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Review/Reseña

Juan José Saldaña, ed., Bernabé Madrigal, trans. *Science in Latin America: A History*. Austin: University of Texas Press, 2006.

Science and Scientists in Latin America: An Historical Overview

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Historians have studied science in the colonial context for decades, generating fascinating studies that illuminate not only the historical production of scientific knowledge, but also the inner workings of global empires.[1] For Latin America, research on imperial science has grown steadily in recent years and expanded to diverse areas and periods.[2] But the

[1] For overviews of this literature, see Londa Schiebinger, "Forum Introduction: The European Colonial Science Complex," *Isis* 96, no. 1 (2005): 52-55; Roy MacLeod, "Introduction" to "Nature and Empire: Science and the Colonial Enterprise," *Osiris* 2nd series, 15 (2000): 1-13.

[2] For examples in English, see Jorge Cañizares-Esguerra, *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World* (Stanford: Stanford University Press, 2006); Londa Schiebinger, *Plants and*

history of science *within* Latin America and *by* Latin Americans is also vital to illuminate historical processes. Those who have conducted research on the region's distinct history of science have increased our understanding of its science on its own terms—as distinctly Latin American, as knowledge systems that were not simply offshoots of Western science but rather were meaningful, if alternative, ways of understanding the world.[3] Yet this approach has in many ways received less attention than colonial science, especially among international researchers working in the region. As two scholars recently lamented about British scholarship on Latin America's history of science, the field remains "on the margins of scholarly interest, occupying a rather vulnerable space between the social sciences and the humanities."[4]

Juan José Saldaña's edited book, *Science in Latin America*, thus remains an important work a decade after it was first published in Spanish as *Historia social de las ciencias en América Latina* (Mexico City: UNAM and M.A. Porrúa, 1996). In nine chapters organized chronologically, the book spans the sixteenth to the twentieth centuries and covers a range of issues related to science in the colonial and national periods of Spanish and Portuguese America. Topics include, for example, herbal medicine in the sixteenth century, Jesuit science teachings in the eighteenth century, public health in the nineteenth century, and the exact sciences in the twentieth

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Empire: Colonial Bioprospecting in the Atlantic World (Cambridge: Harvard University Press, 2004); Laura Briggs, *Reproducing Empire: Race, Sex, Science, and U.S. Imperialism in Puerto Rico* (Berkeley: University of California Press, 2002); Nancy Leys Stepan, *Picturing Tropical Nature* (Ithaca: Cornell University Press, 2001); Peter Redfield, *Space in the Tropics: From Convicts to Rockets in French Guiana* (Berkeley: University of California Press, 2000); D. Graham Burnett, *Masters of All They Surveyed: Exploration, Geography, and a British El Dorado* (Chicago: University of Chicago Press, 2000); James E. McClellan III, *Colonialism and Science: Saint Domingue in the Old Regime* (Baltimore, MD: Johns Hopkins University Press, 1992).

[3] For a good overview of and introduction to current trends in the history of science in Latin America, see Pablo Kreimer, "Social Studies of Science and Technology in Latin America: A Field in the Process of Consolidation," *Science, Technology and Society* 12, no. 1 (2007): 1-9. Also, for an older, comparative overview of the field's historical development, see Hebe M.C. Vessuri, "The Social Study of Science in Latin America," *Social Studies of Science* 17, no. 3 (1987): 519-554.

[4] John Fisher and Natalia Priego, "Ignorance and 'Habitus': Blinkered and Enlightened Approaches Towards the History of Science in Latin America," *Bulletin of Latin American Research* 25, no. 4 (2006): 529.

century. This translated edition brings the fruits of Latin Americans' scholarship on the history of science to English-speaking readers.

