

Problematizing the Past: An Overview of Teaching the History of Science in Latin America in the Anglophone Classroom and Its Major Issues

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ANDRÉS MANUEL DEL RÍO was born a Spaniard in Madrid in November of 1764, and died a Mexican scientist eighty-four years later in his beloved home of Mexico City. His circuitous story is characteristic of the heterogeneous nature of the history of science in Latin America. Del Río studied mining and metallurgy in Spain with the eminent German mining engineer Heinrich Cristóbal Storr, then learned about geology alongside naturalist Alexander von Humboldt under the tutelage of prominent geologist Abraham Gottlob Werner in Freiburg, Germany. Del Río later studied chemistry in Paris, France with the illustrious Antoine Lavoisier. In 1794, the recently-founded Real Colegio de Minería (Royal College of Mining) in Mexico City offered del Río a position as the college's first Chair of Mineralogy, which he accepted with great gusto. In Mexico, del Río taught classes in the sciences, published the first book on mineralogy in the New World, developed a new method for draining mines, established the first ironworks in Mexico, and

in 1801, del Río also discovered the element vanadium. Despite his long, productive career and his dedication to Mexican mineralogy, Andrés Manuel del Río died in poverty and remained essentially ignored by historians for decades. Outside of his chosen home of Mexico, del Río is almost entirely absent from histories of science. From the mathematics of pre-Hispanic indigenous civilizations to the nuclear program of Cold War-era Mexico, Andrés del Río's story is but one of countless narratives from Latin America's scientific history that deserves more broad attention from historians outside of Latin America.¹

Science in Latin America has a rich, complicated history, but it is often ignored both by traditional historians of science, as well as Latin American historians. Latin American science is characterized by liminality, *nepantlismo*, an in-between-ness, a hybridization, a *mestizaje* of multiple indigenous, Creole, imperial Iberian, and Western/Northern knowledge practices.² The segregation of a Southern science from a Western (or Northern) science is a false dichotomy that leads to exclusion of one or the other within historical narratives. This inability to effectively categorize and constrain Latin American science within the traditional narrative of the Western history of science means that Latin America is often excluded from world histories of science, and frequently omitted from narratives written and taught by Anglophone historians in the West. A greater awareness of the richness of Latin America's history of science, combined with different methodological approaches, can help pry open the doors to greater discourse and learning in a wider variety of settings. The key to teaching and learning about the history of science in Latin America is to employ a multitude of methods and to include a plurality of voices and places.

This essay is an English-language overview of a few of the broad themes in the history of science in Latin America, an introduction to the historiography of science in Latin America, and potential approaches to teaching and learning about the history of science in Latin America in the Anglophone classroom moving forward (see **Appendix A** for thematic readings and **Appendix B** for classroom readings and suggested assignments). This approach is not intended to exclude scholars who write in languages other than English and who make up a significant volume of the leading thinkers on this subject, but rather to make this sub-discipline more accessible to a

wider audience outside of Latin America and the Latin Americans living in Anglophone countries. It should also be addressed that this essay refers to the regions of South America, Central America, parts of North America, and the Caribbean generally as “Latin America,” with the understanding that the term “Latin America” is historically complicated. This essay also distinguishes between “Western” and “non-Western” science, with Latin American science being classified as the latter. As with many categorical terms, this is a false dichotomy that masks the complicated nature of Latin America geographically, as well as Latin American science historically. Similarly misleadingly binomial categories that historians have used, sometimes contentiously, include “global South/North,” “developed/undeveloped,” and “First World/Third World.” Historians of science in Western Europe and the United States are most familiar with the terms “Western” and “non-Western” and the global regions which are embodied in those terms. “Western” science includes northern North America (the United States, Canada) and Europe (Great Britain, France, Germany, Scandinavia), while “non-Western” science incorporates Africa, Arabic and Islamic countries, non-Arabic Asian countries (China, Japan, India), and Latin America. Most non-European indigenous science is considered “non-Western.” For the purposes of this essay, Iberian science is also classified as “non-Western” because it has been historically marginalized within Europe. Admittedly, the terms “Western” and “non-Western” are outdated over-simplifications of complex histories and regions, but for the sake of brevity and for a lack of appropriate alternatives, they will be used in this essay.

A Brief Overview of Some of the Major Themes of the History of Science in Latin America

There are several excellent secondary works in English on the history of science in Latin America that offer a more comprehensive examination of the people, places, and politics involved in the production and spread of science and technology across such a diverse region and through such a massive time scale, but an extremely abbreviated overview is provided below. Juan José Saldaña, Jorge Cañizares-Esguerra, Daniela Bleichmar, and Marcos Cueto are among the scholars who have published some of the most

accessible material currently available in the Anglophone academic world.³ The History of Science in Latin America and the Caribbean (HOSLAC) website is an excellent online resource for primary source documents, curated by Julia E. Rodriguez at the University of New Hampshire.⁴ The history of science in Latin America can be considered through the lens of the traditional chronological periodization that occurs in Latin American history classrooms, or perhaps more readily through a thematic study. The field does not translate as well into the typical chronology of Western histories of science (arguably, neither does pre-nineteenth-century North America), but that does not mean that Latin American science should be ignored in Western history of science classes. Thematic approaches, as mentioned, could allow for inclusion in a wide variety of classwork, and this thought will be extended in another section below. What follows is an abbreviated semi-chronological account of some major themes in the history of science in Latin America, which will hopefully offer some perspective on the breadth and depth of the material available for scholarly exploration to those unfamiliar with the topic.

Indigenous Science

The science and technology of ancient civilizations such as the Aztecs, Maya, and Inca are perhaps the most familiar in Anglophone countries. Known for their epic pyramidal structures, Mesoamericans used precise astronomical observations to erect religious architecture such as El Caracol at Chichen Itza, Templo Mayor in Mexico City, and Alta Vista near Zacatecas.⁵ Indigenous peoples in the Andes had well-developed metallurgical traditions from about 1800 BCE, and metallurgy had spread to Central America by around 200 BCE. These pre-Hispanic civilizations mined gold, silver, copper, tin bronze, and an important gold-copper alloy called *tumbaga*, which indigenous crafters then cast, hammered, gilded, smelted, and welded to form items of religious significance.⁶ The ancient Andean civilizations also created systems of roads for transport, trade, and ritual, though few were surfaced with anything other than the natural terrain.⁷ In addition to mining, massive architecture, and earthworks, indigenous Amerindians also significantly modified their natural environment for the production of food. The Tupi of pre-

conquest Amazonia utilized unique agricultural processes such as controlled slash-and-burn (swidden) methods to create biochar, and terracing was widespread in the Andes.⁸ Semasiographic systems of communication, which functioned independently of spoken language, included Andean knotted cords called *quipu*, and Mixtec and Aztec pictographs. The phonetic system of Mayan hieroglyphics is also a widely recognized form of non-alphabetic writing.⁹ The Inca, Maya, and Aztecs all developed mathematical systems which they used most frequently to record calendar dates, but some Andean civilizations also used mathematics for cultural purposes such as crafting intricate woven textiles.¹⁰ A great deal about pre-Hispanic cultures remains a mystery, in large part because Iberian explorers and the subsequent centuries of colonization destroyed the physical remains of countless peoples. However, archaeologists are still discovering and excavating new finds that may help contribute to our knowledge of the science that ancient cultures produced.¹¹ It should also be noted that indigenous science in Latin America was not limited to the pre-Hispanic civilizations, as indigenous groups and cultures persist to the present day.

“*Scientific Mestizaje*”

At the end of the fifteenth century, the voyages of discovery brought the Iberian Empire into contact and conflict with the indigenous peoples. These explorations forged a new era in the history of science in Latin America: the beginning of a “scientific *mestizaje*,” a hybridization of imperial and Amerindian sciences characterized by violence and an asymmetry of power. Amerindian sciences and technologies were inseparable from their religious beliefs, which the Europeans systematically worked to eradicate. Spanish and Portuguese men imported Iberian science to the New World with little acknowledgement of existing indigenous practices of engineering, agriculture, astronomy, herbalism, or medicine. The Conquest forced many Amerindian peoples to suppress their own knowledge practices, or in some cases adopt hybrid, syncretic, or heterogeneous knowledge practices in order to survive.

