral diffraction gratings. In the summer of 1883, at the height of his professional renown, Rowland traveled to Minneapolis to the annual meeting of the American Association for the Advancement of Science, where he delivered the vice-presidential address of the association’s physics section.\footnote{18}

The address sparked discussion across the country. Shortly after Rowland’s speech, physicist and engineer William A. Anthony told the association that Rowland hardly fulfilled his own stated ideal of pure science. As Anthony pointed out, Rowland’s position as an industrial consultant and holder of several patents made him a rather hypocritical proponent of the nobility of nonutilitarian research. Anthony also drew attention to the elitism of Rowland’s position: “Few can devote their lives to work that promises no return except for the satisfaction of adding to the sum of human knowledge. Very few have both the means and the inclination to do this. Most of us are dependent upon salaries, and a salary binds us to service which, unfortunately, does not, in this country, usually mean scien-
tific research.” Others, however, heard in Rowland’s critique of profit-oriented research echoes of their own growing dissatisfaction with the commercialism of American science. In a letter to the president of Johns Hopkins, physicist John Trowbridge described the popularity of the speech’s message among his colleagues at Harvard. The Harvard men, Trowbridge noted, were themselves too timid to lash out at “mercantile professional chaps” as Rowland had done. Other approving listeners urged publication of the address; and “A Plea for Pure Science” was soon reprinted in Science, the Journal of the Franklin Institute, Popular Science Monthly, and an array of other periodicals.

A close reading of Rowland’s text illuminates the place of suffering in defining pure science. The address begins by differentiating pure science—a term conflated with science throughout the speech—from its “applications,” conveniences such as telegraphs and electric lights. To make the somewhat hazy distinction between pure science and its applications more clear, Rowland distinguishes the types of men engaged in each activity. A “people like the Chinese,” he suggests, have satisfied themselves with the applications of science, using gunpowder without analyzing its chemical properties. By failing to pursue further research, the Chinese have “fallen behind in the progress of the world; and we now regard this oldest and most numerous of nations as only barbarians.” If “Americans” hoped to resist a similar slide toward barbarity, they must display the “moral courage” necessary to obtain new knowledge of scientific theory. Rowland here assumes that the nation’s evolutionary position is mutable: it might advance through courageous work or regress through sloth and inattention—a position he shared with other university reformers of the time.

Moral courage is required, he continues, since pure science necessarily entails hardships, particularly financial impoverishment. Unlike the applications of science, which offer immediate economic rewards, the “higher pursuit” of scientific study attracted no monetary benefits. The researcher’s courageous disavowal of material concerns therefore becomes a prerequisite for pure science. Echoing the declaration of poverty he made to his mother fifteen years earlier, Rowland insists that the pure scientist must not be guided by acquisitiveness: “If our aim in life is wealth, let us honestly engage in commercial pursuits, and compete with others for its profession; but if we choose a life which we consider higher, let us live up to it, taking wealth or poverty as it may chance to come to us.” The stigmatizing connotations of poverty are thus elided through the matter of choice: the atavistic barbarian haplessly endures material impoverishment, but the “great and unselfish workers” of the past elect this condition. The exemplary “poor man,” Michael Faraday, represents the “few, the very few, who, in spite of all difficulties, have kept their eyes fixed on the goal.”

The embrace of poverty demonstrates the choice itself: Faraday’s renunciation of material goods and his pauper’s death testify to the purity of his devotion to truth.
Scientists such as Rowland were hardly unique among late nineteenth-century professionals in trading lamentations about salaries with sympathetic colleagues. Yet unlike commentary on law or medicine, disregard for financial affairs here acted to define pure science as distinct from alternate modes of investigation. For Rowland, poverty constitutes the boundaries of the endeavor: a man made wealthy by his research would, by definition, no longer be pure.

