# SCIENCE and the SOCIAL GOOD

NATURE, CULTURE,

COMMUNITY, 1865-1965

JOHN 9 HERRON

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Nature, Culture, and Community, 1865–1965

John P. Herron



## **OXFORD**

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Science and the Social Good

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#### INTRODUCTION

**66** They will Mexicanize the country," wailed a despondent Louis Agassiz. Having just heard of the Confederate attack on South Carolina's Fort Sumter, Agassiz—the most accomplished natural scientist in America—feared the nation verged on race suicide. Agassiz's language was curious; after all, his distress had little to do with borderland politics. Rather, his concern was for the social consequences of racial reordering. The Swiss-born scientist was critical of American slavery, yet he questioned the decision to wage a war for racial equality. If the Civil War led to balance among the races, rather than a "manly population descended from cognate nations," America would be "inhabited by the effeminate progeny of the mixed races." In April of 1861, with the Civil War finally upon the nation, Agassiz worried the abolitionist demand for social equality would devastate society.<sup>1</sup>

On that spring day, Agassiz broke down before Nathaniel Southgate Shaler, then a student at Harvard University's Lawrence Scientific School. Now largely forgotten, Shaler became a giant among American natural scientists.<sup>2</sup> In 1862, he completed his studies under Agassiz, fought for the Union, and, after the war, returned to Cambridge first as an instructor of zoology, later professor of geology, and eventually, dean of sciences. Writing of the Agassiz encounter in his autobiography, Shaler, a strong proponent of national development and expansion, thought Agassiz misunderstood the war and the American mind. In a surprisingly upbeat summary of the Civil War, Shaler chided his mentor for not recognizing Americans as an energet-ic lot, and the war merely the growing pains of expansion and modernity. Shaler never publicly contradicted Agassiz, but he provided an interesting interpretation of his teacher's anxiety-laden admission. "All along," he remembered, Agassiz "had taken the war as an end to his hopes."

Today, Agassiz's emotional outburst seems odd, even eccentric. Of all the issues that could have, and perhaps should have, occupied his thoughts, his first concern was a racist commentary about the nation's impending cultural collapse. Look closer, however, as beneath Agassiz's alarm lie significant debates of the age, including the limits of federal authority and the evolving definition of citizenship. With the nation in political turmoil, Agassiz believed his science could offer guidance—a faith that both frames the position of the natural scientist within American society and explains his disappointment that war had finally come. It was Agassiz's understanding of biology that contributed to his unease over the Fort Sumter crisis. He cried at the outbreak of war because he interpreted the conflict as a natural scientist who studied the consequences of species amalgamation in nature. The mixing of separate human races, like the interbreeding of different animal species, was a biological mistake and, he insisted, a political disaster. Agassiz's science suggested that such "unnatural" behavior was trouble for animals and that it would be trouble for humans as well.<sup>4</sup> Throughout his long career, he directed his work-whether on fish, frogs, or fossils-to understanding species relationships and, especially, interactions. His intent was to reveal foundational laws shaping kinship among and between natural communities-moral laws he believed held as much application in the human as in the nonhuman world.<sup>5</sup>

To dissect Agassiz's philosophy is to reveal the authority many placed in science to influence cultural affairs. His understanding of creation and biology did not survive the nineteenth century intact, but his use of a scientific platform to make social and political claims did. Agassiz's willingness to speculate in an area seemingly outside his expertise was hardly unusual. In mid-century America, a natural scientist could comment *as a scientist* on cultural affairs. Making understandable the efforts of natural scientists to interpret the social good, as well as the cultural processes behind those efforts, is a primary aim of this study.

This book examines the working world of natural scientists, exploring how they used science within American life and, most important, illuminating the impact of natural science on American culture. Beginning with the conclusion of the Civil War and the creation of a recognizably modern America and continuing forward to the emergence of environmentalism as a political force nearly a century later, this work explores the evolving internal paradigms and external forces influencing the design and purpose of American natural science. I argue that natural scientists, like Louis Agassiz and his professional descendants, understood their work as a cultural activity contributing to social stability and viewed their field as a powerful tool that could enhance the quality of American life. Their common goal was to advance a civic-minded natural science concerned with the political well-being of American society.