Spain and Portugal’s explorations of the New World forever changed European world maps, as Iberian navigators and cartographers charted new coastlines by different stars. The Iberian explorers

mapped their courses using relatively sophisticated instrumentation for the era, and royal cosmographers in Spain collected and analyzed the scientific and technical material that returned from the New World.¹² In search of riches, the brutal extractive mining of silver and gold in the Andes and New Spain funded imperial ventures at home and abroad, and made Spain's colonial wealth the envy of Western Europe. In Pachuca, Mexico in the mid-1550s, Spaniard Bartolomé de Medina developed the patio process of amalgamation, a process that uses mercury to extract silver from lesser-grade ore. Metallurgists in the Andes later modified Mexico's process of amalgamation for the elevation and ore native to the mountainous mining of the Andes.¹³ Apart from silver and gold, the riches of the New World were also botanic in nature: Spain sent many botanical expeditions to the New World in search of medicine, food, spices, and other commodities that could enrich the imperial coffers. In what is now referred to as the Columbian Exchange, European travelers in this era returned to their home countries with foods that are indispensable to modern palates: potatoes, chiles, tomatoes, corn, chocolate, vanilla, strawberries, peanuts, and pumpkins to name just a few.¹⁴ In the 1570s, Spanish naturalist Francisco Hernández spent nearly seven years traveling, collecting, illustrating, and testing the properties of 3,000 plants in New Spain, drawing on the cultural knowledge of Nahua herbalists and relying on Nahua translators and historians.¹⁵ Many of the records from these botanical expeditions are only now being exhumed from the archives in Spain.¹⁶

Many Spaniards born in the New World, called *criollos*, or Creoles, helped found universities and other scientific practices. The University of Mexico was founded in 1553, and by 1810, there were thirty universities in Spanish America.¹⁷ There were also alternative places of knowledge production and dissemination open to Peninsulars and Creoles in the New World, such as private libraries, courts, and military establishments. Convents were sometimes repositories of education for women like the prodigious seventeenth-century Mexican writer and intellectual Sor Juana Inés de la Cruz, and elite indigenous men had access to formal and informal religious education.¹⁸ As Jorge Cañizares-Esguerra has cleverly demonstrated, a type of nationalistic Creole science (part of what he termed a "patriotic epistemology") also emerged in the late sixteenth and early seventeenth centuries as a response to perceived

neglect from the Iberian monarchies, as well as a way to reject negative stereotypes of European-descended residents of the New World.¹⁹ This patriotic battle of Creole versus European scientists emerged as a common thread that spanned several centuries after the “discovery” of the New World.²⁰

Eighteenth- and Nineteenth-Century Science

The end of the eighteenth and beginning of the nineteenth centuries saw a new wave of European scientific expeditions in Latin America. The German naturalist Alexander von Humboldt traveled extensively through Spanish America from 1799 through 1804, and wrote prodigiously about his encounters.²¹ Influential Czech botanist Tadeo Haenke traveled to Spanish America in 1789 to work with the Malaspina Expedition, and spent the remainder of his life collecting botanical specimens, experimenting, and writing in Cochabamba, Bolivia.²² With the rise of the railroads in the early part of the nineteenth century came the first major wave of domestic iron and steel production, in part to increase economic independence from the largely European nations that constructed, owned, and operated the railroads.²³ The Wars for Independence, which broadly occurred between 1810 and 1826, also altered the course of science and technology in Latin America. Juan José Saldaña and Thomas Glick have argued that science and scientists were vital to the building of new the nation-states, and that the post-Independence era, rather than stymie scientific advances, actually fostered a new form of scientific nationalism that focused on “useful” science and education.²⁴ The late nineteenth century saw the rise of Darwinism in Latin America, both in the traditional sense of the study of evolution as well as in the Spencerian concept of racialized bodies and social Darwinism. This type of “scientific” racialization, which Cañizares-Esguerra argued actually began in the seventeenth century with Creole thinkers, eventually morphed into the eugenics movement of the early twentieth century.²⁵ The post-Independence era was also the era of scientific Positivism, especially in Mexico, where Porfirio Díaz and his technocratic *científicos* instituted “scientific” laws intended to reshape Mexican society into a logical, orderly, efficient culture, including the implementation of highly regulated health and hygiene measures in Mexico City.²⁶

Twentieth-Century Science

In the beginning of the twentieth century, relatively well-established nations such as Argentina and post-Revolution Mexico ramped up efforts to strengthen scientific education and research within their respective countries.²⁷ The early twentieth century also saw Latin America as the stage for international health initiatives, spearheaded initially by the Rockefeller Foundation, which zealously pursued the “Americanization” of medicine in the top-down fashion expected of the Western medical “elite.”²⁸ This period also saw an increase in the transnational politicization of the production of food, and with it, the rise of local and global exchanges about agricultural science.²⁹ As the Cold War developed by the middle of the twentieth century, so did new global technologies such as nuclear power. Both Argentina and Mexico developed well-publicized programs for the promotion of nuclear energy, though Mexico’s program desired peaceful power solutions and Argentina’s president Juan Perón imported European scientists for a shockingly expensive debacle involving nuclear fusion.³⁰

**Who Should Study the History of Science
in Latin America and Why?**

Traditional history of science curriculums, which often include at least cursory information about non-Western science, would benefit from the inclusion of Latin American and imperial Iberian science. As Cañizares-Esguerra stated, “Portuguese and Spanish cosmographers and navigators literally redrew the map of the earth.”³¹ The cartographic, navigational, and natural history of the early “Voyages of Discovery” of the Iberian empire alone merit discussion, not to mention the rich scientific material produced in the New World and post-independence Latin America. Likewise, both colonial and modern Latin American history classes could enrich their syllabi by the inclusion of science and technology history.

Many disciplines outside the field of history could benefit from the inclusion of Latin America’s science and technology history. Science educators may find value in the socio-cultural aspects of knowledge production. Public health educators might appreciate aspects of Latin American public health history (perhaps most

especially where it overlaps with the United States). Comparative Studies students might appreciate the Hippocratic/Galenic debates of the ancient world about New World constitutions. Ethnobotany students will find rich material in Latin American science as well, including centuries of indigenous herbalism, post-conquest search for New World botanical medicines, and ancient religious use of hallucinogens. Environmental Engineering students might be interested in the destructive nature of grazing animals in the New World, or perhaps of the extensive mining that occurred in Mexico and the Andes. Political Science, Biology, and Nursing students can consult material about U.S. science policies and practices (health, medicine, agriculture, engineering) that directly affected, or were affected by, Latin America. English Literature students could, for example, identify the inter-relation between magic realist literature (Jorge Luis Borges being a prime example) and the way in which science fiction became enmeshed in popular culture in the nineteenth and twentieth centuries.

Select Barriers to Studying the History of Science and Technology in Latin America

Western historians of science and technology have widely ignored Latin America, in part because until the end of the twentieth century, little had been written in English that detailed the scientific histories of Latin America. The majority of the primary sources that could illuminate the scientific and technological histories of the indigenous Amerindians, as well as the imperial colonizers, were either in the languages of conquest (Spanish, Portuguese), or written in native languages when alphabetic writing was introduced post-conquest (Nahuatl in Mexico and Quechua in the Andes, among others). Scholars have encountered multiple challenges in the interpretation of non-textual records, including Mayan hieroglyphs, Andean *quipus*, maps, and paintings. Since the mid-1990s, however, the pace with which scholarly articles and books have been published about science in Latin America has quickened almost exponentially, both in English as well as in Spanish and Portuguese. More historians are delving into unpublished, untranslated archives to draw out stories of people, places, and sciences that have been buried for centuries.

