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# Popular Science in National and Transnational Perspective

## Suggestions from the American Context

*By Katherine Pandora\**

### ABSTRACT

In what ways can the study of science and popular culture in the American context contribute to ongoing debates on popularization and popular science? This essay suggests that, for several reasons, attention to the antebellum era offers the most significant opportunity to realize more sophisticated understandings of science in American popular culture. First, it enables us to take advantage of comparative opportunities, both by benefiting from the advanced state of historiography for Victorian popular science and by engaging with a generation of historiographic innovations by scholars in U.S. history, American studies, literature, and art history. Second, the emergence of popular science in the context of the republican ethos of the antebellum period provides an important vantage point from which to assess the extent to which the general issue of “popular science” and its cognates is historically variable and multiple in terms of the politics of knowledge. Third, the ramifications of the development of popular science for relations between science and the public well into the twentieth century cannot be understood until we gain a more clearly developed sense of the emergent period.

SINCE THE 1970S, historians of American science have taken hold of wide swaths of the nineteenth and twentieth centuries, painstakingly recreating the intellectual, social, and material sources of the scientific enterprise. In particular, sociologically oriented forms of intellectual history came to occupy the center of gravity, with professionalization, disciplinary development, institutional ecologies, genealogies, work practices, patronage, and gender receiving particular attention. These thematic emphases resulted in ever-finer understandings of how particular scientists produced scientific knowledge, constructed their identities as members of various professional endeavors, and inhabited

\* Department of the History of Science, University of Oklahoma, 619 Physical Sciences Building, Norman, Oklahoma 73019; [kpandora@ou.edu](mailto:kpandora@ou.edu).

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worlds of specialized thought and action.<sup>1</sup> Given the enormous growth of the scientific enterprise in the United States, from its modest form in the nineteenth century to its global preeminence after World War II, it is not surprising that mapping the socio-intellectual dynamics of this rise—especially as it culminated in a “big science” revolution to which, unlike previous scientific “revolutions,” Americans could stake an indigenous claim—has been seen as marking out the leading edge in the historical study of science in America.

This attention to the social history of scientific intellectuals also highlighted the permeability of scientific boundaries—often phrased as relating to “science and society” or “science and social thought” or, more recently, in referencing various “publics”—and is responsible for much of what we think we know about what lies “outside” professional science in the American context. Certainly, historians of American science have opened up questions about the public when looking more closely at the relations between professionalizing elites and scientific amateurs or in writing about historical episodes that attracted media attention. And yet, because the bulk of this research proceeds from the viewpoints of scientific practitioners themselves, the dynamics of scientific knowledge within the American vernacular remain underresearched and undertheorized.<sup>2</sup>

These kinds of demarcationist issues are part and parcel of the tension involved in placing science and popular culture as a field of inquiry in relation to the history of scientific disciplines; think also of the partitioning off of the history of medicine and the history of technology from the history of science for research purposes. Such professional norms favor bringing specialist expertise to bear on questions of popular experience, but it may be that generalist skills are of greater value. Encounters with science in the everyday world can be multifarious, miscellaneous, overlapping, partial, and contradictory—in fact, *undisciplined*; so, too, experiences of technology, medicine, and science come mixed together in disparate ways as everyday matters. To entertain a more ethnographically apposite range of questions about science in public thus places generalist burdens on scholars, burdens that come into being owing to the need to modify work practices that were designed for purposes at odds with mapping variants of popular culture across time and place.<sup>3</sup>

The move from studying scientists *in situ* to the pursuit of questions of cultural meaning usually entails adopting expansive definitions of “science,” bringing to the fore debates about the efficacy of default understandings of the phrase “science and popular culture” and the term “popularization.” Roger Cooter and Stephen Pumfrey cogently articulated this problematic in their now-classic article “Separate Spheres and Public Places,” delineating with clarity the ideological freight carried by this nomenclature and the possible benefits and limitations of alternative formulations. Nearly anyone who works in this area has had to come to some kind of accommodation with this issue—for example, in advocating that these concepts be retired, or arguing for their practical utility and validity as actors’ categories even while highlighting their vagaries, or positing alternative con-

<sup>1</sup> For an early analysis of these trends see *Osiris*, 1985, 1: *Historical Writing on American Science*. See also Charles Rosenberg, “Toward an Ecology of Knowledge: On Discipline, Context, and History,” in *No Other Gods: On Science and American Social Thought*, rev. ed. (Baltimore: Johns Hopkins Univ. Press, 1997); and Rosenberg, “Science in American Society: A Generation of Historical Debate,” *Isis*, 1983, 74:356–367.

<sup>2</sup> For further discussion of the concept of “science in the vernacular” see Katherine Pandora, “Knowledge Held in Common: Tales of Luther Burbank and Science in the American Vernacular,” *Isis*, 2001, 92:484–516.

<sup>3</sup> On “generalism” see “The Generalist Vision in the History of Science” [Focus section], *Isis*, 2005, 96:224–251.

ceptualizations.<sup>4</sup> All of these approaches have merit and help to throw light on the very real ambiguities as to what the study of science as a popular matter *is*; but none of them can by itself resolve these ambiguities, because the issues raised by moving deeply and broadly into the study of science and popular culture inevitably challenge conventional understandings of how to conceptualize “science.”