A picture of the social investment of natural science emerges from the cultural biographies of three figures: geologist Clarence King (1842–1901), forester Robert Marshall (1901–1939), and biologist Rachel Carson (1907– 1964). These three are not the lone representatives of the period; other equally viable scientists-John Muir, Frederick Clemens, and Barry Commoner or John Wesley Powell, Alice Hamilton, and Paul Ehrlich, among others—could have appeared in these pages. But like Agassiz, this trio is significant because they purposefully considered the social outcomes, what historian Thomas Gieryn labeled the "downstream applications," of their work.<sup>6</sup> During their careers, King, Marshall, and Carson became increasingly wary of the costs of industrial development, and they used their scientific work to address problems of ecological and social imbalance. To many scientific practitioners, the arrival of Charles Darwin signaled the decline in popularity of such concepts as "unity" and "harmony." Questions about species immutability challenged ideas about fixity and order in both natural and human environments. Yet these three scientists continued to see balance as a necessary element of their work. They were not, like many of their scientific contemporaries, mathematical modelers, but they did use their work in nature to make predictions about society. The individuals in this study considered science an especially effective tool to improve American adaptability; natural science, it was believed, could solve historical and social problems.<sup>7</sup> As concerned individuals, King, Marshall, and especially Carson are figures known to environmental scholars, but the focus here is the orientation they shared, despite differences of field and era, that linked their science to environmental, political, and cultural affairs. Perhaps more so than their respective peers, this trio saw responsibility as central to their science. As a result, they worked not only within the evolving dynamics of their field but also within a broader discourse of American intellectual life.

Although these three figures did not know one another, nor were their lives explicitly connected, their work reveals a continuum of beliefs about science, natural philosophy, and American democracy. King, Marshall, and Carson lived and worked during critical periods of social upheaval in American life. In the Victorian era of the 1870s and 1880s, interwar America of the 1920s and 1930s, and postwar America of the 1950s and 1960s, massive social change, economic collapse and recovery, and the crisis of war and its aftermath prompted many Americans to look to the nonhuman world for answers to contemporary problems. As their contemporaries struggled with the unmooring of social norms—industrialization and the new modes of business, rising consumerism, evolving notions of family and gender responsibility, shifting ideas of faith, the increasing authority of the federal government—these scientists embraced the physical world as a means to improve America's social health.

It is not unexpected that scientists and citizens alike should turn to nature for solutions to human problems. The belief that the physical world can provide instruction for society has a deep history. From the beginnings of industrial capitalism, with an emphasis on competitive struggle, to contemporary evolutionary debates and the renewed importance of progress, nature and natural science have long been part of a public effort to improve the social good. Definitions of what qualifies as the social good are very subjective and, at times, contested, but many American natural scientists have believed that the benefits of nature's analytical study were especially profitable. It was in the natural world that scientists found support for national goals, even methods to strengthen democracy. Nature, for instance, provided models for proper community organization, examples of workable hierarchies of species, and illustrations of system stability-each a hands-on tutorial in American civics. Biological ideas about function and structure influenced the scientific management of factory labor, animal instinct studies affected evolving attitudes about proper parenting, and the study of mutually interactive species offered an explanation for the dynamics of group behavior in humans.<sup>8</sup> That these natural science efforts could then influence politics is also not surprising. The shape and direction of contemporary environmental politics owe much to the emergence of ecology in the 1960s, but such connections are not new. Science has long fulfilled diverse political ends. Many of these motivations served a less than altruistic agenda, including Social Darwinism and eugenics, but natural science also supported the nation's progressive faith in social improvement. Disagreements on method divided the subfields of American natural science, but collectively, scientists-aware of their dual responsibilities as citizens and technicians-anchored their work in the belief that human activities could be made comprehensible through nature's systematic investigation.