The West's historic views about Iberia and Latin America as being backward, unscientific, and unworthy of study have also formed a barrier to studying Latin American science. Cañizares-Esguerra has argued that these Western beliefs stem in part from the widespread anti-Iberian sentiments that emerged from the Catholic and Protestant confrontations as a result of the Reformation. Iberia's scientific expeditions were steeped in the Catholic religious culture from which they ventured, and Catholic priests wrote or commissioned many of the first scientific treatises produced in the New World. *La Leyenda Negra*, or "The Black Legend," was a successful Western European propaganda campaign that demonized Catholic Spaniards and distorted Western Europe's perception of Spanish history and culture. Furthermore, the secrecy with which the Spanish crown dealt with potentially valuable information relegated many of their subjects' scientific works to the dusty imperial archives, where many were printed only decades later or not at all. It is only now that researchers and historians are mining some of these archives for their scientific papers.

A final potential barrier to the study of Latin America's history of science in Western schools involves questions of epistemologies and ontologies. In other words, what is *history*?—and whose history is being told, where, and by whom? Who has a voice in the *histories*? Likewise, what is *science*, and who can be considered *scientists*? Who defines what constitutes *science*? These discussions and their attendant rebuttals are beyond the scope of this document, but it is important to acknowledge that they are legitimate questions in the non-Western histories of science. Historically, Western science has presumed an aura of universality and neutrality, with all non-Western science relegated to the inferior status of "other." In this model, the West "does" the science, and non-Western groups merely have cultural knowledge practices. Rather, we argue that Western science is one among countless highly localized, historically based and socially constructed knowledge practices. Furthermore, the "scientific *mestizaje*" that characterized much of the post-invasion production of knowledge in Latin America brings up the question of what can be considered "Western" and what can be considered "non-Western" in Latin American histories of science. Thus, the issue is not about legitimizing the history of science in Latin America within the Western tradition, it is rather about re-framing the discussion entirely.³²

A Brief Introduction to the Historiography of Science in Latin America

The historiography of science in Latin America has a slightly different approach from within Latin America and from the external view of Western academia, but many of the foundational texts have not yet been translated and so must be read in their original language (predominantly Spanish). Juan Jose Saldaña offered an excellent overview of the historiography in his introduction to *Science in Latin America: A History*. In his essay, Saldaña discussed the manner in which the evolution of the history of science had largely neglected “peripheral” places and peoples, and he sought to problematize the concept of “periphery” in relation to Latin American science.³³ The following brief historiography is different in that it is thematic as opposed to strictly chronological, and additionally accounts for themes not touched on by Saldaña. It further differs because there have been advances in the historiography of science since Saldaña’s work was originally published at the end of the twentieth century, notably, the historical reinterpretations produced by subaltern/postcolonial/decolonial perspectives.

Colonial, “Big Man,” and Western Approaches

Until recently, the English-language secondary sources about the history of science in Latin America have consisted of colonial science, “big man” science, and/or Western science—or what Juan Pimentel has aptly dubbed “the hagiography of the mainstream.”³⁴ There is frequent overlap within the categories. Colonial science accounts present the efforts of imperial Europeans to travel to the colonies, to exploit the colonies economically (with mining, agriculture, or slavery, for example), to do European science of one form or another in the colonies, or consists of a history of an imperial European living or working in the colonies.³⁵ “Big man” science is a biographical history about a Western man (not woman) doing science in a non-Western place. The plethora of books published about Alexander von Humboldt are a prime example, or even the constant reprisals about Charles Darwin’s voyage on the HMS *Beagle*. Finally, Western science is similar to colonial science in that it is a Eurocentric history in which the non-Western places and

peoples are tangential to the triumphalist Western arc of the story, but it occurs in the post-independence era.

The most prominent mode of analysis used in the history of science in Latin America is that of the center and periphery, where the “center” generally refers to an imperial nation and the “periphery” usually refers to a colony. The center is also sometimes called the “core” or the “metropolis,” but the concept is the same. This model frequently assumes that science and scientists originate in the (usually European) center, while only passive reception of science occurs in the (non-European) periphery. This center-periphery framework is a prevalent standalone analytical approach, as well as a common thread throughout multiple historical methodologies such as dependency theory and technological diffusion, described below.³⁶

Dependency Theory Approaches

Dependency theory emerged from the United Nations Economic Commission for Latin America in the mid-twentieth century, and rose to prominence in the 1960s and 1970s. The writings of German-American economic historian Andre Gunder Frank spurred the rise of neo-Marxist dependency theory in Europe and the United States. Frank’s argument was that the impoverishment and deliberate underdevelopment of Latin American countries (the periphery) benefited the developed nations (the core), who only sought to extract and exploit material wealth from Latin America. According to this theory, the historical need for Latin American countries to export raw materials forced them to be dependent on the same countries who exploited them. This was in part because manufacturers in the imperial nation fashioned Latin America’s raw materials into finished goods, which were subsequently sold to the exploited nation in an economic transaction that benefited the imperial nation. Dependency theory affected the historiography of science in Latin America by overshadowing and ignoring Latin America’s historical contributions to science and technology, from pre-Hispanic civilizations through the modern era. Implicit in the theory was the idea that Latin American countries had nothing to offer the West apart from their material resources, and that the technologies used for exploiting the materials were imported to Latin America by Western nations and used exclusively by Westerners working in Latin America for

Western corporations. Dependency theory did not just highlight asymmetrical power systems and economic dependency, it also incorrectly cast Latin American cultures as inherently scientifically and technologically impoverished and thus unworthy of study by Western historians of science. A notable historical work based on dependency theory is renowned Uruguayan historian and writer Eduardo Galeano's *Las Venas Abiertas de América Latina* (*Open Veins of Latin America*), a copy of which former Venezuelan President Hugo Chávez publicly gave to former United States President Barack Obama in 2009. In the book, Galeano wielded vibrant prose to highlight the ways that developed nations had relentlessly extracted material wealth from Latin American nations, leaving impoverishment and underdevelopment in their wake.

World-Systems Theory Approaches

In the 1980s, Immanuel Wallerstein's world-systems theory evolved out of dependency theory. The world-systems theory's primary difference in Wallerstein's work being the idea that "central" capitalists exploited peoples in every feasible location (not merely in a "periphery") and that every nation-state functioned within and could not be understood apart from a world-system.³⁷ In this approach, Europe and the United States forcibly imposed their world-systems onto Latin America, beginning with first contact. According to Aníbel Quijano, Western Europe's domination of the "center" of the world-system manifested as ethnocentrism and, by extension, as racialization and racism. This had historical ramifications that reverberate through to modern societies, notably in what Quijano termed the "coloniality of power." Although Quijano focused primarily on political, economic, and cultural aspects of coloniality, his argument can also be extended into science and technology, in part due to his questioning of the concept of "modernity" as defined by Europe and the United States. According to Quijano, the colonial power differential was manifested in Eurocentric hierarchies in which European men deemed European knowledge systems as superior, while non-European knowledge systems were classified as inferior and pushed aside. The Western perception of "modernity," as imposed onto Latin America, included Eurocentric definitions of

science and technology, as well as Eurocentric visions of *what* constituted science, *who* could do science, and *where* science could be produced. The Quijano/Wallerstein approach to world-systems theory is relevant to the study of the history of science in Latin America because it undermines the whiggish narrative of traditionally Eurocentric histories of science, which then opens the door to the consideration and formation of additional/alternative frameworks. Furthermore, Quijano's concept of coloniality of power was foundational for the burgeoning studies of decoloniality, which will be discussed briefly below.³⁸