In large part, these theoretical discussions have been derived from British and European examples, which to date have provided a default model for Americanists. It is unclear to what extent considering the United States as a junior version of the British and European situations makes sense or, in turn, to what extent consideration of American examples may suggest new modes of analysis that are applicable in other national contexts, either in supplementing or in modifying the default model. One of the next steps is to assess the extent to which the general issue of “popular science” and its cognates is historically variable and multiple, and the American case presents an excellent opportunity to explore this issue further. Here I offer reflections on the circulation of scientific knowledge in antebellum popular culture as a pertinent example of how a relatively overlooked site for research holds the potential both to complement and complicate work on Anglo-European topics and to open up new lines of investigation. This is true not only for the antebellum era itself but also for what came next—in the transitional period to modern society, from the 1870s to the 1920s—because understanding what was later at stake with regard to the public and science depends on gaining the fullest possible picture of what was at stake as the United States emerged from the decades in which the nation’s identity was forged. And possessing a deeper and more critical sense of the shift to the modern era will have ramifications for our understanding of how these issues were transformed from the 1930s forward.<sup>5</sup>

#### HISTORIOGRAPHIC ISSUES

To propose that the antebellum era in the United States deserves particular attention with respect to science and popular culture may seem surprising, given that the research findings of scholars in the 1960s and 1970s who detailed the emergence of a professional scientific community had seemed to relegate investigation of what had been termed “the amateur tradition” to the dusty reaches of the discipline’s historiographic attic. In contextualizing the popular sphere from which emergent professionals extricated themselves, these scholars identified historical instances that could have served as departure points for wider cultural exploration of popular science. That this rarely happened is perhaps due to a perception that the amateur tradition was an evolutionary dead end when compared with

<sup>4</sup> Roger Cooter and Stephen Pumfrey, “Separate Spheres and Public Places: Reflections on the History of Science Popularization and Science in Popular Culture,” *History of Science*, 1994, 32:237–267. For current debates see James A. Secord, “Knowledge in Transit,” *Isis*, 2004, 95:654–672; Bernard Lightman, *Victorian Popularizers of Science: Designing Nature for New Audiences* (Chicago: Univ. Chicago Press, 2007); and Jonathan R. Topham, “Rethinking the History of Science Popularization/Popular Science,” in *Popularizing Science and Technology in the European Periphery, 1800–2000*, ed. Faidra Papanelopoulou, Agustí Nieto-Galan, and Enrique Perdiguero (Aldershot: Ashgate, forthcoming). I have discussed these issues in “Knowledge Held in Common” (cit. n. 2); and Katherine Pandora and Karen A. Rader, “Science in the Everyday World: Why Perspectives from the History of Science Matter,” *Isis*, 2008, 99:350–364.

<sup>5</sup> Interpretations regarding science and the American public that span the nineteenth and twentieth centuries are scarce. For two different approaches see John C. Burnham, *How Superstition Won and Science Lost: Popularizing Science and Health in the United States* (New Brunswick, N.J.: Rutgers Univ. Press, 1987); and Daniel Patrick Thurs, *Science Talk: Changing Notions of Science in American Culture* (New Brunswick, N.J.: Rutgers Univ. Press, 2007).

the later dominance of professional scientific man, making further investigation pointless. If so, the cobwebs of this view should have been cleared away by Sally Gregory Kohlstedt's 1990 article "Parlors, Primers, and Public Schooling," which redirected historians' attention to the importance of the "formative years of national history" and to the need to account for the fact that popularized science "reached unprecedented and perhaps unsustainable levels in the first half of the nineteenth century." For the most part, the impressive array of potential lines of research into the everyday worlds of family, education, and popular culture detailed in this piece remain unmapped.<sup>6</sup>

If increased attention to the nature of popular science in the antebellum period has been unlikely given current historiographic conventions, a shift in framework—first by looking at the British case, then by sketching out work in U.S. history and American studies—can demonstrate the need to reevaluate the status quo. The impressive achievements that have been made in studying science beyond the sphere of Victorian Britain's gentlemanly specialists—particularly on topics related to print culture, religion and natural knowledge, women and popularization, and the proliferation of sites for scientific education and entertainment—have opened up new questions about how to define "science," "the public," and "knowledge."<sup>7</sup> Certainly, the existence of this research provides a robust set of materials for Americanists to draw on for brainstorming new questions and offers ready-made opportunities for comparative analyses.

The fact that nothing of comparable historiographic scope *does* exist on the American side for comparative purposes is disadvantageous for scholars of the British context as well, as it is likely that research on American topics could provide useful contrasts for Britain, especially in regard to the politics of knowledge. In fact, James Secord has noted "the remarkable gulf" that exists between British and American historiographies for this period and suggests that those who work in the Victorian era "have been even more nationalistic than the people we study."<sup>8</sup> Popular culture with scientific overtones flowed both ways across the Atlantic, with chess-playing automata and aquarium keeping and Egyptomania, for example, equally at home on either side and newly minted images such as ratiocinating humans investigating orangutan murders in the Rue Morgue carrying within them cross-cultural resonances that in turn produced transnational responses. British scientists and popularizers were among the stream of Anglo-European visitors who traveled the lecture circuit in the new republic, and American scientists and popularizers likewise visited Britain and Europe, with all hands observing and comparing cultural peculiarities and convergences in regard to the circulation of scientific knowledge among differing polities. Other comparisons should also be taken under consideration: sites that suggest themselves include nations with elite scientific traditions, such as France and Germany; other postcolonial nations; and other nations within the American hemisphere.

A generation of innovative scholarship on the antebellum period by scholars in U.S.