Natural scientists, biologist Donna Haraway explains, were never "ventriloquists speaking for the Earth itself," but their understanding of nature's processes, especially those processes that seemed to connect humans to the natural environment, led them to comment on social values.<sup>9</sup> How scientists investigated the physical world reflected many of the questions their contemporaries asked about American society. When natural scientists "probed the natural world and formulated scientific theories about how nature worked," argues historian Sharon Kingsland, "they were also grappling with how their own future would unfold, what their relationship with nature was, and what new things might evolve from the synergistic interactions of people and environments."<sup>10</sup> Amid a shifting cultural landscape, King, Marshall, and Carson are representative of the community of natural scientists who blended their work, understanding of politics, and concern for social welfare into a vision of a liberal, cooperative, and scientifically informed America. Their views were not always consistent or unproblematic, but their science was an effort to critique and, at the same time, reform American life.

For their labor, all three achieved at least some level of success. Lionized by his contemporaries, including Henry Adams, John Hay, and William Dean Howells, as the most able man of his generation, the Yale-trained Clarence King was the founding director of the U.S. Geological Survey. A celebrated geologist. King was as comfortable in the royal courts of Europe as he was the remote field camps of the American West. He used his social standing to integrate his science into late-nineteenth-century political debates about foreign policy, immigration, and social reform. Of equal interest, however, King also was an influential participant in more abstract national conversations about faith, skepticism, and modernity. Robert Marshall had the wealth and education to move in similar circles, but chose another path. In the mid-1930s, he organized the environmental advocacy group The Wilderness Society and transformed the face of natural preservation in America. Committed to social justice, Marshall blended forest ecology and pragmatic philosophy to craft a natural science ethic that influenced the contours of early-twentieth-century American political life. Here, too, he extended the reach of his science into political discussions about the restructuring of society prompted by urbanization and economic crisis. Rachel Carson deservedly gets credit for launching the modern environmental movement with her 1962 classic, Silent Spring. Her books sold in the millions and made a generation of Americans aware of the social costs inherent in the human manipulation of the natural world. She pushed her work into unexpected applications in postwar literary circles, gender politics, and social welfare reform. Carson's personal style was far from confrontational, but she should be included within an eclectic group of postwar populists, including reformers such as sociologist Paul Goodman and urban planner Jane Jacobs, who used natural science to critique established institutions and then offer an alternative vision of a healthy and diverse society.

Despite their many achievements, at various points in their careers King, Marshall, and Carson were labeled by critics as outsiders operating on the margins of professional natural science. These charges have some traction. With his training and extensive field experience in federal land surveys, King still drifted away from serious scientific work before middle age. Although he held scientific degrees from Syracuse and Harvard and a Johns Hopkins Ph.D., Marshall never became an accomplished researcher. Carson also completed advanced work at Johns Hopkins but lacked both a terminal degree and a permanent institutional affiliation. Yet even as they moved from margin to center (and at times back again), all three used their insider-outsider status to reach a wide audience of specialists and nonspecialists. They deserve consideration as "real" scientists, but more significant was their unique relationship to the traditional nodes of science that permitted them unusual opportunities to connect their work with a larger community. In renegotiating the meanings of natural science, King, Marshall, and Carson created new social spaces to operate as both scientists and concerned individuals.

The significance of the fields of science that King, Marshall, and Carson represent also underscores changes within American society. In the late nineteenth century, the interwar period, and the post-World War II era, King's geology, Marshall's forestry, and Carson's biology engaged contemporary issues of major significance. Many of the cultural disputes of science in Victorian America, for example, involved evolution. While questions about evolution and its multiple implications occupied the practices of many fields, few did so as directly as geology. With an emphasis on explaining process and development, geology was used to supply scientific facts in debates about religion, race relations, and political theory. Marshall's forestry, while not seemingly containing obvious social applications, engaged fundamental questions about state responsibility, community health, and distribution of resources in an era of economic collapse and social upheaval. Carson's career began at the opening of the atomic era, when the scientific manipulation of the physical world brought questions of life and purpose to the foreground, issues that held especially serious import within biology.