Diffusion Theory Approaches

In 1967, the year after Andre Gunder Frank published his influential work *The Development of Underdevelopment*, historian George Basalla penned his treatise "The Spread of Western Science." Basalla's painfully Eurocentric diffusion model, which has since been widely discredited, described three overlapping stages in which Western European science "diffused" from Western European countries to "nonscientific" nations. In this model, the first phase consisted of a (male) European who traveled to a "nonscientific" place and explored its geography, natural resources, flora, and fauna, then returned to Europe with this information. The second phase, which Basalla termed "colonial science," entailed a significantly larger group of Europeans who ventured to the new land and brought their science with them. In this phase, the "nonscientific" peoples depended upon the European-educated scientists and their attendant European sciences. Curiously, Basalla claimed that this phase did not imply scientific imperialism. The third and final phase was the "struggle to establish an independent scientific tradition" within the non-Western country. By this, Basalla meant that the Western European colonial scientific expeditions paternalistically attempted to force the growth of Western European science in non-Western places, especially through the suppression or supplantation of local cultural and religious beliefs.³⁹ Historians and social scientists have widely criticized this Eurocentric and uni-directional model of science because its simplistic, linear account of scientific diffusion failed to address the complex nature of knowledge practices across multiple cultures.⁴⁰ Saldaña also

argued that the omission of local context inherent in all diffusionist approaches “make the science of peripheral areas dependent on the mythical and, consequently, ideological scientific misoneism of a ‘disinterested’ Europe.”⁴¹

Technology Transfer Approaches

A method of analysis related to both Basalla’s diffusion theory and dependency theory is that of technology transfer, in which technologies are disseminated from the “center,” usually presented as a Western nation, to a “periphery,” which is generally represented by a non-Western place. Sometimes the center is a large metropolis and the periphery is a rural area within a single nation. Common in histories of agriculture and railroads, analysis of technology transfer is still relatively prevalent in modern Western histories of technology in Latin America.⁴² It is theoretically possible to write about technology transfer in a more inclusive manner, in which the standard uni-directional and top-down narratives are problematized. An example of this approach is by Hugo Palmarola and Pedro Ignacio Alonso’s “Tropical Assemblage: The Soviet Large Panel in Cuba,” one of the chapters in *Beyond Imported Magic*. In the essay, the authors demonstrated the way in which the construction of a Soviet-financed factory that manufactured large concrete panels for housing developments evolved into a hybrid Soviet-Cuban technology that was uniquely Cuban in design and symbolism.⁴³

Constructivist Approaches

By the late 1980s and into the 1990s, diffusion and dependence models largely gave way to more contextual analyses of the history of science in Latin America. These analyses used a constructivist approach to examine particular localities, as opposed to the homogenizing center-periphery model.⁴⁴ These histories often used what Clifford Geertz called “thick description” to illuminate the rich and complex practices of science in non-dominant places and spaces.⁴⁵ Social construction of science and technology is still commonly used, not just in Latin America, but in science studies across the world.

Postcolonial Approaches

The most recent methodological development in the history of science in Latin America has recently emerged from cross-disciplinary subaltern studies, postcolonialism, and decoloniality. This approach will be referred to henceforth under the umbrella term “postcolonial” because postcolonialism best approximates the current academic-historiographic epoch. Decoloniality, which should not be conflated with postcolonialism, is another important framework for understanding historically marginalized peoples and knowledge practices. Latin American postcolonial studies are notoriously challenging to define. “Postcolonial” does not necessarily refer to a period in time after a nation achieves political independence from another, colonizing nation, but rather refers to the decolonization of the historical narrative itself, with the intent of opening up space for discourse. Collectively, these theoretical frameworks moved beyond the standard model of white, male, Western histories by problematizing and disrupting the dominant discourses. They created space for historically marginalized peoples to speak and to have agency by re-contextualizing, re-localizing, and re-framing possible narratives. In these histories, Western science was one of multiple voices, not *the* voice. It had been removed from its exalted position of universality and neutrality. Western Europe and the United States were no longer the center; they were part of the narrative, but no longer the entirety.⁴⁶ As stated by renowned Latin American semiotician Walter Mignolo, Latin American postcolonial studies were about “decentering the center or multiplying it” and altering the “loci of enunciation.”⁴⁷ Unlike earlier iterations of social constructivism, these were not social histories of subaltern peoples from a Western/central perspective, but rather a deconstruction of the traditional narratives in order to expand discourse. Postcolonialism, it should be said, is an intermediary stage, a sort of methodological placeholder in the current historiographic evolution toward an as-yet-unknown future analytical framework. Perhaps decoloniality will take precedence. What will emerge next, and what it will be called, is as yet unknown.

Although he has been critical of Mignolo’s works, selections from Jorge Cañizares-Esguerra’s book of essays, *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World*, could be considered postcolonial because of the way in which

the author radically and brilliantly re-framed certain histories of science and illuminated the narratives of less well-known histories. In *Nature, Empire, and Nation*, Cañizares-Esguerra removed pillars of Western science such as Alexander von Humboldt and Francis Bacon from their pedestal and placed them alongside equally as important Iberian, Creole, and indigenous thinkers.⁴⁸

In the last few decades, the trajectory of the historiography of science in Latin America has thus gradually shifted away from Eurocentric approaches, such as Basalla's diffusion model and the overly simplistic and homogenizing narratives of center and periphery. Social construction of science, though useful for its contextualization, is limited in its ability to navigate the complex nature of Latin American science. Postcolonialism, which is already well established in academia, and decoloniality, which is an important burgeoning framework, provide vital foundations for rebuilding the history of science in Latin America from a non-Eurocentric perspective.

How Aspects of Postcolonialism Are Useful in Teaching the History of Science in Latin America

First and foremost, it is not necessary to teach postcolonial theory to bring the history of science in Latin America into the classroom. Some historians are notoriously anti-theory, so perhaps it is more pedagogically useful to view postcolonialism as a historiographic methodology. Using a postcolonial approach is only one of many tools that allow a historian of science to move beyond traditional Western narratives that devalue the sciences and technologies of non-Western peoples, and it is undoubtedly not the only approach that the historian/professor of Latin American science might employ.⁴⁹ In that vein, rather than dismiss postcolonialism as irrelevant (or even paradoxical) to teaching about history of science in Latin America, it is possible, as Fernando Coronil argued, that it should be treated as a "liminal space for developing knowledge from our various loci of enunciation."⁵⁰ In other words, postcolonialism is an evolving place from which a historian/professor may speak about an underserved discipline of history, including historically marginalized peoples and places. The postcolonial approach allows the historian to move beyond limited (and limiting) methods of analysis, such as center-periphery, diffusion, or dependency.

The aforementioned “scientific syncretism” complicates the narratives, since multiple knowledge practices are often intertwined.⁵¹ Rather than take sources at face value, it is important to contextualize the primary sources. The violence, racism, greed, and destruction inherent in the history of science in Latin America should all still be part of the narratives, as with other stories such as the “big man” histories of Humboldt and Darwin, and dependence narratives such as in Galeano’s *Open Veins of Latin America*. These histories continue to have value, but they are no longer the only histories that need to be told. What is important is to re-frame these and other traditionally Eurocentric narratives, and put them in context or comparison. This questioning can spark lively discourse, and can challenge personal or historical assumptions. Who did Humboldt encounter in Latin America and what were their influences on him? How did indigenous metallurgical techniques influence Iberian metallurgy in the New World? How does the art of a particular era reflect the science that was evolving at the time? What role did women play in the history of medicine, and how do we know? How were Spanish maps used against the Spaniards for indigenous land claims in New Spain? And so forth.