Poverty, however, is not the only hardship said to demand the pure scientist’s moral courage. According to Rowland, a tolerance for social isolation is equally important for those abandoning applied or commercial endeavors. Because pure science requires unencumbered travel in the furthest reaches of the unknown, investigators must be willing to deny their inherent conviviality. Since “Man is a gregarious animal, and depends very much, for his happiness, on the sympathy of those around him,” the pure scientist’s ability to curtail these animal desires is crucial to his success. While stopping short of declaring the scientist’s need for chastity, Rowland’s speech stresses the importance of solitude. In the United States, pure science necessitates a particular tolerance for loneliness, he informed the crowd gathered in Minneapolis, since Americans are uncommonly hostile to nonprofitable endeavors. In such a materialistic nation, the pure scientist “must be prepared to be looked down upon.” As with the endurance of financial hardship, the investigator’s suppression of his innate sociability becomes synonymous with pure science itself. In Rowland’s terms, “pure science is the pioneer who must not hover about cities and civilized countries, but must strike into unknown forests, and climb the hitherto inaccessible mountains which lead to and command a view of the promised land.”

So intense are the myriad hardships of pure science, he suggests, that only those who share a “love of nature” will be moved to participate; the nature of the self determines the nature of the science and vice versa. Because the work of pure science is so difficult, so lacking in financial reward, and so opposed to man’s “gregarious” nature, most will be driven away from its pursuit. The true scientist, however, possesses ardor sufficient to compel the embrace of toil, poverty, and loneliness. Unlike applied scientists, pure scientists are not motivated by the common aims of wealth, fame, or societal improvement but by “pure love.” “We must live such lives of pure devotion to our science,” Rowland maintains, “that all shall see that we ask for money, not that we may live in indolent ease at the expense of charity, but that we may work for that which has advanced and will advance the world more than any other subject, both intellectually and physically.”

The purity of the science, in other words, lies not in the object of inquiry but in the inner affect of the scientist—in the moral character of his desire.

These affections, essentially internal and invisible, are made evident by the scientist’s persistence in the face of suffering. Devotion impels him through the
vale of solitude and poverty; at the same time, endurance of these hardships reveals the purity of his veneration. Insisting on the necessity of isolation and poverty, Rowland implies that these difficult external conditions affirm the scientist’s inner commitment: “if the spirit is there, it will show itself in spite of circumstances.”28 The scientificity of the man—that is, the purity of his devotion to truth—is never so vivid as when placed against the backdrop of loneliness and destitution. In the words of Rowland’s famous ancestor, Jonathan Edwards, “true virtue never appears so lovely, as when it is most oppressed.”29

Rowland’s speech does not suggest that devotion alone can support pure science. Alongside glowing descriptions of Faraday’s noble endurance of poverty, Rowland lobbies for greater public provision for pure scientists and their research within the collective space of the university. Unlike the novelist, the poet, and the musician, Rowland complains, the scientist lacks any external incentive to work. While a “chivalric spirit” might encourage rare men such as Faraday to devote their lives to the study of nature, to “cultivate this highest class of men in science, we must open a career for them worthy of their efforts.” In time, Rowland maintains, the presence of full-time pure scientists within the university would transmit the importance of this work to future generations. “Young men, looking forward into the world for something to do, see before them this high and noble life, and they see that there is something more honorable than the accumulation of wealth. They are thus led to devote their lives to similar pursuits, and they honor the professor who has drawn them to something higher than they might otherwise have aspired to reach.”30

Rowland thus identifies the university as a special preserve for those men who share a “love of nature,” that elite group with the “ability” and “taste for higher pursuits.” So great is the emphasis on this special ability that it appears the more “the masses” despised an endeavor, the more pure it became.31 The elite devotees of science—whom Rowland insists are neither Chinese nor “red” men nor, apparently, women of any color—are distinguished by their willingness to endure whatever obstacles the pursuit of science might entail.32

Recalling earlier theological debates over the nature of free will, whether these “better feelings” are entirely inborn or whether men might elevate themselves through perseverance and hard work remains an unanswered question in Rowland’s remarks. While emphasizing the civilizing effects of toil, he also insists that “it is a fact in nature, that no democracy can change, that men are not equal,—that some have brains, and some hands; and no idle talk about equality can ever subvert the order of the universe.”33 The point to reiterate here, however, is that endurance of hardship, renunciation of wealth, and disavowal of companionship helped to demonstrate the scientist’s purity. Whereas telegraphs and electric lights indicate applied science, pure science is signaled by the poverty and loneliness of its practitioners. For a science characterized by the scientist’s inner devotion, such ordeals provide crucial testimony to the
integrity of internal commitment, whether inborn or acquired. Palpable suffering renders visible the self’s moral character.