Science in Latin America has several objectives: (1) to study scientists as a distinct and important social group in Latin American history; (2) to situate Latin American science within its own regional or national contexts while simultaneously demonstrating that science can thrive on the "periphery"; (3) to show that meanings of science vary through time and space; (4) to reveal how historical contexts within and beyond Latin America shaped the evolution of science; (5) to demonstrate the syncretic nature of science and knowledge; and (6) to show how, why, when, and where a scientific culture emerged in Latin America. In short, Saldaña poses two broad questions for the collection of essays: "What has Latin American scientific activity been specifically, and what social conditions made it possible?" (9).

Though some contributors help illuminate these issues and answer the questions to a greater extent than others, the book is successful on many accounts. It demonstrates how Latin Americans appropriated European and North American science for their own ends. Additionally, contributors develop new, complementary historical narratives of Latin America's past. Above all, the authors help periodize the history of science in Latin America, noting particularly important changes in the sixteenth, late eighteenth, and late nineteenth centuries.

Given that the book originally appeared a decade ago, it is worth keeping in mind that scholarship has since evolved. Topics such as the hybridization of science and indigenous knowledge, and the entire concept of the "periphery," have become significantly more nuanced and complex since this anthology originally appeared in 1996. Even on its own terms, though, the book leaves some gaps and chapters tend to emphasize summaries and overviews, thus making their strongest contributions at the descriptive or empirical level. Few authors tackle theoretical issues or dialogue explicitly with contemporary history of science historiography.

The Chapters

In Chapter 1, Xavier Lozoya contrasts European with indigenous (namely Mexica) understandings of science and nature in the sixteenth century. Each of the three chapter sections makes distinct claims. First, Indians and Spaniards had different views of nature, and the author demonstrates this primarily by providing various examples of Mexica views of nature, such as their conception of the sky as having many different levels. Second, Lozoya argues that Spaniards' initial views of nature and natural history in the Americas stemmed more from Medieval than Renaissance sensibilities. He thus contends that Europeans' scientific sensibilities of the day were more complex and had deeper historical roots than other scholars have suggested. Third, the author shows that Spaniards took medicinal plants from the Americas back to Spain and used these new plants to cure illness. The Americas became such an important plant repository for sixteenth-century Spanish doctors that Lozoya labels Spanish America "a wonder-drug gold mine" (44).

While focusing on a rich topic—the sixteenth-century exchange of medicinal plants and health knowledge between indigenous America and Spain—the chapter's three sections read more like distinct essays than a unified argument. Moreover, the absence of dates, authors, and references for many of this chapter's substantive quotations creates confusion about change over time during this period when European knowledge about the Americas shifted from almost complete ignorance in 1500 to far-reaching colonization by 1600. Nevertheless, Lozoya illuminates the complexities of European sensibilities and Spaniards' understanding of nature in the Americas and enhances our knowledge about the Columbian Exchange.

In Chapter 2, the volume's editor, Juan José Saldaña, examines how new Enlightenment ideas spread through Spanish America. Saldaña traces the diffusion of eighteenth century science through personal libraries, publications, economic societies, convents, and universities. Private libraries, for example, were especially critical for disseminating knowledge during the second half of the eighteenth century, a time when the Crown banned the importation of many Enlightenment books and when the Inquisition monitored reading habits. In New Spain, José Ignacio

Bartolache accumulated 712 volumes for his personal library, of which 177 were devoted to science. Additionally, groups such as Lima's Society of Lovers of the Country (*Sociedad de Amantes del País*) circulated Enlightenment ideas through its principal publication, the *Mercurio Peruano*. More than simply spreading ideas, however, the Enlightenment in Hispanic America incorporated new science and put it into practice. Saldaña identifies four arenas in which Enlightenment science was adopted: (1) mining and other economic activities; (2) public works; (3) culture and education; and (4) the exploration of Hispanic American territory. These arenas were distinct from the Spanish Crown and thus fostered unique sciences in Hispanic America.