<sup>6</sup> Sally Gregory Kohlstedt, "Parlors, Primers, and Public Schooling: Education for Science in Nineteenth-Century America," *Isis*, 1990, 81:425–445, on pp. 444, 439. For examples of the professionalization literature see George Daniels, *American Science in the Age of Jackson* (New York: Columbia Univ. Press, 1968); Kohlstedt, *The Formation of the American Scientific Community: The American Association for the Advancement of Science, 1848–1860* (Urbana: Univ. Illinois Press, 1976); and Robert Bruce, *The Launching of Modern American Science, 1846–1876* (New York: Knopf, 1987). For a contemporaneous critique that argued that "the preoccupation of historians of science with the scientific community" needed to be balanced "with a study of the place of science in American communities" see Thomas Bender, "Science and the Culture of American Communities: The Nineteenth Century," *History of Education Quarterly*, 1976, 16:63–77, on p. 65.

<sup>7</sup> Lightman sketches this historiography in *Victorian Popularizers of Science* (cit. n. 4), Ch. 1.

<sup>8</sup> Secord, "Knowledge in Transit" (cit. n. 4), p. 669.

history, American studies, literature, and art history provides another framework shift, for it has changed the historiographic map considerably—in terms of the market revolution, racial realities, labor histories, the American West, working- and middle-class social patterns, gender, and material culture, just to start.<sup>9</sup> Some of this literature takes on scientific themes directly, representing an alternative body of research that delves into topics such as vernacular epistemologies that have received only glancing attention from within the history of American science. For example, Susan Scott Parrish's recalibration of center and periphery in her work on natural history and the British colonies scrutinizes conventions about the derivative and peripheral status of American empiricism and finds them wanting, especially in light of an evidentiary base that encompasses not only transatlantic correspondence networks but the topographies of slave knowledge, "female curiosity" and knowledge production, and Indian "sagacity" as well. Her arguments regarding "colonial resistance to metropolitan hauteur" and the cultivation of a "spiritually and linguistically rebellious American empiricism" have implications for the postcolonial republic and later—and for revisionist comparative accounts of the provincial/cosmopolitan binary in regard to Anglo-European contexts and the new United States.<sup>10</sup> Consider a not unrelated example from Ralph O'Connor's *The Earth on Show*, where he points out that many in Britain first encountered the reality of species extinction from the visit of the American Rembrandt Peale to London in 1802. Peale brought along his family's reconstructed mammoth skeleton for exhibition; O'Connor argues that this episode is significant as a "visualizing moment" that "helped to focus and define the distant past" for Britons.<sup>11</sup>

Parrish's work indicates deep roots for an American resistance to hierarchies of knowledge, such as the challenges one finds on display in midcentury at P. T. Barnum's American Museum in New York City. Historians of American science have tended to avoid analysis of Barnum's natural history theatrics, preferring instead to focus on the Enlightenment productions of Charles Willson Peale or skipping ahead to the establishment of the American Museum of Natural History in 1869. And yet, as historians such as Neil Harris and James W. Cook have shown, the epistemological contests that Barnum arranged through his displays and hoaxes—as in such liminal objects as "the Feejee Mermaid" and "the Nondescript"—authorized the public to judge for themselves rather than defer to the authority of experts. This was certainly the case in 1846, when Barnum capitalized on the interest generated by *Vestiges of the Natural History of Creation* by putting an orangutan on display so that the public could ponder the claim that "she seems to be the Grand Connecting Link between the two great families, the Human and Brute Creation."<sup>12</sup> Nor were Americans bound in their interpretations of God and nature to the

<sup>9</sup> For an overview see James Cook, "Antebellum Cultural History," in *A Companion to American Cultural History*, ed. Karen Halttunen (Malden, Mass.: Blackwell, 2008), pp. 65–78.

<sup>10</sup> Susan Scott Parrish, *American Curiosity: Cultures of Natural History in the Colonial British Atlantic World* (Chapel Hill: Univ. North Carolina Press, 2006), p. 312. Other examples are Laura Dassow Walls, *Seeing New Worlds: Henry David Thoreau and Nineteenth-Century Natural Science* (Madison: Univ. Wisconsin Press, 1995); Margaret Welch, *The Book of Nature: Natural History in the United States, 1825–1875* (Boston: Northeastern Univ. Press, 1998); Christoph Irmscher, *The Poetics of Natural History, from John Bartram to William James* (New Brunswick, N.J.: Rutgers Univ. Press, 1999); and Nina Baym, *American Women of Letters and the Nineteenth-Century Sciences: Styles of Affiliation* (New Brunswick, N.J.: Rutgers Univ. Press, 2002).

<sup>11</sup> Ralph O'Connor, *The Earth on Show: Fossils and the Poetics of Popular Science, 1802–1856* (Chicago: Univ. Chicago Press, 2007), p. 34.

<sup>12</sup> John Betts, "P. T. Barnum and the Popularization of Natural History," *Journal of the History of Ideas*, 1959, 20:353–368, on pp. 353–354. Advertised as the only living specimen in England or America, the orangutan was sold for \$3,000 from the Royal Surrey Zoological Garden (p. 353). This episode also points to Barnum as a transnational figure, an international entrepreneur and celebrity who toured throughout Britain, France, Spain,

hierarchical strictures of a state church, as they had none; in this period diverse theologies (even orthodox ones) could accommodate a collective and amorphous “Christianized pantheism” in which many Americans divined common ground, finding that “Nature’s text, like the Bible, could be interpreted with Protestant independence.”<sup>13</sup> To explore the nature of scientific meaning in the popular sphere in this period—as in any other—requires more than a knowledge of what a learned elite was doing: a more competent fluency and more complete knowledge of the cultural practices of an era and a locale are needed as well. Staying too closely tethered to historiographies of disciplinary and subdisciplinary professional activity makes such forays difficult to achieve.