To be sure, suffering was not the only route to truth found in narratives of scientific advancement. Rowland himself distinguished these paths when accepting a medal from the American Association for the Advancement of Science, segregating results stemming from “long and persistent endeavor” from those obtained by “happy accident.” Willful labor, he reminded his audience, must not be confused with fortuity. Nor did all scientists glorify voluntary suffering. As Rowland idealized the scientist’s groveling pursuit of an ever-distant truth, other self-described scientists were pathologizing avowed commitment to continually deferred satisfaction. In emerging studies of masochism, displays of willful debasement troubled rather than enlarged the subject’s perceived capacity for rationality.

Yet the “Plea for Pure Science” amplified themes flowing through the writings of university-based advocates of pure science in the 1880s and 1890s. Like Rowland, these advocates generally held salaried positions in new research universities, had been reared in pious Protestant families, and considered ministry before choosing scientific careers. And like Rowland, they tied the purity of science to the scientist’s willingness to suffer. Pure scientists’ unique “spirit of inquiry,” it was routinely suggested, propelled them through the inevitable hardships of the scientific endeavor. The scientist’s extraordinary devotion to truth was said to inspire an uncommon tolerance for “toil, solitude and penury.” Like the stigmata of a tortured saint, the scientist’s tribulations, an embrace of “unremitting toil,” manifested an ineffable, interior devotion to truth. And in each case, pure science was defined by this inner affect. As University of Michigan physicist Henry Carhart argued, passionate zeal for truth distinguished the pure scientist: “It is a gross libel on scientific men to assert that the chief end[s] . . . are narrowly utilitarian or intensely practical. If worldly success were the only reward awaiting the scientific investigator, but few branches of science would be fortunate enough to find their votaries. The taste for scientific research is a passion which finds its gratification in the truth it seeks.”

As in Rowland’s “Plea,” these discussions display a persistent ambivalence about whether this inner purity was inherent and fixed or whether it might be acquired and cultivated through deliberate labor. They also waffle on the attribution of causal agency: in some instances, the desires of the scientist direct science’s unfolding; in others, the demands of science direct the scientist’s desires. Science, Hall wrote in 1894, “transfigures work so that men come to love nothing so well as difficulties to be overcome.” Like the domineering “Venus in Furs” of Leopold von Sacher-Masoch’s famous 1870 novel, in this instance scientific truth holds the dominant role in the relationship, rewarding only “those who truly love and wait upon her.” Writing in 1900, Charles Sanders Pierce similarly emphasized the scientist’s servility but instead placed agency with the “man of
science” moved by his “deep impression of the majesty of truth . . . that to which, sooner or later, every knee must bow.” In pure science as in other domains of life after Reconstruction, the free, volitional self was constantly in tension with the demands and imperatives of larger abstractions. Like the Christian, the pure scientist displayed his will most by submitting to a higher power.