In essence, Saldaña's excellent chapter demonstrates how a scientific culture formed in Hispanic America in spite of the Spanish Crown's efforts to control the book trade and prevent the spread of knowledge to its American colonies. He identifies many individuals and groups who helped spread and use Enlightenment science in the Americas. Unfortunately, Saldaña does not analyze the social history and relationships of the scientists themselves: readers do not necessarily learn who the Creole scientists were or which Creole groups, if any, were most drawn to Enlightenment science. Further, he argues for the uniqueness of Hispanic American science, but without a comparison to European science it is difficult to understand precisely how it differed.

In Chapter 3, Luis Carlos Arboleda and Diana Soto Arango build on the previous chapter to demonstrate how Enlightenment scientific thought was "introduced, developed, and crystallized" in Hispanic South America, specifically in Santa Fe, Quito, and Caracas (94). The authors analyze the role of university professors—especially Jesuits before 1767 and Dominicans thereafter—in these processes. Jesuit teachers, they point out, were the first in New Granada to teach the theories of Descartes, Copernicus, and Newton. They evaded the Inquisition's ban on such thinkers' ideas by treating the Copernican system and Newtonian physics as "hypotheses" rather than fact. After expulsion of the Jesuits in 1767, Dominicans attempted to fill the vacant Jesuit niche and consolidate greater Dominican control over education in the Americas. To achieve this,

the authors contend, Dominicans often focused more on politics and power than on innovative teaching: by keeping their teachings more traditional, they avoided conflicts that may have jeopardized their political mission.

This chapter clearly contributes to scholarship on the social construction of science. As the authors demonstrate, historical context shaped the history of science (and education) in eighteenth century Hispanic America through the expulsion of the Jesuits and the relentless efforts of the Crown to isolate the Americas. More broadly, the authors show how Jesuit and other Hispanic American intellectuals negotiated the hostile and closed-minded terrain between science and theology. In Chapter 4, Antonio Lafuente and Leoncio López-Ocón diversify the study of eighteenth-century scientific expeditions. First, they show that the Spanish Crown was not the only entity to conduct geographical and natural history research. Second, they reveal that these studies were not simply efforts to expand control or achieve mercantile objectives, as scholars examining colonial science usually argue. Rather, the authors demonstrate that Latin Americans themselves also carried out scientific studies and geographical reconnaissance. They identify three groups that performed these eighteenth-century scientific expeditions: clergy, viceregal governments, and the home country. By going beyond the famous European expeditions of Cook, Malaspina, and Humboldt, Chapter 4 helps illuminate who produced science and how science evolved in Hispanic America. Further, the discussion of viceregal governments and the clergy underscores the political, economic, and cultural forces that shaped science. The chapter also shows—though the authors never discuss this explicitly—that, despite the differences among these groups, all three were interested in the same objectives: to expand power and control over environments and people. The objectives for and uses of science may not have been that different after all, even when produced on different sides of the Atlantic. I will come back to this issue later.

Juan José Saldaña argues in Chapter 5 that scientists and scientific principles played a fundamental role during Latin American independence, shaping not only the independence process but also the objectives and organization of republican governments thereafter. Noting that historians

of science have neglected the role of scientists in the new nations, Saldaña asserts broadly that "The constitutional history of Latin America is the expression of the new mentality that emerged in 1810 and in which science played a role that was little known until now" (151). Essentially, he asserts that science and technology shifted from being a "private affair" in the colonial period to "public interest" after independence. Saldaña also discusses two principal roles for science during independence.

First, he argues that scientific and geographical studies helped prove to Latin Americans that they had sufficient land, natural resources, population, and industries to thrive independently from Spain. Second, he explains that scientists took key positions of power within the new republics and thus shaped constitutional governments in the national period. While important to recognize the increasing role of scientists during the nineteenth century, Saldaña's celebration of science and technology as "the means to accomplish the common good" (155) raises many unanswered questions. Namely, without exploring ground-level consequences of scientists' positions and ideas about constitutional rule, it remains unclear whether scientists and scientific ideas actually achieved their lofty goals for social equality.