Within this dynamic, the larger social context of each period dramatically affected how these sciences were used. King, for instance, understood natural science as a salve to what he saw as America's deteriorating moral foundation in the late nineteenth century. He connected the increase in everything from social unrest to mental illness to the nation's waning support for rigorous natural selection. Staunch preservationists read Marshall's deep interest in wilderness as a counter to the frenzied urbanization of his era, yet his scientific approach to nature was constructed as a support for modern America, not an antidote. He embraced the primitive but remained equally interested in housing reform, labor unionism, and the work of progressive architectural critic Catherine Bauer and urban theorist Lewis Mumford. Carson internalized the changing cultural dynamics of postwar America, including suburban expansion and consumption, as she relied on biology to inform her understanding of what constituted secure habitats in an age of cold war threats.

Collectively, their respective fields also inform the investigation of the social authority of science. As just one example, King, Marshall, and Carson worked outside a traditional laboratory culture. For much of American science, the restricted and standardized spaces of laboratories carried the official stamp of authority. The field, by contrast, was open. Natural scientists shared their investigative space (and often their investigative techniques) with tourists, birdwatchers, and adventurers. One consequence was an assumption that field science was a less credible, even amateur, mode of

investigation, a charge that questioned the gender authority of natural scientists as well. Real science was done indoors; fieldwork in nature was the province of unskilled technicians.<sup>11</sup>

Beyond their influence on credibility, laboratories also altered the nature of scientific inquiry itself. Laboratories enabled scientists to study elements of the physical world in a controlled environment. This detachmentnature as specimen-was key to universalizing claims of scientific knowledge and the establishment of scientific authority. For most natural scientists, however, nature's objects were not "just neutral stages for measuring and experiment," but active agents within an evolving environment. Such variability often restricted the wide application of natural science, but field scientists such as King, Marshall, and Carson turned this limitation into an advantage by elevating the social importance of nature while claiming scientific privilege to manipulate nature as a means of social transformation.<sup>12</sup> Each of the three employed different strategies to deal with nature's vagaries, but the shared result was a continued blurring of the divide between scientific practice and social application. They remained less interested in the world that science depicts and more focused on the cultural realities that natural science sustains.<sup>13</sup>

Just as important as the context and orientation of their work was the fact that each held a position as a federal scientist. King worked as a government surveyor and geologist, Marshall spent his career with the U.S. Department of Agriculture, and Carson began her professional life with the U.S. Fish and Wildlife Service. To follow their career trajectories is to chart the increasing importance of the federal government in national scientific affairs. While no member of this trio was a bureaucrat in the traditional sense, their careers dovetailed with an escalating federal investment in science. For King, and especially Marshall and Carson, federal monies supporting national objectives determined the path of their careers and, ultimately, the outcome of their science.<sup>14</sup>

King, Marshall, and Carson continually reevaluated their views on nature and science in response to a changing social climate, including ideas of gender. I employ gender analysis in many places and on many levels, most directly through the history of science. An impressive community of scholars has directed considerable professional attention to investigating how the practices of science reflect and reify gender stereotypes. The fact that scientific knowledge is often coded as masculine has serious consequences for the shape of the scientific community, the nature of scientific authority, the techniques of scientific investigation, and the status of the scientist within American society. Understanding the gender divide at play in the sciences helps frame the internal boundaries of natural science and the social standing of the scientist.

When applied to the study of nature, a gendered analysis offers additional important insights. Nature is often portrayed as feminine, while control of the physical world remains a masculine activity. Among its many consequences, this divide has fixed the utility of natural science, determined membership in the ranks of professional science, and colored our perceptions of natural resource use. The individuals in this study reshaped conventions of gender to solidify personal authority, invigorate political activism, and influence federal land policy. King, Marshall, and Carson held differing views on the need for scientific control of the landscape, but they demonstrated a shared desire to control their bodily interaction with nature. King's very personal narratives about nature were aggressive and imperial and helped determine which nineteenth-century landscapes became socially valued. Marshall's fascination with primitive environments, a product of a changing understanding of interwar masculinity, questioned the national faith in modernity to ensure social harmony. Carson operated during a period when cold war conformity restricted women's public sphere autonomy. But the anxieties of the age, including concerns about the consequences of America's new atomic order, also prompted an embrace of nature from a domestic perspective, a view made popular in much of Carson's scientific writing.