The scientist’s devoted subservience emerged in tandem with this power, the object for which one chose to suffer: a truth that negates completion and satisfaction. In the opening decades of the nineteenth century, “truth” was hardly so mercurial. Instead, it was generally represented as a comforting edifice of universal knowledge, stable and timeless. The scholar’s task was to study this unchanging edifice, to know and represent its fine contours. Yet with the shift from truth to objectivity as the dominant epistemological ideal after midcentury came a corresponding sense of the ephemerality and incompleteness of human knowledge. The arrival of the principles of Darwinism, the abandonment of the Newtonian emission theory of light, and other radical reorientations of thought challenged any notion of truth as comprehensive and lasting. Everywhere there seemed new evidence for what Lorraine Daston has called “the Heraclitean lesson of panta rhei”: nothing in stasis, everything in tumultuous upheaval. As Ernst Mach noted in 1872, “attempts to hold fast to the beautiful moment through textbooks have always been futile. One gradually accustoms oneself [to the fact] that science is incomplete, mutable.” Because truth was a permanently receding object, the pure scientist was accordingly imagined as a doting follower, Sisyphean in his relentless toil. Echoing the capitalist imperative of privation in the name of a future, always-deferred reward, the seeker of truth similarly affirmed renunciation in the name of a distant, indeed unattainable goal. Pure scientists praised one another for engaging in the restless pursuit of an ephemeral ideal—“like the chase after the foot of the rainbow, which ever moves onward as it is pursued.”

Emphasis on scientists’ servility was of particular consequence to pure science, a field whose most palpable attribute was the flesh of its practitioners. As an endeavor identified by a lack of material productivity—as that “for which there is no reward except the glory thereof”—pure science could only be demonstrated by its subjects themselves. Just as useful inventions such as telegraphs and electric lights provided the tangible incarnation of applied science, so the fatigued, impoverished body of the researcher came to manifest pure science. The pure scientist’s body suggested his internal predilections, the integrity of his deep love for truth. While working out a difficult and forceful idea at Johns Hopkins, for example, eminent mathematician James Joseph Sylvester sat up “a good part of the night with his feet in warm water to check the rush of blood to his head.” Absorbed in the course of his research, Harvard’s Charles Gross often neglected to take meals, a habit thought to have hastened his fatal illness. Perennially concerned that he was faltering in the pace of his research, Gross’s
Harvard colleague Herbert Levi Osgood frequently rose from bed at two o’clock in the morning to continue his work. Watching Osgood, his colleagues recalled, “one could almost actually see the element of will pitilessly driving a poor body to the limit of its power.” The fact that prominent scientists were rarely seen outside the laboratory was taken as further testimony to the purity of their devotion to truth. Socially inept researchers were lauded for their ability to devote themselves even “more assiduously, not only days but nights,” to their scientific work. Invoked in each instance as the natural premise for such behaviors, the pure scientist’s moral integrity was constituted through his laborious suffering; manifest misery signaled an invisible, interior devotion to truth. Impoverishment, fatigue, social isolation, and other displays of deprivation substantiated the ardor of the researcher’s devotion and hence the intensity of his proximity to pure science.

In the eyes of its proponents, the university offered a particularly important location in which to live out this devotion. This was not because the university was free from commercial interests. Rather, the university was distinguished as a site for pure science by a relative lack of stricture. At a time when Darwinism still drew ire and censorship in denominational colleges, the absence of external compulsions (from administrators, clergy, or trustees) emerged as the crucial difference between the university and the conventional American college. The “true distinction between Collegiate and University education,” said the president of Tulane University in an 1884 address, is that the “former is training, the latter emancipation and liberty.” “If it is the truth that makes us free,” Johns Hopkins professor Basil Gildersleeve wrote in 1893, “it is freedom that opens the way to truth.” To effectively “fan the burning coals of that enthusiasm which is absolutely untainted by any sordid motives into the intensest glow,” Hermann von Holst argued at the first convocation of the University of Chicago, students must be granted a “large measure of liberty,” not only with respect to “the What, but also as to the How, When, and How Much.” The first president of Johns Hopkins, Daniel Coit Gilman, staunchly defended the ideal of individual freedom. In response to unsolicited advice, he once angrily declared his unwillingness to place “fetters put upon a professor in any department of science.”