Chapter 6 examines health and medicine in the late nineteenth century, focusing on Colombia, Mexico, and Brazil. Authors Emilio Quevedo and Francisco Gutiérrez examine three aspects of medicine. First, they identify medical schools and briefly describe curricular emphases. Second, they discuss health-related policies to point out a transition from the emphasis on hygiene in the late nineteenth century to public health by the early twentieth century. The authors, however, focus primarily on the late 1800s "hygienist period." Third, Quevedo and Gutiérrez discuss medical research trends and accomplishments, though these points are embedded in the other two sections rather than in a distinct chapter section. The chapter's lack of an introduction or clear linkages among sections makes it difficult to discern the essay's historiographical or theoretical contributions, though it compiles impressive information about health research and curriculum.

In Chapter 7, Hebe M.C. Vessuri traces the emergence of an "institutionalized" scientific community during and after the late nineteenth century, identifying five phases in this process. The first period was the late 1800s and early 1900s, when European positivism legitimized science in Latin America by convincing governments of science's crucial role in national development, modernization, and progress. Second, from 1918-1940, Latin American nations institutionalized experimental sciences and eschewed European influence. Chile, for example, devoted more attention to physiology and histology while Mexico focused on agricultural research. Third, between 1940 and 1960, Latin American science turned to development to help fulfill Import Substitution Industrialization (ISI) objectives. Governments encouraged national scientists through groups such as Brazil's Society for Scientific Progress. Fourth, during the "Age of Scientific Policy" (1960 to 1980), science served pragmatic ends, such as atomic energy in Argentina or electronics in Brazil. Fifth, from 1980-1990, industry rather than government played the most active role in producing and funding science because state research budgets evaporated.

Vessuri's five-period framework makes an important contribution to the periodization of twentieth-century science. The chronology is helpful not only for history of science scholarship but also for linking science and scientists with broader historical narratives. Tighter period limits, however, could illuminate the motors of change driving science and creating transitions from one stage/era to the next. Further, Vessuri argues that science became more institutionalized and more absorbed into society and government after the late nineteenth century. Yet previous chapters made the same contention for the late eighteenth and early nineteenth centuries. Clarification about what the "institutionalization" of science means or what made the late 1800s different from the late 1700s would provide a more precise picture of specific changes taking place over time.

In Chapter 8, Marcos Cueto makes both empirical and theoretical contributions through his study of Peru's Andean Biology Institute. His chapter describes the formation of the Andean Biology Institute in the early 1930s and its advances in the study of human adaptation to high-altitude living. By studying this institute's history, Cueto demonstrates how

scientists overcame a lack of institutional support and continuity to produce their scientific studies. Because these obstacles were common throughout Peru—and elsewhere in Latin America—they point to distinct challenges and achievements that non-European scientists experienced. In this way, Cueto's discussion contributes to a broader analysis of science on the periphery.[5]

More than other chapters in this volume, Cueto's explicitly engages one of the book's principal themes: science on the periphery. He challenges the concept of the periphery because he believes "periphery" is based in dependency theory and thus runs the risk of simply showing how Latin Americans contributed to the world's main body of science in Europe. This tendency, argues Cueto, ignores scientific achievements within Latin America and denies Latin Americans' historical agency. As he explains, "periphery" can be useful only as a reference to space; otherwise "it prevents a clear understanding of important instances of scientific excellence" and "minimizes the role played by Latin American scientists in the construction of their own history" (232). Cueto's analysis remains relevant still today, evidenced by recent scholarship tackling the notion of science on the periphery.[6]

Chapter 9, by Regis Cabral, seeks to reconstruct and periodize the exact sciences in twentieth-century Latin America. Unlike Vessuri's chapter that divided the twentieth century into five periods, Cabral identifies three periods for the exact sciences. First, from the late nineteenth century to 1914, positivism and imperial expansion shaped science. Cabral discusses significant roles foreigners played in Latin America, such as the US domination of the fourth Pan-American Scientific Congress in 1908-1909 and German scientists' influence at Argentina's Universidad de La Plata. Second, the period from 1914 to 1945 was a time of great scientific

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[5] He elaborates on these issues in Marcos Cueto, *Excelencia científica en la periferia: Actividades científicas e investigación biomédica en el Perú 1890-1950* (Lima: Grupo de Análisis para el Desarrollo, 1989); Marcos Cueto, "Andean Biology in Peru: Scientific Styles on the Periphery," *Isis* 80, no. 4 (1989): 640-658.