#### “PLACING KNOWLEDGE WITHIN REACH”: MAKING SCIENTIFIC AMERICANS

In the United States, “popular science” emerged in the 1820s and 1830s embedded within a culture in which the scientific leadership lacked the kind of central organization or privileged status that characterized British and European science. As a result, popular science developed in a very different environment, in which a learned elite lacked the tools their transatlantic colleagues possessed for advancing their ends or disciplining and managing challenges to their authority. It was not until the 1840s that a vigorous circle of American scientific practitioners began to mount strategic challenges to the weak structural and societal status of “pure science.” They then had to contend with the fact that successive cohorts of Americans had already experienced the manifestations of popular science as normative—and that, in fact, varied forms of popular science had a head start over the representations that these practitioners preferred to be held as definitive. As was stated in a Wisconsin newspaper article in 1842, “people now-a-days . . . when a new and startling theory is brought up, do not wait for the wise men and the doctors to analyze and investigate it, before they can venture an opinion on its merits or demerits; but they take up the subject at once for themselves; they reason it over in their own mind, and discuss it among their neighbors.” A riveting example of this mind-set is related by Ronald and Mary Zboray, who open their book *Everyday Ideas: Socioliterary Experience among Antebellum New Englanders* with the response of a seventeen-year-old farmer’s son to a fictional tale of tragic experimentation on the secret of life, “The Tree of Knowledge,” that he read in a borrowed copy of the August 1853 issue of *Harper’s New Monthly Magazine*. As recorded in his diary, this lightly schooled working-class reader was moved to lengthy contemplation on mind/body dualism, relativistic conceptions of religion, and the principles of the universe.<sup>14</sup>

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Belgium, Holland, and Cuba; see Cook, “Antebellum Cultural History” (cit. n. 9), p. 73. On Barnum see Neil Harris, *Humbug: The Art of P. T. Barnum* (New York: Little, Brown, 1973); James Cook, *The Arts of Deception: Playing with Fraud in the Age of Barnum* (Cambridge, Mass.: Harvard Univ. Press, 2001); Benjamin Reiss, *The Showman and the Slave: Race, Death, and Memory in Barnum’s America* (Cambridge, Mass.: Harvard Univ. Press, 2001); and Irmscher, *Poetics of Natural History* (cit. n. 10).

<sup>13</sup> Barbara Novak, *Nature and Culture: American Landscape and Painting, 1825–1875*, 3rd ed. (New York: Oxford Univ. Press, 2007), pp. 3, 4. For further analyses of art and science in this period see Rebecca Bedell, *The Anatomy of Nature: Geology and American Landscape Painting, 1825–1875* (Princeton, N.J.: Princeton Univ. Press, 2002); Kenneth Haltman, *Looking Close and Seeing Far: Samuel Seymour, Titian Ramsey Peale, and the Art of the Long Expedition, 1818–1823* (University Park: Pennsylvania State Univ. Press, 2008); and Laura Rival, *The American Manufactory: Art, Labor, and the World of Things in the Early Republic* (Princeton, N.J.: Princeton Univ. Press, 1998).

<sup>14</sup> Donald Zochert, “Science and the Common Man in Ante-Bellum America,” *Isis*, 1974, 65:448–473, on p. 473 (quoting the Wisconsin newspaper); and Ronald Zboray and Mary Zboray, *Everyday Ideas: Socioliterary Experience among Antebellum New Englanders* (Knoxville: Univ. Tennessee Press, 2006), pp. xii–xvi.

It is likely that the use of “popular science” as a common locution was initially transferred from its early nineteenth-century British context directly to the early American republic, as most printed matter came from British imprints (the lack of international copyright protection meant that British books were reprinted with impunity). Where British publishers had pioneered in identifying and creating new markets for popular science—for example, children’s books and “libraries of knowledge”—Americans followed suit as they began expanding the home market with American-oriented products created by native authors.<sup>15</sup> The works of the British popularizers Samuel Parkes and Jane Marcet, for example, were familiar to American audiences and circulated as part of a common literary market that came to include widely read domestic works such as *Familiar Lectures on Botany* by Almira Hart Lincoln Phelps. It was also the case in this period that when Americans composed “new” books on scientific topics they plundered the published work of British scientists, in addition to drawing on indigenous reports (such as government surveys of the American West). There was overlap in forms and categories, but this did not necessarily imply strict congruences between the two countries in assumptions about authorial intentions, audience composition, readers’ expectations, and market realities.

The print culture of popular science in the American context emerged as a cultural hybrid, both as embodied in the texts themselves and when generated in reading them in relation to and against British works. Although the American texts were not, strictly, linguistic translations, they nonetheless exhibit some of the same redirection of meaning that can occur with translated editions, and the same sorts of issues regarding the differences between the context of production and the context of reading pertain to the appearance of British texts on American bookshelves—texts that were often modified in one form or another by American publishers. Of course, attention to actual translations of non-English works is also essential. A case in point is literature from and about Alexander von Humboldt, who possessed iconic status for antebellum Americans in their thinking about science and nature. Because of Humboldt’s pervasive influence, the stunning historiographic gap on American responses to him distorts our general understanding of the cultural and intellectual history of American science in the nineteenth century (a situation akin to “studying the twentieth century under the assumption that Albert Einstein was a German patent clerk,” as Laura Dassow Walls has remarked). Aaron Sachs’s recently published volume *The Humboldt Current* is a welcome start both toward analyzing the meanings of America’s Humboldt and in establishing the grounds for participating more fully in the development of international scholarship on his influence.<sup>16</sup>

Approaching popular science in this period requires some readjustment of the idea that popularization occurs because science inevitably (if regrettably) becomes so complex and arcane that the only possible way for a nonprofessional to learn anything about it is

<sup>15</sup> For Britain see Jonathan R. Topham, “Publishing ‘Popular Science’ in Early Nineteenth-Century Britain,” in *Science in the Marketplace: Nineteenth-Century Sites and Experiences*, ed. Aileen Fyfe and Bernard Lightman (Chicago: Univ. Chicago Press, 2007), pp. 135–168.