Within the university, defined as that emancipated space where external strictures on curriculum were relaxed or abandoned, the researcher might work himself to the limits of his strength. The absence of collegiate rules and regulations translated into increased self-scrutiny. Discipline ceased to be a matter of external coercion (an authority’s assessment of the rate, amount, and content of work performed) and became a matter of inner compulsion. Supposedly inspired and sustained by a deep love for truth, scientists were compelled to maintain “eternal vigilance,” a “constant watching of themselves.” Themes of strict self-governance were repeated throughout the celebrated translation of
Friedrich Paulsen’s *The German Universities and University Study*, adopted by American educators as a blueprint for their own reforms.\(^{56}\) In the absence of “external compulsion,” Paulsen wrote, “the more imperative is the duty of self-control. Whoever confounds freedom with license, misunderstands its meaning; it is given to the individual not that he may do as he pleases, but that he may learn to govern himself.”\(^{57}\) Or as historian von Holst stated succinctly in 1893, “incessant work is the price of liberty.”\(^{58}\) At Johns Hopkins, historian Owen Hannaway has argued, Gilman’s major influence was to transfer the force of control from “the general curriculum and the external conduct of the university (where great liberality was granted) to the intimate atmosphere of the laboratory and seminar,” in which students and faculty became ever more responsible for their own discipline.\(^{59}\)

Such calls for exacting self-discipline and exhaustive effort helped craft a remarkably consistent and singular vision of science, one all the more noteworthy in light of the transformation of practices of inquiry then ongoing. As we have seen, the passage of the Morrill Land Grant Act in 1862, the adoption of elective systems at denominational colleges, and the establishment of universities made possible by vast industrial fortunes altered the material conditions of organized research. In the context of this institutional growth and reorganization, descriptions of suffering played a unifying role, bringing a sense of interconnection and purpose to intellectual work increasingly fragmented and specialized. Within the walls of a single university, researchers were segregated by department, field, division, and school. Even as investigation grew ever more diffuse and disunified—divided among universities, philanthropic institutes, industrial laboratories, experimental stations, and observatories—the word *science* increasingly referred to a single, autonomous entity that demanded toil, privation, and penury. A letter from mineralogist Marshman Edward Wadsworth, penned in response to Rowland’s “Plea,” expressed hope in the deep, underlying unity of seemingly distinct realms of knowledge and practice, a unity revealed in “true scientific work.” Wadsworth tentatively suggested that Rowland’s remarks applied equally to both “natural” and “physical” sciences, fields knit together by a common “duty” to truth.\(^{60}\) Institutional cleavage, in other words, might be healed by the shared wounds of pure scientific work.\(^{61}\)

Even as voluntary suffering provided a sense of common purpose for investigators such as Rowland and Wadsworth, it created schisms along lines of sex and race, distancing advocates of pure science from other researchers in the last quarter of the nineteenth century. As discussed in chapter 1, the capacity for self-sacrifice presumed a self socially endowed with personal autonomy and bodily integrity. Black and female bodies, which had been demarcated by and through systems of dependency, commodification, dispossession, and exchange, could scarcely call on ethics of voluntary suffering to the same extent as Rowland and his colleagues. While devotion to truth might bring a man like
Osgood to the limits of his power, the will to suffer was structured by existing positions of privilege.

For white women and black women and men with interest in scientific research, agency tended to take other forms: namely, the pursuit of projects with clear practical or profit-minded goals in areas such as medicine or agriculture. Astronomer Maria Mitchell (1818–89) discovered as much in 1876, when she obtained responses to a questionnaire sent to white women investigators across the country. That such women were more likely to pursue “those sciences which touch life and health” stemmed only in part from humanitarian sentiments. Of equal consequence was the pressing matter of opportunity: postgraduate training and employment in physics, astronomy, or mathematics were simply more difficult to attain than work in charitable organizations, medical missions, or agricultural research.\(^6\) Barriers to white women’s participation in more abstract fields were layered, multiple, and perpetuated even by the most vociferous advocates of “higher” research. Despite Rowland’s pleas for pure science, for example, he was one of the most strident opponents to women’s participation at his own university, Johns Hopkins. Although women were admitted to the Hopkins medical school in 1893, they were not officially admitted to the university’s graduate school until 1907, thirty-one years after its founding. Even then, individual faculty members reserved the right to refuse women entry to their laboratories and classrooms.\(^6\)