[6] See, for example, Schiebinger, "Forum Introduction: The European Colonial Science Complex"; Steven Palmer, "Central American Encounters with Rockefeller Public Health, 1914-1921," in *Close Encounters of Empire: Writing the Cultural History of U.S.-Latin American Relations*, eds., Gilbert M. Joseph, Catherine C. LeGrand, and Ricardo D. Salvatore (Durham: Duke University Press, 1998): 311-332.

advancement and application of the exact sciences. Physics in particular thrived, with Argentina, Brazil, and Mexico establishing the most vibrant conditions for physics research. Third, from 1945 to 1990, the exact sciences were a tool for national security, shaped powerfully by the nuclear age and the Cold War.

Though the author reiterates the book's quest to distinguish Latin American science from European and North American scientific accomplishments and periods, the chapter also fuels the notion that Latin America's exact sciences were tied chiefly to events in the US and Europe. The chronology hinges on turning points (1914 and 1945) and historical forces (European positivism, nuclear power, and the Cold War) almost exclusively from outside Latin America. These global forces did, in fact, influence Latin American history and science, and the author does well to recognize them—just as earlier chapters noted the important role of European scientific expeditions in Latin America during the eighteenth century. Future research no doubt will illuminate in greater detail the complex interactions among global, national, and regional forces shaping the history of science in Latin America.

Questions and Critiques

Overall, *Science in Latin America* provides a solid overview of scientists, scientific advances, and the institutions that have produced science in Latin America from the sixteenth through the twentieth centuries. The authors' quest to periodize scientific developments—especially during the last 150 years—will offer a framework to help structure future research. Moreover, the book contributes to existing historiography in two ways. First, most authors adhere to the "science on the periphery" concept and thus demonstrate how Latin Americans themselves developed their sciences within the specific context of Latin American history—and not simply as imitators of or contributors to European science. Second, almost all the essays recognize the social context of the history of science; they show how political, economic, social, and cultural issues of the time shaped the development of scientific ideas and the scientists themselves. Empirically, the volume offers its most significant

contributions to our understanding of eighteenth-century scientific transformations in Latin America. Nearly half of the chapters examine how Enlightenment science arrived in, spread through, and became entrenched in Latin America between the mid-eighteenth century and the early nineteenth century.

Structurally, however, the book could be more accessible, especially for non-specialists. There is no index, no common bibliography (only references, often abridged, within each chapter), no conclusion, and no biographical information about chapter authors, such as the type of information normally appearing in a "list of contributors" standard in most edited books. More importantly, though, the book lacks a detailed prologue or foreword to help situate the book and orient twenty-first century readers. Saldaña does provide a short paragraph written in 2001 explaining that the Universidad Nacional Autónoma de México (UNAM) funded this translation after the International Congress of the History of Science held its 2001 meeting in Mexico City. The editor notes that this "English-language version [of *Science in Latin America*] allows the conference's findings to find worldwide distribution" (20). Yet the relationship between conference findings and these essays published five years earlier remains unclear, as do the volume's contributions another five years later when this book appeared in English. Experts of course can decipher the book's value, but other readers will wonder what aspects of the book remain timely and important for history of science research today.