<sup>16</sup> On translation see Nicolaas Rupke, “Translational Studies in the History of Science: The Example of *Vestiges*,” *British Journal for the History of Science*, 2000, 33:209–222. On Humboldt see Laura Dassow Walls, “‘The Napoleon of Science’: Alexander von Humboldt in Antebellum America,” *Nineteenth-Century Contexts*, 1990, 14:71–98 (the quotation is from p. 91); Aaron Sachs, *The Humboldt Current: Nineteenth-Century Explorations and the Roots of American Environmentalism* (New York: Viking, 2006); and Walls, *Passage to Cosmos: Alexander Humboldt and the Shaping of America* (Chicago: Univ. Chicago Press, forthcoming). For a sense of the breadth of current scholarship see Andreas W. Daum, “Alexander von Humboldt and North America,” *Bulletin of the German Historical Institute*, 2004, 35:200–206.



through a popularized account that simplifies the subject matter. This sense of “popularization” appears to miss a significant aspect of what constituted the idea of popular science in the antebellum period. Certainly, authors of popular texts eschewed technical or scholarly terminology that would interfere with clear explanations for a nonexpert audience, and they presented a selective rather than an exhaustive view of the topic at hand. But the fact that a work was popular did not mean that it was necessarily *subordinate* to a more complex rendition: the intent was to make it possible for knowledge to be held in common rather than exclusively by adepts—a republican ethic about which there was general ambivalence among men of science, although some endorsed it and others were hostile to it (at least *sotto voce*).

For example, in his 1844 volume *A Glance at the Physical Sciences: or, The Wonders of Nature in Earth, Air, and Sky*, the popular author Samuel Griswold Goodrich indicates that what the reader has in hand is a “rapid and distinct outline of *Physical Science*, as it is now exhibited in the works of learned men,” focusing on the plethora of discoveries that had been made in an age in which “the march of knowledge has been rapid beyond example.” Rather than suggesting that the reader lacked a “learned” competence in regard to knowledge acquisition, Goodrich stressed instead that he or she was not a person of leisure—and thus required a “rapid and distinct outline.” He also noted how fast things changed in the sciences and offered his book as a canvass that would enable readers to be *au courant* with the latest findings. What was being negotiated in the pages of the text was *access*: Goodrich promised that “in the compass of this little volume” he would “place within the reach” of his readers “the most important results” of the researches of Herschel, Laplace, Lyell, Mantell, and others. What made it possible for these discoveries to have “been brought within the reach of every reader” was the fact that “philosophy is no longer sealed up in learned languages, and kept under lock and key of colleges and universities.” As Goodrich explained in his book *Fireside Education*, “the truth is, that knowledge is common property, and those who possess it are bound to distribute it for the benefit of others.” Goodrich presents himself as a conduit for knowledge on behalf of ordinary individuals, enabling them to remain “within the reach” of activities that had occurred outside their normal round of duties and thus to be part of the scientific community, broadly understood.<sup>17</sup>

Such acts of popularization were essential components of a republican ethos, and the sciences were seen as bound toward this political end as much as any other form of knowledge. As the influential Unitarian leader and admired essayist William Ellery Channing explained in a lecture on “The Present Age” to the Philadelphia Mechanics’ Institute in 1841, whereas the past had been marked by “the spirit of exclusiveness, restriction, narrowness, [and] monopoly,” in the present era it was becoming axiomatic “that the world was made for all.” That is why the most noble intellects of the age had undertaken to facilitate the process of self-culture: “the greatest minds are at work on popular education.” So, too, with science, Channing claimed, for “science, once the greatest of distinctions, is becoming *popular*.” The sense here is not that of something that was once recondite becoming comprehensible: it is of something that had been *aristocratic* becoming *democratic*, for science was no longer “locked up in a few colleges, or

<sup>17</sup> Samuel G. Goodrich, *A Glance at the Physical Sciences; or, The Wonders of Nature in Earth, Air, and Sky* (1844; Boston: Rand & Mann, 1849), pp. 7, 8; and Goodrich, *Fireside Education* (New York: F. J. Huntington, 1838), p. 59. On Goodrich and popular science see Katherine Pandora, “The Children’s Republic of Science in the Antebellum Literature of Samuel Griswold Goodrich and Jacob Abbott,” *Osiris*, 2009, 24 (forthcoming).

royal societies, or inaccessible in volumes,” with its “portals guarded by a dark phraseology which to the multitude is a foreign tongue.” No, observed Channing with triumph, “science has now left her retreats, . . . her selected votaries,” and adopted a “familiar tone”—and with the assistance of “the press, discoveries and theories once the monopoly of philosophers have become the property of the multitude.” It was not the rapid improvement of science that was the particular characteristic of the age but, instead, “its extension to all men.”<sup>18</sup>