Some agitators sought to draw on norms of purity and sacrifice when promoting new research opportunities for women. For example, one contributor to *Popular Science Monthly* proposed that any science advanced by a woman was “pure” by definition.\(^6\) Another argued that enlisting “the enthusiasm, the self-sacrifice and vitality of women in the cause of science” would not only advance knowledge but also enliven women and the men who lived with them. Where women were “complaining and sentimental, they will grow cheerful and wise”; where there had been “restless longings” would come instead “continuous and pains-taking labor.”\(^6\) Mitchell herself conjured existing conventions of feminine self-sacrifice in her 1875 presidential address before the Association for the Advancement of Women. Women’s disregard for self, she argued, made them exceptionally suited for the work of science: “In my younger days, when I was pained by the half-educated, loose, and inaccurate ways which we [women] all had, I used to say, ‘How much women need exact science,’ but since I have known some workers in science who were not always true to the teachings of nature, who have loved self more than science, I have now said, ‘How much science needs women.”\(^6\) Basing resistance to institutional barriers on women’s unsullied capacity for self-sacrifice, however, implied a complicated bargain: access to science then depended on one’s special willingness to suffer. Moreover, none of these advocates for women appear to have considered the racial and so-
cioeconomic specificity of this idealized femininity—further reproducing the familiar exclusions of the sacrificial self.

Black men and women were also systematically barred from graduate schools, salaried employment, and professional organizations and similarly migrated toward more available opportunities in biological, medical, pharmaceutical, and agricultural fields. The myriad legal, economic, physical, and social obstacles to black participation in pure science structured period debates over industrial education. Booker T. Washington alluded to these obstacles when asserting that black education “should be so directed that the greatest proportion of the mental strength of the masses will be brought to bear upon the everyday practical things of life, upon something that is needed to be done, and something which they will be permitted to do in the community in which they reside.” His words suggest the conflict between ideals of unfettered inquiry and the concrete realities of systemic racism in the closing years of the century. Sandwiched between inequities in secondary educational funding and inadequate employment opportunities for postgraduate scientists, most black colleges chose to support the model of vocational education promoted by Washington, influencing the scope of scientific research for years to come.

In the context of ongoing struggles over access to the material resources necessary for organized research, recurrent emphasis on the nobility and civility of suffering for pure science played a particular role. As Rowland’s “Plea” makes clear, it is the directed, deliberate character of the scientist’s exertions, the volition emphasized throughout the address, that differentiates Anglo-Saxon men of science from the effeminate, degenerate, pathological sufferings understood to be helplessly, irrationally endured by women, barbarians, or masochists. The scientist chose his suffering and, by choosing to suffer, both demonstrated and reinforced his elevation. Yet while a privileged legacy of bodily ownership secured one’s ability to suffer for science, that position of agency and control depended on the continual exhibition of its characteristic vulnerability.

Displays of suffering—relentless toil, social isolation, fasting, penury—thus became the language in which pure researchers spoke of their commitment to a constantly retreating higher truth, and research universities provided space for this display. The interpenetration of pain, truth, and devotion found in pure science is particularly evident in the university laboratory of Ira Remsen (1846–1927), where students enacted the tensions of scientific suffering. Remsen’s chemical laboratory at Johns Hopkins became a key location for transmitting the disciplines of purity and exemplifies the power of an ethic of suffering in a specific community. (Clark University, one of only two all-postgraduate institutions in the country at the time, was described by some late nineteenth-century commentators as “more pure” than Hopkins. Yet Clark never achieved
equivalent renown and hence never exerted such a continuing and considerable effect on the shape of science education in the United States.)