Some Potential Issues with the Use of Postcolonialism in the History of Science in Latin America Classroom

The most salient issue with the application of postcolonialism in the Latin American history classroom is that the term itself implies that Latin America has moved past colonialism, which is not entirely true. Post-independence Latin American nations have had to deal with the almost continuous neocolonial and imperialistic incursions of many Western nations, from France and Britain to the United States and Russia, among others. Furthermore, there is the sensitive issue of Western academic colonialism, in which privileged academics appropriate the narratives of Latin American academics or of historically marginalized peoples. However, as Mignolo stated, “The issue here is not whether one who is born in Holland should be a miller and one born in New York a stockbroker nor whether someone born in Holland or in New York has more authority when it comes to mills or the stock market but rather who is talking about what where and why.”⁵² Teachers should also be cautious regarding

the scholarly danger of presentism and of relativism, issues that are often addressed in any history class. Finally, in the classroom, there is the looming shadow of the “PC,” or the politically correct, which some students (and professors) have wielded to deride and dismiss non-dominant narratives.

Moving Forward

In conclusion, scholars need to perform more deep archival research, and more academic works need to be written about the history of science and technology in Latin America and the Caribbean. However, very little has been written that is accessible outside of niche academic circles. This is in part because it is a relatively new field and much work has yet to be done, but the popularization of the field must first overcome long-standing prejudices against non-Western peoples and knowledge practices, as well as a cultural anxiety in the humanities about science and technology. Incorporating Latin America into textbooks on non-Western histories of science would be an excellent start, and the publication of sensitively written books that are also highly readable and accessible to the general public would be even better.

Notes

1. Emma Yanes Rizo, “Pasión por la Tierra,” *Artes de México*, no. 86, Una Visión de la Minería (October 2007): 48-55; Santiago Ramírez, *Biografía del Sr. D. Andrés Manuel del Río, Primer Catedrático de Mineralogía del Colegio de Minería* (Mexico: Imprenta del Sagrado Corazón de Jesús, 1891), available at Colección Digital de la Universidad Autónoma de Nuevo León, <<https://cd.dgb.uanl.mx/handle/201504211/7861>>; Carlos Prieto, *Mining in the New World* (New York: McGraw-Hill, 1973), 127-128; Maria de la Paz Ramos Lara and Juan José Saldaña, “Del Colegio de Minería de México a la Escuela Nacional de Ingenieros,” *Quipu* 13, no. 1 (January-April 2000): 105-126.

2. Gordon Brotherston, “America and the Colonizer Question: Two Formative Statements from Early Mexico,” in *Coloniality at Large: Latin America and the Postcolonial Debate*, ed. Mabel Moraña, Enrique Dussel, and Carlos A. Jáuregui (Durham, NC: Duke University Press, 2008), 24. “And I now call it *Nepantla*, which is a Nahuatl word for the space between two bodies of water,

the space between two worlds. It is a limited space, a space where you are not this or that but where you are changing. You haven't got into the new identity yet and haven't left the old identity behind either—you are in a kind of transition. And that is what *Nepantla* stands for. It is very awkward, uncomfortable, and frustrating to be in that *Nepantla* because you are in the midst of transformation.” Gloria Anzaldúa, *Borderlands/La Frontera: The New Mestiza* (San Francisco, CA: Aunt Lute Books, 1987), 13. The term *mestizaje* is a Spanish word that originally meant the mixing of races, particularly the mixing of a person with Iberian (Spanish or Portuguese) lineage and an indigenous person. The term has since developed wider cultural implications and connotations.

3. Juan José Saldaña, *Science in Latin America: A History* (Austin, TX: University of Texas Press, 2006); Jorge Cañizares-Esguerra, *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World* (Stanford, CA: Stanford University Press, 2006); Daniela Bleichmar, Paula De Vos, Kristen Huffine, and Kevin Sheehan, eds., *Science in the Spanish and Portuguese Empires, 1500-1800* (Stanford, CA: Stanford University Press, 2009); Marcos Cueto and Steven Palmer, *Medicine and Public Health in Latin America: A History* (Cambridge, United Kingdom: Cambridge University Press, 2015).

4. History of Science in Latin America and the Caribbean (HOSLAC), <<http://www.hoslac.org>>.

5. Martha J. Macri, “Astronomy in Mesoamerica,” in *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*, ed. Helaine Selin, second ed. (Dordrecht, Netherlands: Springer, 2008), 360-364.

6. Karen Olsen Bruhns, *Ancient South America* (Cambridge, United Kingdom: Cambridge University Press, 1994), 174-177; Kendall W. Brown, *A History of Mining in Latin America: From the Colonial Era to the Present* (Albuquerque, NM: University of New Mexico Press, 2012), 6-8.

7. Bruhns, *Ancient South America*, 289.

8. Shawn William Miller, *An Environmental History of Latin America* (New York: Cambridge University Press, 2007), 14, 23; Charles C. Mann, *1491: New Revelations of the Americas Before Columbus* (New York: Knopf, 2005).

9. Elizabeth Hill Boone and Walter Mignolo, *Writing Without Words: Alternative Literacies in Mesoamerica and the Andes* (Durham, NC: Duke University Press, 1994), 15-22.

10. Michael P. Closs, “Mathematics: Aztec Mathematics,” in *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*, second ed., ed. Helaine Selin (Dordrecht, Netherlands: Springer, 2008), 1368-1371; Michael P. Closs, “Mathematics: Maya Mathematics,” in *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*, ed. Helaine Selin, second ed. (Dordrecht, Netherlands: Springer, 2008), 1406-1410; Thomas E. Gilsdorf, “Ethnomathematics of the Inkas,” *Encyclopaedia of the History of Science, Technology, and Medicine in Non-Western Cultures*, ed. Helaine Selin, second ed. (Dordrecht, Netherlands: Springer, 2008), 903-914.

11. See, for example: “Peru: Wood Sculptures and Other Relics Found at Ancient Chan Chan,” *Andina: Agencia Peruana de Noticias*, 27 September 2017, <<http://www.andina.com.pe/Ingles/noticia-peru-wood-sculptures-and-other->

relics-found-at-ancient-chan-chan-684510.aspx>. Another interesting note about this brief article is that some of the primary scientists involved in this excavation were women.

12. María M. Portuondo, “Cosmography at the *Casa, Consejo, and Corte* during the Century of Discovery,” in *Science in the Spanish and Portuguese Empires, 1500-1800*, ed. Daniela Bleichmar, Paula De Vos, Kristen Huffine, and Kevin Sheehan (Stanford, CA: Stanford University Press, 2009), 57-77. For a recent discovery of one of the maritime instruments used by the Iberian empire, see Sarah Gibbens, “Rare Solar Navigation Tool Found in Ancient Shipwreck,” *National Geographic*, 24 October 2017, <<https://news.nationalgeographic.com/2017/10/navigation-tool-astrolabe-vasco-da-gama-shipwreck-esmeralda-spd/>>.

13. Brown, *A History of Mining in Latin America*, 30; Cañizares-Esguerra, *Nature, Empire, and Nation*, 33.

14. Alfred W. Crosby, *The Columbian Exchange: Biological and Cultural Consequences of 1492* (Westport, CT: Praeger, 2003).

15. Cañizares-Esguerra, *Nature, Empire, and Nation*, 8.

16. Paula De Vos, “Natural History and the Pursuit of Empire in Eighteenth-Century Spain,” *Eighteenth-Century Studies* 40, no. 2 (Winter 2007): 209-239.

17. John Tate Lanning, *Academic Culture in the Spanish Colonies* (London, United Kingdom: Oxford University Press, 1940), 14; Daniela Bleichmar, et al., *Science in the Spanish and Portuguese Empires*, 26.

18. Sor Juana Inés de la Cruz, *The Answer/La Respuesta, Expanded Edition*, trans. Electa Arenal and Amanda Powell, second ed. (New York: The Feminist Press, 2009), 4; Gabriela Ramos and Yanna Yannakakis, *Indigenous Intellectuals: Knowledge, Power, and Colonial Culture in Mexico and the Andes* (Durham, NC: Duke University Press, 2014), 8-9.

19. Jorge Cañizares-Esguerra, *How to Write the History of the New World: Histories, Epistemologies, and Identities in the Eighteenth-Century Atlantic World* (Stanford, CA: Stanford University Press, 2001), 204; Jorge Cañizares-Esguerra, “New World, New Stars: Patriotic Astrology and the Invention of Amerindian and Creole Bodies in Colonial Spanish America, 1600-1650,” in *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World* (Stanford, CA: Stanford University Press, 2006), 64-95.