Moreover, their different gendered understandings of landscape and topography influenced the social application of their respective sciences. King and Marshall, for example, were drawn to mountains, while Carson took inspiration from the sea. Both men, especially King, devoted considerable scientific energy to mapping, determining distances, and recording the heights of America's mountains. These were exacting scientific exercises, but mastery of the nation's high peaks was also a personal challenge. Conquering summits was folded into the social exercise of determining self-worth and social strength. Even Marshall, who lived during a time when the hypermasculinity of King's era was becoming less prevalent, reveled in the personal and scientific accomplishment associated with mountain study. Carson's preferred oceans were certainly as inspiring as mountains, but she did not approach her biological studies of the sea with a similar commitment to control. Oceans do not lend themselves to the same analogies associated with masculine mountaineering, but for Carson, the fluidity and timelessness of the sea provided an ideal setting to test her views on the ecological web of life. Exploring how gender operates within the discourses of nature, science, and society, including the scientific language of control, the masculine emphasis on conquest, and the feminine narratives of protection, reveals much about American cultural expectations and understandings about proper social order.

Scientists were not in the habit of diagramming their desires to reach beyond technical achievement and influence a public dialogue about politics. The personal and professional motivations that inform scientific inquiry can be multiple and varied at one point and then restricted to specific applications at another. Additionally, thanks to an emphasis on research specialization, natural science has, over the past century, divided into dozens of subdisciplines, making generalizations about field objectives difficult to sustain. Still, evidence for an important common thread remains. Many American natural scientists, including those in this study, understood the relationship between organisms and their physical world as "an interactive process" in which organisms continually restructured their world to meet the demands of a changing environment. This framework prioritized behavior and purposeful activity as determining elements in the construction and maintenance of stable ecological communities. Working from this foundation, then, many natural scientists believed that the study of nature's economy could reveal principles of social organization-progress, development, efficiency, cooperation—that are equally applicable to humans. The preservationist desire to use nature to reconnect to the primitive and confirm our appreciation for things nonhuman is well known. Perhaps less understood, however, is how through the examination of relationships among and between organisms and their environment, natural scientists saw nature as more than an object of analysis; the physical world held answers that mattered to human society.<sup>15</sup> A better understanding of the intersection between these two worlds can illuminate how our approach to the physical world shaped ideas about the constitution of a healthy and balanced society and, more specifically, how American natural scientists used nature to achieve their social and political goals.

As intellectual environmental history, *Science and the Social Good* owes much to the history of science. For more than four decades, scholars have investigated the social construction of scientific knowledge. The result is a large and sophisticated body of work detailing the heavy correspondence and reciprocal relationship between scientific theory and social assumptions, and my heavy debts to this field appear in the notes to every chapter. As part of that tradition, this work explores the cultural production of American natural science and adds to our understanding of what (and who) falls under the purview of science. Laboratory work and scientific practice, however, play a secondary role in this study, as my primary focus remains the natural world. I also examine how the various understandings of nature influenced the parameters of natural science as well as how the scientific interpretation of nature's value illuminated social concerns.

In method, purpose, and audience, the history of science and environmental studies are natural allies, but for all the possible points of connection, the two fields do not intersect as much as they should. Emerging out of political activism, environmental history developed by exploring natural change through a materialistic investigation of past events. Concomitantly, the history of science examined the production of scientific knowledge as part of a social discourse. With little to link scientific thought to environmental change, the two fields remained distant.<sup>16</sup> Many historians of science have, not surprisingly, called for better integration of scientific methods and practices into environmental narratives. Environmental history deconstructs the multiple meanings of nature, but its practitioners devote less attention to understanding humans as biological agents and less still to recognizing human activity as "always and everywhere ... technologically embedded."<sup>17</sup> Even as they acknowledge this liability, however, other voices in the humanities bemoan the deference given to scientific authority within environmental history. Historians of the environment do rely heavily on natural science to measure the human impact on the physical world, but like historians of science who explore the social dimension of "objective" practices, environmental historians make parallel claims about nature as a social construct. Many environmental historians, myself included, are not yet fully literate in science studies and methodologies, but even still, the benefits of cross-fertilization are many. Perhaps most fundamental, the blending of the two fields makes possible more complex narratives that integrate human and natural history and, as a result, take seriously political, cultural, and natural change.<sup>18</sup>