Unlike his Hopkins colleague Rowland (who crowed of neglecting students for his research), Remsen was known for a strong commitment to instructing future generations of scientists, and he placed special emphasis on the value of pure science. In Remsen’s view, the pursuit of science is “nothing but” the expression of a desire to know, which “we have implanted in us.” Truly pure science must thus be distinguished from applications and all other research conducted with profit in mind. “It is the province of science to investigate, to discover, to know, to furnish the material or the knowledge that is to be applied,” he argued, “but it is not its province to apply.” Like Rowland, he filled his descriptions of curiosity-driven science with tales of the toil and poverty of great scientists of the past. This elevation of the impoverished seeker of truth made an impression on Remsen’s students, who recalled themselves at Hopkins as “noble young men dedicated to learning and poverty.”

For those students not yet dedicated to the pursuit of pure science, Remsen reiterated the moral significance of science pursued without practical use in mind, often describing his contempt for hands “sull[ied]” with industry. Best known for his role in the synthesis of benzoic sulfinide (saccharin), he was somewhat ambivalent on the matter of commercialism. Although himself a consultant to General Chemical, Standard Oil, and numerous other industrial and governmental bodies, he actively dissuaded his students from pursuing such appointments. When one student suggested that impoverished universities might seek industrial sponsorship for their laboratories, Remsen “responded that he could think of no worse fate for the university than such an invasion.” Despite his consultations for large businesses, he was, as Owen Hannaway has argued, a “pious worshipper at the shrine of pure science” and a disciple who actively sought to convert his students.

To his students, Remsen also imparted the virtues of hard work. He always insisted that a certain amount of arduous and tedious experimentation was necessary for research, particularly in chemistry. Remsen frequently cited his mentor, Justus von Liebig, on this point: “Any idea that stimulates men to work, excites the perceptive faculties and brings perseverance is a gain for science, for it is work which leads to discoveries.” Like many of his peers, he was fond of describing the “exceedingly severe” examinations of German students and how lacking American universities were in the ability to turn out a similarly “full-grown scientific man.”

Furthermore, Remsen considered rigorous work as ceaseless as the expansion of knowledge itself. No matter how much perseverance and thoroughness a student might exhibit, there was always more work to be done: discovery is necessarily ceaseless. “Every so-called ‘complete’ investigation,” he reminded his students, “is surrounded by question marks.” The universe, he suggested,
held “a power ‘that passeth all understanding.’” In knowledge’s limitlessness, Remsen found an easy affinity with his early religious training. Like many fellow advocates of pure science, he had undergone a strict Protestant upbringing. After his mother’s death in his early childhood, Remsen was sent to a small village to live with his stern maternal great-grandmother and his great-grandfather, a pastor in the Dutch Reformed Church. In his adult life, Remsen retained his childhood piety and expressed no conflict between his religious and scientific beliefs, even clipping devotional articles to glue inside his professional notebooks. In his words, “the ultimate of both science and religion are infinites . . . something that gives meaning to all that passes, and yet eludes apprehension; something whose possession is the final good, and yet beyond all reach, something which is the ultimate ideal, and the hopeless quest.”

Like the quest for religious truth, the search for knowledge was always receding; the work required of the researcher was correspondingly ceaseless.

While Remsen emphasized ceaseless work, poverty, and the desire for knowledge in his discussions of pure science, he differed from many of his peers in an important way. Unlike Rowland, who dramatically emphasized the individual researcher’s lonely ascent of the scientific mountaintop, Remsen always stressed the communal aspects of pure science in both his professional publications and his daily interactions with students. He refused to lead a reclusive life and encouraged students to see themselves (to cite the title of an 1912 address) as “all members one of another.” Adamant that students should not work in isolated chambers, Remsen arranged laboratories at both Johns Hopkins and other universities around a large central room to encourage contact among students. When he helped plan a new chemical laboratory at the University of Chicago, for example, he designed rooms for students to gather separately from their instructors, remarking that “students learn more from each other than from their teachers.”