20. See, for example, Anna More, “Cosmopolitanism and Scientific Reason in New Spain: Carlos de Sigüenza Góngora and the Dispute over the 1680 Comet,” in *Science in the Spanish and Portuguese Empires, 1500-1800*, ed. Daniela Bleichmar, Paula De Vos, Kristen Huffine, and Kevin Sheehan (Stanford, CA: Stanford University Press, 2009), 115-131.

21. Alexander von Humboldt, *Political Essay on the Kingdom of New Spain*, third ed. (London, United Kingdom: Longman, Hurst, Rees, Orme, and Brown, 1822).

22. Leticá Halperín Donghí, “Chemistry in the Rio de la Plata at the End of the Colonial Epoch,” *Chymia* 12 (1967): 119-126.

23. William E. Cole, *Steel and Economic Growth in Mexico* (Austin, TX: University of Texas Press for the Institute of Latin American Studies, 1967), 8-9, 26-27.

24. Juan José Saldaña, "Science and Freedom: Science and Technology as a Policy of the New American States," in *Science in Latin America: A History* (Austin, TX: University of Texas Press, 2006), 151-162; Thomas F. Glick, "Science and Independence in Latin America," *Hispanic American Historical Review* 71, no. 2 (May 1991): 307-334.

25. Cañizares-Esguerra, *Nature, Empire, and Nation*, 85, 93; see also Nancy Leys Stepan *The Hour of Eugenics: Race, Gender, and Nation in Latin America* (Ithaca, NY: Cornell University Press, 1991); Adriana Novoa and Alex Levine, *From Man to Ape: Darwinism in Argentina, 1870-1920* (Chicago, IL: The University of Chicago Press, 2010).

26. Claudia Agostini, "Material Culture, Public Health, and the Technologies of Hygiene in Modern Mexico, 1890s-1940s," in *Technology and Culture in Twentieth-Century Mexico*, ed. J. Brian Freeman and Araceli Tinajero (Tuscaloosa, AL: The University of Alabama Press, 2013), 25-42; for additional countries, see Marcos Cueto and Steven Palmer, *Medicine and Public Health in Latin America: A History* (Cambridge, United Kingdom: Cambridge University Press, 2015).

27. Thomas Glick, "History of Science in Latin America," *The Cambridge Encyclopedia of Latin America and the Caribbean*, second ed. (Cambridge, United Kingdom: Cambridge University Press, 1992), 427.

28. Marcos Cueto and Steven Palmer, *Medicine and Public Health in Latin America: A History* (Cambridge, United Kingdom: Cambridge University Press, 2015), 109-122; see also Marcos Cueto, ed., *Missionaries of Science: The Rockefeller Foundation and Latin America* (Bloomington, IN: Indiana University Press, 1994); Marcos Cueto, "El Rockefeller Archive Center y la Medicina, la Ciencia y la Agricultura Latinoamericanas del Siglo Veinte: Una Revisión de Fondos Documentales," *Quipu* 8, no. 1 (January-April 1991): 35-50; Nancy Leys Stepan, "The National and the International in Public Health: Carlos Chagas and the Rockefeller Foundation in Brazil, 1917-1930s," *Hispanic American Historical Review* 91, no. 3 (August 2001): 469-502.

29. Leida Fernández Prieto, "Islands of Knowledge: Science and Agriculture in the History of Latin America and the Caribbean," *Isis* 104, no. 4 (December 2013): 788-797.

30. Eden Medina, Ivan da Costa Marques, and Christina Holmes, eds., *Beyond Imported Magic: Essays on Science, Technology, and Society in Latin America* (Cambridge, MA: The MIT Press, 2014).

31. Jorge Cañizares-Esguerra, "Introduction," in *Science in the Spanish and Portuguese Empires, 1500-1800*, ed. Daniela Bleichmar, Paula De Vos, Kristen Huffine, and Kevin Sheehan (Stanford, CA: Stanford University Press, 2009), 1.

32. Ivan da Costa Marques, "Ontological Politics and Latin American Local Knowledges," in *Beyond Imported Magic: Essays of Science, Technology, and Society in Latin America*, ed. Eden Medinas, Ivan da Costa Marques, and Christina Holmes (Cambridge, MA: The MIT Press, 2014), 85-109; Sandra Harding, "Postcolonial Science and Technology Studies: Are There Multiple Sciences?" in *Sciences from Below: Feminisms, Postcolonialities, and Modernities* (Durham, NC: Duke University Press, 2008), 130-154; Michael Kuhn and Hebe Vessuri,

“The Misery of Defining What Scientific Knowledge Is—and What Not,” in *Contributions to Alternative Concepts of Knowledge*, ed. Michael Kuhn and Hebe Vessuri (Stuttgart, Germany: Ibidem-Verlag, 2016), 9-18.

33. Saldaña, *Science in Latin America*, 1-27.

34. Juan Pimentel, “The Iberian Vision: Science and Empire in the Framework of a Universal Monarchy, 1500-1800,” *Osiris* 15, no. 1 (2000): 17-30.

35. Juan José Saldaña, “Western and Non-Western Science: History and Perspectives,” in *Science and Cultural Diversity. Filling a Gap in the History of Science*, ed. Juan José Saldaña (Mexico City, Mexico: Sociedad Latinoamericana de Historia de las Ciencias y la Tecnología, 2001), 123-144; Roy McLeod, “Introduction,” in *Nature and Empire: Science and the Colonial Enterprise*, ed. Roy McLeod (Chicago, IL: The University of Chicago Press, 2001): 1-13; George Basalla, “The Spread of Western Science: A Three-Stage Model Describes the Introduction of Modern Science into any Non-European Nation,” *Science* 156, no. 3775 (May 1967): 611-622.

36. David Wade Chambers, “Locality and Science: Myths of Center and Periphery,” in *Mundialización de la Ciencia y Cultura Nacional*, ed. Antonio Lafuente, Alberto Elena, and M. L. Ortega (Madrid, Spain: Doce Calles, 1991), 605-618.

37. Dennis Conway and Nikolas Heynen, “Dependency Theories: From ECLA to Andre Gunder Frank and Beyond,” *The Companion to Development Studies*, second ed., ed. Vandana Desai and Robert B. Potter (London, United Kingdom: Taylor and Francis, 2008).

38. Aníbal Quijano, “Coloniality of Power, Eurocentrism, and Latin America,” in *Coloniality at Large: Latin America and the Postcolonial Debate*, ed. Mabel Moraña, Enrique Dussel, and Carlos A. Jáuregui (Durham, NC: Duke University Press, 2008), 181-224; Aníbal Quijano and Immanuel Wallerstein, “Americanness as a Concept, or the Americas in the Modern World-System,” *International Social Science Journal* 44, no. 134 (November 1992): 549-557.

39. Basalla, “The Spread of Western Science,” 611-622.

40. María Portuondo, “Constructing a Narrative: The History of Science and Technology in Latin America,” *History Compass* 7, no. 2 (March 2009): 500-522; Warwick Anderson, “Introduction: Postcolonial Technoscience,” *Social Studies of Science* 32, no. 5-6 (October-December 2002): 648; Roy McLeod, “Introduction.”

41. Saldaña, *Science in Latin America*, 13.

42. Edward Beatty, “Approaches to Technology Transfer in History and the Case of Nineteenth-Century Mexico,” *Comparative Technology Transfer and Society* 1, no. 2 (2003): 167-197; Michael Johns, “From Field to Port,” in *Mapping Latin America: A Cartographic Reader*, ed. Jordana Dym and Karl Offen (Chicago, IL: The University of Chicago Press, 2011), 177-180.