The book also ignores another important section: pre-Columbian science and scientific understandings. This absence poses a particular problem, not because I wish to rewrite the book on my terms, but because the book's back-cover blurb claims that the chapters will show how Europeans "hybridized" their knowledge systems with those of Latin America's indigenous societies. In fact, this marketing suggests that what made Latin American science unique was its link with indigenous science: "Science in Latin America has roots that reach back to the information gathering and recording practices of the Maya, Aztec, and Inca civilizations. Spanish and Portuguese conquerors and colonists introduced European scientific practices to the continent, where they hybridized with local

traditions to form the beginnings of a truly Latin American science." While these concepts are innovative and interesting, they never appear in the actual book. Instead, chapters show how Latin America's Creole elite tweaked *European* science—not indigenous knowledge—and responded to historical events driven largely by foreigners, such as the Enlightenment, Bourbon Reforms, European positivism, world wars, and the Cold War. The only chapter that mentions an indigenous group is Chapter 1, which briefly discusses the Mexica but focuses on European extraction of medicinal plants rather than syncretic medical practices. The prominent appearance of Creole-indigenous hybridization on the back cover seems to underscore historiographical tendencies today rather than summarizing the book's objectives.

On a deeper level, *Science in Latin America* shows how difficult it is to navigate the intellectual terrain of "science on the periphery" and, more importantly, the potential pitfalls of this approach to the history of science. Essentially, in their quest to showcase science on the periphery, the authors of this volume tend to extol Latin American science without asking questions about the impact of science within Latin America and on Latin Americans.[7] At root is the complicated task of *simultaneously* celebrating Latin American science on its own terms, independent of Europe, without ignoring the power of science and scientific discourse—that is, the potential for science to facilitate social control, political agendas, and cultural hegemony within Latin America by the Latin American elite. Chapter titles such as "Science and Public Happiness" and "Science and Freedom" suggest, in contrast to scholarship exposing deleterious aspects of science, that science in Latin America brought happiness and freedom, though these chapters do not demonstrate whether or how people became happier or

[7] Of course, this historiographical emphasis on science, the state, and nation building has increased markedly since original publication of this volume in 1996. See, for example, Raymond B. Craib, *Cartographic Mexico: A History of State Fixations and Fugitive Landscapes* (Durham: Duke University Press, 2004); Stuart McCook, *States of Nature: Science, Agriculture, and Environment in the Spanish Caribbean, 1760-1940* (Austin: University of Texas Press, 2002). James Scott's *Seeing Like a State: How Certain Schemes to Improve the Human Condition Have Failed* (New Haven: Yale University Press, 1998) also inspired this type of research.

freer (or the reverse).[8] Saldaña's chapter on "science and freedom" in the new Latin American nations, for instance, praises the early republican leaders who believed that education and scientific knowledge could democratize and improve societies. He notes that José María Vargas in Caracas reformed universities, supposedly, to end discrimination based on race or religion. Clearly, discrimination did not disappear and education did not open to everyone in Latin America. What this essay neglects to show is the extent to which scientists' participation in republican society was real or strictly at the theoretical or discursive level. In another chapter, Cueto celebrates Peruvian scientists' achievements in the Andean Biology Institute, but the chapter does not analyze how this Institute's research affected Peru's indigenous population, the object of its studies. Did the research essentialize Indians or render them lab specimens, thereby perpetuating stereotypes that Indians were both exotic and fit only for the highlands? Did their studies help solidify coast-sierra divisions in the Andes and thereby enhance racism—or at least racial differentiation—already embedded within the *indigenismo* movement?

Ultimately, this volume accumulates important data and expands our understanding of Latin American science. But in many ways it contrasts with other history of science scholarship that has increasingly since the 1980s examined issues of power and social relations. *Science in Latin America* provides a springboard for future research that will no doubt tackle the deeper issues this book raises: To what ends was science used *within* Latin America and by Latin Americans? How did these uses of science and their effects on societies change over time? How has science affected long-term processes related to nation building, social control, gender relations, political economy, and access to natural resources? These are crucial questions this volume raises—questions that scholars are increasingly addressing today and will, I hope, continue to probe in the future.

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[8] For example, Gyan Prakash, *Another Reason: Science and the Imagination of Modern India* (Princeton: Princeton University Press, 1999).