To foster continuous interaction among these disciples of pure science, Remsen carefully delineated scientific from nonscientific spaces, starting with the racially and sexually marked bodies long kept to the vestibules of civic society. Neither black students nor white women students were admitted to Remsen’s laboratory; and even those students allowed into the space were, for the larger part of each day, cut off from the rest of the university community. The careful purification of the laboratory extended to supposedly defiling objects. When the Spanish-American War broke out, Remsen refused to allow certain “base” newspapers into the laboratory, although everyone was admittedly interested in the contents of the articles. Within the exclusive space of the laboratory, students were taught to be fastidious about its condition, not only about the neatness and cleanliness of the equipment and surfaces but also about behaviors. Smoking was not allowed in Remsen’s laboratory, and no student felt comfortable arriving in shirt sleeves. Many recalled its church-like
atmosphere, and students emerged from Hopkins imagining themselves to be “high priests . . . bound to the truth”—a truth perpetually just out of grasp.85

It is here that the significance of voluntary suffering in pure science begins to emerge, for in Remsen’s laboratory students drove themselves to incessant work. Although Remsen insisted that tedious exertion was necessary to scientific advancement and that American students were not nearly as driven as their impressive German counterparts, he did not force students to toil in his laboratory. On the contrary, he was known to remark disapprovingly on the increasing “pressure for more work in all departments,” and the fact that such “hurry and worry” left little time for reflection. When a group of students came to him to complain about the amount of work they had been assigned in another class, Remsen quickly took steps to alleviate their obligations in his mandatory chemistry lab. He maintained strict hours in the laboratory, shutting off the gas at five o’clock sharp to discourage lingering.86

Remsen’s laboratory, then, displayed not dictatorial control but the social power of a norm of science marked by the capacity and desire for voluntary suffering. Although he encouraged his students to maintain regular hours, they instead enacted the assumption that the purity of one’s commitment was demonstrated in the vigor of one’s exertion. Becoming model voluntary sufferers, students learned to monitor their own habits of investigation, “determined to produce something more in research to please the Old Master.”87 The general impression among laboratory students was that “nobody ever cuts Remsen.”88 Sharing stories of peers who pursued truth with exceptional diligence, students breathed further life into the valorization of what Nietzsche has called “self-chosen torture.”89 One Hopkins alum recalled a legendary student who “kept an all-night’s vigil in one of the laboratories, like Don Quixote watching his armour.” Two other students were found to have broken into a biological laboratory on campus to continue their work after hours. Understanding their efforts to be generated by devotion to an infinite truth, and believing that the existence of their devotion distinguished them from everyone outside the laboratory, students came to determine their own work discipline.90 An invisible, ineffable commitment was made palpable and veritable through the medium of the flesh. Custom had created within the community practices of deliberate privation that further elevated pure science as an object worthy of sacrifice.

Remsen’s students went on to found chemical laboratories in universities across the United States, disseminating his pedagogical style and the Hopkins’s model of self-governance.91 The university, in turn, shaped future understandings of science. By 1895, the retiring president of the Philosophical Society of Washington could claim that Americans had done little to advance applied science; investigators’ chief contributions, wrote G. Brown Goode, had been “in pure science rather than in the application of science.”92 By the turn of the century, some American researchers lamented that applied science had come to re-
quire cultural and financial reinforcement. Chemical expert Ellen Swallow Richards argued in 1911 that the basic merits of the “useful dollar” had to be forced upon a powerful “aristocracy of learning,” which had grown resistant to all practical work. Despite Tocqueville’s earlier predictions to the contrary, “science for science’s sake” had acquired currency in the United States, a currency incarnated in the suffering bodies of its proponents.

At stake in the suffering evident among late nineteenth-century proponents of pure science, then, was a telling feature of their civility: a willing subjection to habits of deprivation and toil. These displays of willful subjection were condemned to repetition, since purity ran the risk of being contaminated at every interval. As evident in the incessant toil of Remsen’s students and the excessive mutilations described by Slosson, establishing the purity of one’s science was not a singular act but a routine, methodical, and recurring activity. Truth was now ever elusive and the search for truth never ending. Maintaining purity therefore demanded a constant and uncompromising self-governance, staking proponents of pure science to ceaseless labors of love.