43. Hugo Palmarola and Pedro Ignacio Alonso, “Tropical Assemblage The Soviet Large Panel in Cuba,” in *Beyond Imported Magic: Essays on Science, Technology, and Society in Latin America*, ed. Eden Medina, Ivan da Costa Marques, and Christina Holmes (Cambridge, MA: The MIT Press, 2014), 159-179.

44. Portuondo, “Constructing a Narrative,” 500; David Wade Chambers and Richard Gillespie, “Locality and Science: Myths of Center and Periphery,” in

Mundialización de la Ciencia y Cultura Nacional, ed. Antonio Lafuente, Alberto Elena, and M. L. Ortega (Madrid, Spain: Doce Calles, 1991), 605-618.

45. Clifford Geertz, "Thick Description: Toward an Interpretive Theory of Culture, from *The Interpretation of Cultures: Selected Essays* (1973)," in *The Cultural Geography Reader*, ed. Timothy S. Oaks and Patricia L. Price (London, United Kingdom: Routledge, 2008), 29-39.

46. Rosalind C. Morris and Gayatri Chakravorty Spivak, *Can the Subaltern Speak?: Reflections on the History of an Idea* (New York: Columbia University Press, 2010); Fernando Coronil, "Latin American Postcolonial Studies and Global Decolonization," in *Postcolonial Studies: An Anthology*, ed. Pramod K. Nayer (Oxford, United Kingdom: Wiley Blackwell, 2016).

47. Walter D. Mignolo, "Colonial and Postcolonial Discourse: Cultural Critique or Academic Colonialism?" *Latin American Research Review* 28, no. 3 (July 1993): 120-134.

48. Jorge Cañizares-Esguerra, *How to Write the History of the New World: Histories, Epistemologies, and Identities in the Eighteenth-Century Atlantic World* (Stanford, CA: Stanford University Press, 2001), 7; Jorge Cañizares-Esguerra, *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World* (Stanford, CA: Stanford University Press, 2006).

49. Historians Marcos Cueto and Jorge Cañizares-Esguerra offer some guidelines for teachers, including selected readings and research topics, in "History of Science in Non-Western Traditions: Latin America," History of Science Society, <https://hssonline.org/resources/teaching/teaching_nonwestern/teaching_nonwestern_latin/>.

50. Fernando Coronil, "Latin American Postcolonial Studies and Global Decolonization," in *Postcolonial Studies: An Anthology*, ed. Pramod K. Nayer (Oxford, United Kingdom: Wiley Blackwell, 2016), 182.

51. Portuondo, "Constructing a Narrative," 505.

52. Mignolo, "Colonial and Postcolonial Discourse," 122.

Appendix A

**Select English-Language Readings on the
History of Science in Latin America, by Theme**

Appended are a few recently published secondary works on the history of science in Latin America that are written (or translated into) English and are widely available in the United States through university presses or major booksellers. This is by no means an exhaustive list, but the books below should offer a glimpse into the types of works that are available for teaching or research purposes in Anglophone classrooms.

Foundational and Background Reading

Barrera-Osorio, Antonio. *Experiencing Nature: The Spanish American Empire and the Early Scientific Revolution*. Austin, TX: University of Texas Press, 2006.

Bleichmar, Daniela, Paula De Vos, Kristen Huffine, and Kevin Sheehan, eds. *Science in the Spanish and Portuguese Empires, 1500-1800*. Stanford, CA: Stanford University Press, 2009.

Cañizares-Esguerra, Jorge. *Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World*. Stanford, CA: Stanford University Press, 2006.

Cañizares-Esguerra, Jorge, and Marcos Cueto. "Latin American Science: The Long View." *NACLA Report On The Americas* 35, no. 5 (March-April 2002): 18.

Chambers, David Wade. "Locality and Science: Myths of Centre and Periphery." In *Mundialización de la Ciencia y Cultura Nacional*. Ed. Antonio Lafuente, Alberto Elena, and M. L. Ortega, 605-618. Madrid, Spain: Doce Calles, 1993.

Cueto, Marcos, and Jorge Cañizares-Esguerra. "History of Science in Non-Western Traditions: Latin America." *History of Science Society*. <https://hssonline.org/resources/teaching/teaching_nonwestern/teaching_nonwestern_latina/>.

Glick, Thomas. "History of Science in Latin America." *The Cambridge Encyclopedia of Latin America and the Caribbean*, second ed., 451-457. Cambridge, United Kingdom: Cambridge University Press, 1992.

Portuondo, María. "Constructing a Narrative: The History of Science and Technology in Latin America." *History Compass* 7, no. 2 (March 2009): 500-522.

Ramos, Gabriela, and Yanna Yannakakis, eds. *Indigenous Intellectuals: Knowledge, Power, and Colonial Culture in Mexico and the Andes*. Durham, NC: Duke University Press, 2014.

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

Saldaña, Juan José. "Western and Non-Western Science: History and Perspectives." In *Science and Cultural Diversity. Filling a Gap in the History of Science*. Ed. Juan José Saldaña, 123-144. Mexico City, Mexico: Sociedad Latinoamericana de Historia de las Ciencias y la Tecnología, 2001.

Tinajero, Araceli, and J. Brian Freeman, eds. *Technology and Culture in Twentieth-Century Mexico*. Tuscaloosa, AL: The University of Alabama Press, 2013.

Wendt, Helge, ed. *The Globalization of Knowledge in the Iberian Colonial World*. Berlin, Germany: Max Planck Research Library for the History and Development of Knowledge, 2016.

Cartography, Geography, and Cosmography

Akerman, James R. *Decolonizing the Map: Cartography from Colony to Nation*. Chicago, IL: The University of Chicago Press, 2017.

Craib, Raymond B. *Cartographic Mexico: A History of State Fixations and Fugitive Landscapes*. Durham, NC: Duke University Press, 2004.

Dym, Jordana, and Karl Offen, eds. *Mapping Latin America: A Cartographic Reader*. Chicago, IL: The University of Chicago Press, 2011.

Mundy, Barbara M. *The Mapping of New Spain: Indigenous Cartography and the Maps of the Relaciones Geográficas*. Chicago, IL: The University of Chicago Press, 1996.

Portuondo, María M. *Secret Science: Spanish Cosmography and the New World*. Chicago, IL: The University of Chicago Press, 2009.

Safier, Neil. *Measuring the New World: Enlightenment Science and South America*. Chicago, IL: The University of Chicago Press, 2008.

Environment and Natural Resources

Boyer, Christopher R. *A Land Between Waters: Environmental Histories of Modern Mexico*. Tucson, AZ: University of Arizona Press, 2012.

Brown, Kendall W. *A History of Mining in Latin America: From the Colonial Era to the Present*. Albuquerque, NM: University of New Mexico Press, 2012.

Candiani, Vera S. *Dreaming of Dry Land: Environmental Transformation in Colonial Mexico City*. Stanford, CA: Stanford University Press, 2014.

Crosby, Alfred W. *The Columbian Exchange: Biological and Cultural Consequences of 1492*. Westport, CT: Praeger, 2003.

Melville, Elinor G. K. *A Plague of Sheep: Environmental Consequences of the Conquest of Mexico*. Cambridge, United Kingdom: Cambridge University Press, 1994.

Miller, Shawn William. *An Environmental History of Latin America*. New York: Cambridge University Press, 2007.

Monzote, Reinaldo Funes. *From Rainforest to Cane Field in Cuba: An Environmental History since 1492*. Chapel Hill, NC: The University of North Carolina Press, 2008.

Simonian, Lane. *Defending the Land of the Jaguar: A History of Conservation in Mexico*. Austin, TX: University of Texas Press, 1995.

Tucker, Richard P. *Insatiable Appetite: The United States and the Ecological Degradation of the Tropical World*. Berkeley, CA: University of California Press, 2000.

Alexander von Humboldt and Charles Darwin

Helferich, Gerald. *Humboldt's Cosmos: Alexander von Humboldt and the Latin American Journey that Changed the Way We See the World*. New York: Gotham Books, 2004.