Newspapers were the most important, consistently available, and widely consulted form of reading matter in the antebellum period, and they deserve much greater attention than they have yet received in regard to the diffusion of scientific knowledge. The adult white population had a 90 percent literacy rate in 1850 (as compared to about 60 percent in Britain in 1851); in the northeastern United States it was 97 percent. The extent of newspaper reading was often an occasion for surprised remarks by foreign visitors, who compared its prevalence to that in their own societies, and a cause for critique, as can be seen in an 1852 commentary in the *London Sun* on the “taxes on knowledge” still extant in Britain. The *Sun* found the contrast between New York City (with fifteen daily papers for a population of hundreds of thousands) and London (with ten daily papers for a population of millions) to be exasperating. The lowliest of Americans appeared to live in a different information environment than did their British counterparts: “three-fourths of the families in America take a daily paper—every skilled operative takes one—nay, almost every workman enjoys the privilege of the substantial London citizen, and has his own newspaper regularly with his breakfast.” Newspapers were readily accessible not only in metropolitan areas but also in small towns and less densely populated regions, and they were major sources of scientific information, whether practical, theoretical, speculative, or entertaining. A survey of 1,500 issues of three newspapers from the modest frontier city of Milwaukee from 1837 to 1846 demonstrated coverage of a wide range of scientific topics that varied in approach and sensibility, from the substantive and technical to the curious and awe-inspiring.<sup>19</sup>

In addition to the robust newspaper market, scientific information circulated via general interest magazines and books—accessible via lending libraries as well as available for purchase—and a thriving nationwide lyceum circuit. The spread of the lyceum movement was extraordinary: by the early 1840s some 3,500 to 4,000 communities offered these lectures for a minimal fee, drawing an attendance of approximately 400,000 per week in the North and the West in the 1850s. These oral presentations directly engaged community members from a variety of occupations as a miscellaneous collective, and this audience was further enlarged when the lectures were reported in the local press and then reprinted elsewhere, including in collections published as books (scientific topics were second in popularity only to lay sermons in this format).<sup>20</sup> The *New York Tribune*, for example,

<sup>18</sup> William Ellery Channing, “The Present Age” (1841), in *The Works of William E. Channing* (Boston: American Unitarian Association, 1888), pp. 159–172, on pp. 159, 160, 162, 160 (emphasis added).

<sup>19</sup> “Tax on Knowledge—American and English Newspapers” [rpt. from the *London Sun*], *New York Times*, 29 Nov. 1852, p. 3. On the literacy rates see Ronald Zboray, *A Fictive People: Antebellum Economic Development and the American Reading Public* (New York: Oxford Univ. Press, 1993), p. 83; and Mary Heining, *At Home with a Book: Reading in America, 1840–1940* (Rochester, N.Y.: Strong Museum, 1986), p. 3. On the survey of the Milwaukee papers see Zochert, “Science and the Common Man in Ante-Bellum America” (cit. n. 14), p. 463.

<sup>20</sup> Donald Scott, “The Popular Lecture and the Creation of a Public in Mid-Nineteenth-Century America,” *Journal of American History*, 1980, 66:791–809, esp. pp. 791, 800; and Carl Bode, *The American Lyceum: Town Meeting of the Mind* (New York: Oxford Univ. Press, 1956), p. 230. See also Angela Ray, *The Lyceum and Public Culture in the Nineteenth-Century United States* (East Lansing: Michigan State Univ. Press, 2005).

reported on that city's lectures in a special weekly section with a press run of nearly 175,000, the bulk of which was "distributed to other newspapers and the reading rooms of thousands of young men's associations, library societies, lyceums, and mechanics' institutes."<sup>21</sup>

Historical research has scarcely touched on delineating the who, what, where, when, and why of how science in the vernacular was embedded within a thriving print culture that reached millions of eager readers. So, too, with more active responses. A few classic works have sketched various forms of interest and of vigorous engagement—for example, Elizabeth Keeney's study of the "tens of thousands of enthusiasts [who] embraced botanizing by collecting, identifying, and preserving specimens." These enthusiasts were an essential part of a "botanical culture" that manifested itself in "clubs, correspondence networks, specimen exchanges, and specialized publications" and "included beginner and expert alike." Likewise, Daniel Goldstein's detailed portrait of the Smithsonian Institution's network of correspondents demonstrated that "scientific activity was not limited to a small class of highly educated urban male professionals" but was "complemented by large numbers of farmers, tradesmen, clerical workers, and manual laborers." Many of these widely dispersed individuals were skilled rather than expert, and thus their experiences ("teaching, curatorship, collecting, and private correspondence directed toward a variety of ends") have not been seen as noteworthy. That such individuals were not experts did not keep them from presuming that they were part of the scientific community, however—as when a physician and naturalist from New Orleans approached the Smithsonian Institution for assistance on the basis of an ethic "of what he called 'a sort of free-masonry among the cultivators of Natural Science.'"<sup>22</sup>

Newspapers, periodicals, books, lyceums, and local networks served as powerful sources for the diffusion of scientific information and also represented a resilient, decentralized infrastructure for other elaborations of science as a cultural activity within American communities. And yet a recognition of these dynamics has not sufficed to sustain and extend historical exploration of these cultural patterns for the antebellum era or to stimulate sustained investigation of how the forms of popular science that had taken root were transformed in the decades after the Civil War. Indeed, when looking back from the vantage point of the achievement of professionalization, what had gone before in the public sphere could be interpreted by historians as having amounted to less than the sum of its parts, leaving nothing of worth to *be* transformed: as Robert Bruce summed up the overall dynamic in his Pulitzer Prize-winning book *The Launching of Modern American Science*, there may have been a civic multitude who had been interested in science, but it was a multitude that had "waded happily into the *shallows* of scientific knowledge"