How Americans interact with the physical world reveals much about the social, political, and emotional constitution of national life. The natural world has provided our society with a new vocabulary, a portfolio of images, and a location for expansion.<sup>19</sup> At the same time, nature has also explained and justified social difference. Concern over the abuse of nature's resources has long flavored American politics, but appeals to the balance of nature have also legitimated cultural norms and hierarchies. Defining concepts of natural, both familiar and elusive, then, is not simply a philosophical debate, but an argument that carries a heavy cultural load. The range of possible definitions include nature as object of study, metaphysical discussions about what it means to be human, and considerations of the romantic sublime.

Within this sweeping context, and in the typical shorthand, nature is usually defined as everything humans are not. This "pristine otherness" from human society has often determined nature's value. But two generations of environmental scholars have shown the limits of any definition of nature that separates humans from the physical world. Nature remains, the often-quoted Raymond Williams remarked, one of the most complex words in the language.<sup>20</sup> It is distinct from the cultural, but remains the source of authority we use to understand, or judge, the quality and authenticity of our society. More concretely, there are practical effects of our reliance on nature to interpret social dynamics. Creation studies anchored in nature have provided a context for American religious thought, just as patterns of social interaction based on a natural land ethic have defined sustainable community relations. Appeals to nature have valorized the rural over the

urban and privileged the aesthetic rather than the scientific. Belief in a natural order has defended slavery and antimiscegenation campaigns. Yet even as faith in environmental verities fades, broad appeals to nature also provide a foundation to better understand social change, species diversity, and the responsibilities of stewardship. These discussions, both political and gendered, take on added significance in debates about a possible social foundation for nature and the influence of biological determinism on human conduct. In short, socially defined ideas about nature have influenced behavior, set political agendas, and dictated patterns of consumption throughout American history.<sup>21</sup>

All too often, we become captivated by the majestic and reduce the physical world to a picturesque backdrop for human affairs. Yet Americans continually attach (and reattach) meanings to the natural world surrounding them. Observations about the structure and function of the physical environment profoundly affect the understanding of our social environment. Whether pristine and protected or modern and urbane, nature remains a critical component of American identity. And in this study, I am less interested in defining nature as I am in exploring how the various scientific approaches to nature influenced an American political and social context. *Science and the Social Good* argues that how Americans apprehend nature through a scientific lens is connected to larger questions about progress and order.

To frame this analysis, this work uses what historian of science Charles Rosenberg labeled an "actor-orientated approach to history," employing cultural biography to reconstruct and analyze individual ideas about nature and science even as those ideas operated within a larger social structure.<sup>22</sup> In this context, cultural biography allows us to revisit the well-known lives of King, Marshall, and Carson to reveal the linkages between science and society, especially as those connections, as well as the definitions and significance of nature, changed over time.<sup>23</sup> Biography also permits the blending of multiple avenues of investigation, including an examination of the personal experiences of a distant history and the larger organizational structure of society in which these experiences occur. This twinned mode of inquiry permits the analysis of a flexible life course within institutional and social norms. If nature is a world of laws, humans living in nature inhabit a world of choices.<sup>24</sup> And it is the context of these choices that frames the investigation of King, Marshall, and Carson.