<sup>21</sup> Scott, "Popular Lecture and the Creation of a Public in Mid-Nineteenth-Century America," pp. 798–799. By 1840, lecture topics and audiences at mechanics' institutes and on the lyceum circuit were interchangeable. It appears that the mechanics' institutes in the United States were less politically charged than those in Britain, as American artisans had the franchise and they expressed their conflicts over industrialization more directly through electoral politics. On these matters see Joseph Kett, *The Pursuit of Knowledge under Difficulties: From Self-Improvement to Adult Education in America, 1750–1990* (Stanford, Calif.: Stanford Univ. Press, 1994), pp. 110–125. On science education and mechanics' institutes in Britain see Jonathan R. Topham, "Science and Popular Education in the 1830s: The Role of the *Bridgewater Treatises*," *Brit. J. Hist. Sci.*, 1992, 25:397–430.

<sup>22</sup> Elizabeth Keeney, *The Botanizers: Amateur Scientists in Nineteenth-Century America* (Chapel Hill: Univ. North Carolina Press, 1992), pp. 1, 89; and Daniel Goldstein, "'Yours for Science': The Smithsonian Institution's Correspondents and the Shape of Scientific Community in Nineteenth-Century America," *Isis*, 1994, 85:573–599, on pp. 577, 594. The scientific leadership was clustered in large eastern cities, while this broader network existed in a higher proportion in the north-central and western regions, possessed surprising strength in the South, and was a substantial presence in locales with fewer than four thousand people (p. 579).

without recognizing that their experience of being scientific Americans was only an ersatz one. How could it have been otherwise, he remarked, when “as the professional pushed out into the deep, the layman found him increasingly hard to follow and so at last could only stand and watch”?<sup>23</sup> Given the currency of this formulation, it is not hard to see why scholars of American science would have few qualms about letting the study of popular culture in this period recede from view: it would be professionally disadvantageous to choose to stand in the shallows with the laity.

And yet, even when viewed in the fragmentary form in which our current historical understanding consists, it is clear from the strength and reach of antebellum popular science that it was consequential, if in ways that have yet to be given their due. That the experiences of those who participated in the popular sphere differed in nature from those of professionals does not necessarily render those experiences superficial, the conventional appeal of dichotomous judgments of “shallow” or “deep” notwithstanding. As the American historian James Cook notes in his review of antebellum cultural history, if this period had been seen by a previous cohort of American historians as the “opposite or antipode” of the modern, it is now seen as one of its wellsprings, particularly as “the range of cultural forms generating scholarly attention has expanded to include a far more diverse mix of vernacular, commercial, and transnational sources.” Given the numerous ways in which scientific concerns, interests, and activities were part of antebellum culture, there is every reason to expect similarly innovative results when looking at popular science as cultural history—unless, that is, there is something about the development of the scientific enterprise that results in a discontinuity that sets it apart, therefore rendering the antebellum period’s histories of popular science as anachronistic when compared to subsequent developments. Indeed, acceptance of this tacit assumption *does* affect the amount of attention given to the antebellum era, for it dovetails with the presumption that a professionalized scientific enterprise was the vanguard of a disenchanting modernity that in a post-Darwinian world had emancipated the study of nature from outmoded attachments and indiscriminate commitments. Although clearly a productive framework for conventional forms of histories of professional science in the modern period, variations on an assumption of discontinuity have produced a kind of historiographic impasse in conceptualizing science and popular culture. Attention to the emergent period’s legacies to the years that span the Gilded Age and the Progressive Era can help break this impasse, offering more heterogeneous understandings of what it means to be a scientific American, broadly conceived—if assumptions of what it means to live in an age of science can be put up for reexamination.<sup>24</sup>

#### WHAT NEXT? HOLDING FOUNDATIONAL ASSUMPTIONS UP TO SCRUTINY

The renegotiation at century’s end of what constituted authoritative scientific activity occurred during the same period in which the image of the out-of-depth citizen gained traction and the republican ethic of the diffusion of knowledge characteristic of the antebellum era was overshadowed by the stance of authorized professional scientific

<sup>23</sup> Bruce, *Launching of Modern American Science* (cit. n. 6), pp. 118, 118–119 (emphasis added).

<sup>24</sup> Cook, “Antebellum Cultural History” (cit. n. 9), p. 66. The place of wonder, religion, and other tensions in a presumed-to-be disenchanting world wrought by modern science is a key example of a question that can’t be fully grasped for the twentieth century without a fuller investigation of its nineteenth-century roots. As a starting point see Michael Saler, “Modernity and Enchantment: A Historiographic Review,” *American Historical Review*, 2006, 111:692–716.

popularizers such as Edward Livingston Youmans, the editor of *Popular Science Monthly* (which he founded in 1872). Unlike a popular educator such as Goodrich, who strove to place knowledge within everyone's reach, Youmans pitched his efforts to a more focused and upscale demographic: "the cultivated classes of the country."<sup>25</sup> In turn, as the twentieth century commenced, increasing specialization was held to have outstripped the expectation of "common understanding," and the next generation of professional scientific popularizers—such as Edwin E. Slosson, editor of *Science Service*, which supplied news items to the press—lowered expectations wholesale, explaining that "the most we can expect is that the layman may gain sufficient acquaintance with scientific thinking to understand the methods and aims of research and to appreciate its value to civilization."<sup>26</sup> This renegotiation of the status of professional science was reinforced by images of "the scientific mind" as the antithesis of "the public mind."