Any scholar investigating the intersection of ideas and practices must consider how knowledge and power are intimately connected. *Science and the Social Good* explores the practice of "doing" natural science and the setting in which these activities occurred. The evolution of scientific traditions and interpretations of nature are understood within an equally active social setting. "If we are willing to explore science as a culture," noted historian Gregg Mitman, "then we must be willing to explore how a whole amalgam of noncognitive factors such as personal beliefs and cultural norms" shaped natural science "across the political spectrum."<sup>25</sup> A simultaneous focus on the personal and the professional enables the analysis of localized forces, such as individual agency, faith, and political opinions, as well as larger factors, such as cultural mores and institutional structures. The result is a work necessarily social, intellectual, and institutional that illuminates the unexpected ways that nature and science combined to aid social improvement and civic regeneration. Part I

Clarence King and the Mapping of the Western Landscape This page intentionally left blank

#### PATHS OF SCIENCE

1

### The Maturation of a Public Ideal

B eneath a canopy of elms on the corner of Chapel and College streets stood "the fence." Built to separate campus and city, the fence formed a centerpiece of college life in New Haven, Connecticut. Carved thick with initials, names of sweethearts, and graduation years, the fence was a favorite gathering spot for Yale students. Little paint remained on the posts and rails as the fence wore smooth under the constant wear of undergraduates. Like so many Yale traditions, sitting on the fence followed a rigid class hierarchy. Seniors occupied the largest section facing Chapel Street, while juniors and sophomores were relegated to smaller segments facing inward toward the campus green. Freshman, provided they defeated Harvard in the annual baseball game, sat on a remote end of the fence far beyond the hub of campus activity.<sup>1</sup>

From his rented room on College Street near the center of campus, Clarence King walked past the fence and the gathered crowds of Yale students every day, but he never stopped. King continued down College Street past Elm, Wall, and Grove avenues, past the school chapels and the Divinity School to Sheffield Hall. This large, two-story stone structure, less than six months old when King arrived on campus, housed the Sheffield Scientific School. Though King had followed his grandfather and great-grandfather to the New Haven campus, Yale's traditional curriculum held little appeal for the eighteen-year-old freshman. King remained passionate about the liberal arts, but he turned away from the standard program at Yale and embraced the emerging fields of American natural science. Although the study of natural science in American universities was immature and underdeveloped in 1860, it was a discipline that fired the imagination of young Clarence. And, as he admitted later in life, anticipation of a successful scientific career displaced all his other schoolboy interests and desires.<sup>2</sup>



Figure 1: The Yale fence facing Chapel Street, circa 1874. Image no. 6198, Pictures of Yale University's buildings and grounds, 1716–1980, Manuscripts and Archives, Yale University.

Separated from the main campus by less than three blocks, the Sheffield Scientific School was, in many ways, a world removed. King did not avoid the fence because he wished to, but because he and the rest of the "scientifics" were not welcome. Excluded from many of the customs of undergraduate life, the scientifics were often scorned by their college contemporaries. Yale students regarded their "Sheff" classmates "with a sort of contempt." wondering why they "waste their time on work with blow pipes and test tubes."<sup>3</sup> Main campus students could enroll in Sheffield classes, but many who did exhibited a callous "indifference toward [scientific] instruction," as lectures "were listlessly heard" and class materials "grievously neglected."<sup>4</sup> Traditional Yale undergraduates, one chemistry professor complained, came to class "miserably prepared" and regarded science as little more than "an impediment between them and their degrees."<sup>5</sup> More telling are the memories of Yale graduate and future president of Johns Hopkins University Daniel Coit Gilman. Other students, Gilman remembered, "looked down on the Scientific School because it was scientific and because it was easy, because it had no dormitories or adequate social system, and its men have sometimes lesser abilities or more limited backgrounds."<sup>6</sup> Hostility to the Sheffield School "because it was scientific" reflected a dominant theme in nineteenth-century American education. As the chairman of the Yale admissions board succinctly explained, in most things, "Sheff did not count."<sup>7</sup> Segregated in everything from lectures to chapel service, science students at Yale engaged in studies about which the university was deeply suspicious, if not outright disdainful.<sup>8</sup>

From its founding, Yale emphasized theology and the classics and believed that the infant areas of American science should stand on the periphery of their curriculum. Educated men, Yale President Noah Porter repeatedly stressed at mid-century, should think historically, not scientifically. From his perspective, scientists knew abstract facts about the world, but classically educated men were trained to solve problems and contribute to the gentility of American society. While Porter and other Yale officials insisted that undergraduates approach their studies with the precision demanded by scientific methodology, they wanted students to do so with an eye toward an education that was "truly liberal."<sup>9</sup>