There are striking parallels between the identification of a gulf between experts and the laity, assumed to be intrinsic to the advance of the *sciences*, and the process of "the sacralization of culture" that occurred in other cultural domains in the latter nineteenth century, as described by the historian Lawrence Levine. Just as scientific professionalization resulted in redefinition of what had once been considered to be "the property of the multitude" as now belonging only within the bounded sphere of expert practice, so, too, did social and intellectual elites redefine other aspects of what had been the widely shared culture of the antebellum period—Shakespearean theater, museum-going, opera and the symphony—as having always belonged to a timeless category of "high culture." By the latter nineteenth century, such intellectual products were held to be too difficult, too complex, and too refined for common minds to appreciate, and now only a cultivated minority of initiates were seen as being able to serve as stewards and cultivators—characterizations that paralleled rhetoric about the relationship of the sciences vis-à-vis the general public.<sup>27</sup>

Judgments in our own time have followed the rationales regarding the inevitability of a professional/public divide presented in this transitional period and are apt examples of

<sup>25</sup> Youmans was quoted in an end-page advertisement for *Popular Science Monthly* in Asa Gray, *Darwiniana: Essays and Reviews Pertaining to Darwinism* (New York: Appleton, 1876). On Youmans see John Fiske, *Edward Livingston Youmans: Interpreter of Science for the People* (New York: Appleton, 1894); William E. Leverette, Jr., "E. L. Youmans' Crusade for Scientific Autonomy and Respectability," *American Quarterly*, 1965, 17:12–32; and Barry Werth, *Banquet at Delmonico's: Great Minds, the Gilded Age, and the Triumph of Evolution in America* (New York: Random House, 2009). Youmans's overriding obsessions were Herbert Spencer in particular and evolutionary doctrine in general; through his magazine and other ventures, he served as the American representative for the professional popularizing aims of Thomas Huxley and John Tyndall. On professionals such as Huxley as popularizers see Lightman, *Victorian Popularizers of Science* (cit. n. 4), Ch. 7; he also touches on Youmans's ambitious "International Scientific Series" popularization project. For more on this effort see Andreas W. Daum, "'The Next Great Task of Civilization': International Exchange in Popular Science: The German–American Case, 1850–1900," in *The Mechanics of Internationalism: Culture, Society, and Politics from the 1840s to the First World War*, ed. Martin H. Geyer and Johannes Paulmann (Oxford: Oxford Univ. Press, 2001), pp. 280–314.

<sup>26</sup> Edwin E. Slosson, "Popular Science," *Science*, 5 May 1922, 55(1427):480–482, on p. 481. On Slosson and *Science Service* see David J. Rhees, "A New Voice for Science: *Science Service* under Edwin E. Slosson, 1921–1929" (M.A. thesis, Univ. North Carolina, 1979); Ronald C. Tobey, *The American Ideology of National Science, 1919–1930* (Pittsburgh: Univ. Pittsburgh Press, 1971); and Marcel C. LaFollette, *Science on the Air: Popularizers and Personalities on Radio and Early Television* (Chicago: Univ. Chicago Press, 2008).

<sup>27</sup> Lawrence Levine, *Highbrow/Lowbrow: The Emergence of Cultural Hierarchy in America* (Cambridge, Mass.: Harvard Univ. Press, 1990). On the scientist's image in the Gilded Age see David Hollinger, "Inquiry and Uplift: Late Nineteenth-Century American Academics and the Moral Efficacy of Scientific Practice," in *The Authority of Experts: Studies in History and Theory*, ed. Thomas Haskell (Bloomington: Indiana Univ. Press, 1984), pp. 142–156.

the presumption, as Bernadette Bensaude-Vincent puts it, that “nothing can prevent the increasing gulf between the professional scientists in charge of the production of knowledge and the public that consumes the products of knowledge.” Bensaude-Vincent advises scholars to explore this “mythology of the increasing gulf” more carefully, and she places particular emphasis for the French case on twentieth-century physics as a critical epistemological breaking point. For the American context, I suggest that the focal point is the end of the nineteenth century—and that the rupture occurred then with particular force in reaction to the vigorous development of popular science in the antebellum years, with its deeply rooted expectations that scientific knowledge could be held in common, even when experts and nonexperts had differential investments and ends in mind. If the mythologizing aspects of an inevitably “increasing gulf” are to be recognized at the point when they began to assume the status of conventional wisdom in the United States, then the period from the 1870s through the first decades of the twentieth century needs to be examined more carefully. In turn, challenges to the assumption of an incapacitated laity in this transitional period need to become as well known to historians of American science as is the assumption of incapacity itself, allowing for a more critical examination of the dynamics of science and popular culture as they then played out over the twentieth century.<sup>28</sup>

The descriptions of and explanations for this epistemological rupture (by those who claimed to be experiencing it at the time and by those who came after) need to withstand deeper scrutiny than they have yet received. Recognition of the significance of this discourse as a cultural interpretation that homogenizes a more complex historical reality is one of the most provocative challenges that the study of science in popular culture presents today for the history of American science and for cross-cultural inquiry. In the end, core assumptions that view expert science and lay culture in terms of binary stabilizations that render professional experience as a visible reality while leaving vernacular experience only dimly perceptible will need to be reevaluated, along with what such changes portend about how to conceptualize what it means to live in “an age of science”—and what it means fully to interpret such an age as historians of science.

<sup>28</sup> Bernadette Bensaude-Vincent, “A Genealogy of the Increasing Gap between Science and the Public,” *Public Understanding of Science*, 2001, 10:99–113, on pp. 100, 108.