Criticism of science in higher education extended beyond the city limits of New Haven. Throughout much of the nineteenth century, clerics, conservatives, and classicists controlled the educational structure of many American colleges. Administrators emphasized liberal studies, and many considered science a "dangerous accessory."<sup>10</sup> As a result of this tension, scientific education in America developed amid the skepticism of administrators and the persistent experimentation of scientific instructors. When, for example, future president of the National Academy of Sciences Ira Remsen tried to add basic chemistry to the Williams College curriculum, school officials responded that he "keep in mind" that Williams was a "college and not a technical school." They further warned that students "are not to be trained as chemists or geologists or physicists. They are to be taught the great fundamental truths of all sciences. The object aimed at is culture, not practical knowledge." Similarly, when Princeton added a scientific school, it was done reluctantly because there, too, the objective of education was to produce "educated gentlemen, and not mere scientists."<sup>11</sup> Despite the presence of Louis Agassiz and his equally well-known and respected colleague botanist Asa Gray, Harvard's Lawrence Scientific School fared little better. The school, critics charged, was "the resort of shirkers and strugglers."<sup>12</sup> Natural history was long part of the classical curriculum, but in the second half of the nineteenth century, trying to overcome the handicaps of "practical knowledge" became a priority for scientific educators as they continually grappled with their second-class status within the academy.

More significant than a scientific bias in the classroom, however, is how animosity toward science at Sheffield and beyond represented class hostility. In the first half of the nineteenth century, an expanding and increasingly sophisticated economy reshaped many elements of American society. In an all-encompassing process that historian Alan Trachtenberg famously labeled the "incorporation of America," a new industrial system spread the market economy across the nation. In addition to altering the meanings of work and accomplishment in America, this revolution in business introduced a cadre of salaried professionals who emerged to direct the growth of American capitalism. This new class of men, engaged as supervisors, managers, and owners, began to differentiate themselves from their peers through wealth and financial achievement. Class power was conferred through participation in the economy, and by articulating their claims to this new-found status, managers solidified their title to social authority.<sup>13</sup> Amid this emergent industrial capitalism, however, mid-nineteenth-century science provided a poor pathway to the new economy's riches. In colleges and universities where research opportunities were few and teaching responsibilities many, professors of science were underpaid, sometimes even unsalaried, and often forced to purchase their own laboratory equipment and supplies. Outside the academy, scientists were forced to continually seek out patrons to support their work.

Lack of financial standing was not the only challenge American students of science faced, however. Aside from the general distaste for their work in New Haven, Sheffield students drew criticism from their peers because, as Gilman explained, they "had more limited backgrounds" and lacked an "adequate social system." Like the Yale fence, traditional liberal arts colleges served as a bulwark against the leveling and pragmatic demands of an increasingly utilitarian and industrial century. At a place like Yale, after all, "gentlemen" examined language, literature, and theology; their inferiors dirtied their hands with science. The result of such a view. Yale alumni and publisher Henry Holt recalled, was that Yale students looked upon their Sheffield classmates as outsiders, even as "men of sin."<sup>14</sup> Without the scaffolding of class privilege, students at institutions like Sheffield had limited access to powerful social networks. Many schools shared the assumption that the goal of American education was to produce scholars and men. In the eyes of many, a scientific curriculum did neither. In this era, respectability and gentility remained as critical to the maintenance of social borders as did wealth. To the Americans who supported such a view, an education based in the arts was key to the construction and maintenance of social hierarchies.<sup>15</sup> Already at a cultural disadvantage because of the technical components of their discipline, scientists experienced additional prejudice because of the associated social limits of being a scientist. As a consequence, many natural scientists in the middle of the century labored in a world outside the bounds of accepted American culture.

Nineteenth-century gender roles had an obvious impact on the stature and prominence of scientists. In Victorian America, a popular ethos of strength, morality, utility, and restraint defined class boundaries and linked respectability to manliness. As science struggled for approval, critics