Moreno, Roberto. "Mexico." In *The Comparative Reception of Darwinism*. Ed. Thomas F. Glick. Austin, TX: University of Texas Press, 1974.

Novoa, Adriana and Alex Levine. *From Man to Ape: Darwinism in Argentina, 1870-1920*. Chicago, IL: The University of Chicago Press, 2010.

Leitner, Ulrike. "Humboldt's Works on Mexico." *Quipu* 13, no. 1 (January-April 2000): 7-23.

Medicine, Public Health, and Disease

Alchon, Suzanne Austin. *A Pest in the Land: New World Epidemics in a Global Perspective*. Albuquerque, NM: University of New Mexico Press, 2003.

Armus, Diego, ed. *Disease in the History of Modern Latin America: From Malaria to AIDS*. Durham, NC: Duke University Press, 2003.

Cueto, Marcos, ed. *Missionaries of Science: The Rockefeller Foundation and Latin America*. Bloomington, IN: Indiana University Press, 1994.

Cueto, Marcos, and Steven Palmer. *Medicine and Public Health in Latin America: A History*. Cambridge, United Kingdom: Cambridge University Press, 2015.

Gómez, Pablo F. *The Experiential Caribbean: Creating Knowledge and Healing in the Early Modern Atlantic*. Chapel Hill, NC: The University of North Carolina Press, 2017.

Lanning, John Tate. *The Royal Protomedicato: The Regulation of the Medical Profession in the Spanish Empire*. Durham, NC: Duke University Press, 1985.

Martín, José R. Jouve. *The Black Doctors of Colonial Lima: Science, Race, and Writing in Colonial and Early Republican Peru*. Montreal, Canada: McGill-Queen's University Press, 2014.

Rodríguez, Julia. *Civilizing Argentina: Science, Medicine, and the Modern State*. Chapel Hill, NC: The University of North Carolina Press, 2006.

Soto Laveaga, Gabriela. *Jungle Laboratories: Mexican Peasants, National Projects, and the Making of the Pill*. Durham, NC: Duke University Press, 2009.

Stepan, Nancy Leys. *"The Hour of Eugenics": Race, Gender, and Nation in Latin America*. Ithaca, NY: Cornell University Press, 1991.

Wade, Peter, Carlos López Beltrán, Eduardo Restrepo, and Ricardo Ventura Santos. *Mestizo Genomics: Race Mixture, Nation, and Science in Latin America*. Durham, NC: Duke University Press, 2014.

Technology and Industrialization

Alexander, Anna Rose. *City on Fire: Technology, Social Change, and the Hazards of Progress in Mexico City, 1860-1910*. Pittsburgh, PA: University of Pittsburgh Press, 2016.

Baracca, Angelo, and Rosella Franconi. *Subalternity vs. Hegemony, Cuba's Outstanding Achievements in Science and Biotechnology, 1959-2014*. Basel, Switzerland: Springer, 2016.

Grandin, Greg. *Fordlandia: The Rise and Fall of Henry Ford's Forgotten Jungle City*. New York: Metropolitan Books, 2009.

Matthews, Michael. *The Civilizing Machine: A Cultural History of Mexican Railroads, 1876-1910*. Lincoln, NE: University of Nebraska Press, 2014.

McCullough, David. *The Path Between the Seas: The Creation of the Panama Canal, 1870-1914*. New York: Simon & Schuster, 1978.

Medina, Eden. *Cybernetic Revolutionaries: Technology and Politics in Allende's Chile*. Cambridge, MA: The MIT Press, 2014.

Schweid, Richard. *Che's Chevrolet, Fidel's Oldsmobile: On the Road in Cuba*. Chapel Hill, NC: The University of North Carolina Press, 2008.

Media

- Bleichmar, Daniela. *Visible Empire: Botanical Expeditions and Visual Culture in the Hispanic Enlightenment*. Chicago, IL: The University of Chicago Press, 2012.
- Boone, Elizabeth Hill and Walter Mignolo. *Writing Without Words: Alternative Literacies in Mesoamerica and the Andes*. Durham, NC: Duke University Press, 1994.
- Castro, J. Justin. *Radio in Revolution: Wireless Technology and State Power in Mexico, 1897-1938*. Lincoln, NE: University of Nebraska Press, 2016.
- Cohen, Matt, and Jeffrey Glover, eds. *Colonial Mediascapes: Sensory Worlds of the Early Americas*. Lincoln, NE: University of Nebraska Press, 2014.
- Debroise, Olivier. *Mexican Suite: A History of Photography in Mexico*. Trans. Stella de Sá Rego. Austin, TX: University of Texas Press, 2001.
- Gallo, Rubén. *Mexican Modernity: The Avant-Garde and the Technological Revolution*. Cambridge, MA: The MIT Press, 2006.
- Hershfield, Joanne. *Imagining La Chica Moderna Women, Nation, and Visual Culture in Mexico, 1917-1936*. Durham, NC: Duke University Press, 2008.
- Montross, Sarah. *Past Futures: Science Fiction, Space Travel, and Postwar Art of the Americas*. Brunswick, ME: Bowdoin College, 2015.
- Penix-Tadsen, Phillip. *Cultural Code: Video Games and Latin America*. Cambridge, MA: The MIT Press, 2016.
- Pratt, Mary Louise. *Imperial Eyes: Travel Writing and Transculturation*. New York: Routledge, 2007.
- Rama, Angel. *The Lettered City*. Trans. John Charles Chasteen. Durham, NC: Duke University Press, 1996.
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Appendix B

**History of Science in Latin America
Readings and Suggested Assignments**

Each week, the entire class is required to read the assigned Common Reading (CR). Students are also asked to select an Individual Reading (IR) of their choice. For younger students, single book chapters may be assigned instead of the entire book. Students are responsible for coming to class having thoroughly read the material and being prepared to both ask and answer questions about the Common and Individual Readings. A useful practice is to have students prepare three questions each about the Common and Individual Readings to share with the class during discussions.

Historiography and Approaches to the History of Science in Latin America	
<u>Week 1:</u> Common Reading	Juan José Saldaña, “Western and Non-Western Science: History and Perspectives,” in <i>Science and Cultural Diversity: Filling a Gap in the History of Science</i> , ed. Juan José Saldaña (Mexico City: Mexico: Sociedad Latinoamericana de Historia de las Ciencias y la Tecnología, 2001), 123-144.
<u>Week 1:</u> Individual Readings	David Wade Chambers, “Locality and Science: Myths of Center and Periphery,” in <i>Mundialización de la Ciencia y Cultura Nacional</i> , ed. Antonio Lafuente, Alberto Elena, and M. L. Ortega (Madrid, Spain: Doce Calles, 1991), 605-618. George Basalla, “The Spread of Western Science,” <i>Science</i> 156, no. 3775 (May 1967): 611-622. Santiago Castro-Gómez, “(Post)Coloniality for Dummies: Latin American Perspectives on Modernity, Coloniality, and the Geopolitics of Knowledge,” in <i>Coloniality at Large: Latin America and the Postcolonial Debate</i> , ed. Mabel Moraña, Enrique Dussel, and Carlos A. Jáuregui (Durham, NC: Duke University Press, 2008), 259-285.
<u>Week 1:</u> Assignments or Discussion	What is history? What is science? Make a list of the class’s ideas for what constitutes both history and science. Then discuss the unconscious bias that might be present in these ideas, from where our concepts of history and science come (school, parents, society, etc.), and how these ideas might be different in other places and to other people.

Background and Foundational Reading: The Basics	
<u>Week 2:</u> Common Reading	Juan José Saldaña, <i>Science in Latin America: A History</i> , trans. Bernabé Madrigal (Austin, TX: University of Texas Press, 2006).
<u>Week 2:</u> Individual Readings	<p>Thomas Glick, "History of Science in Latin America," in <i>The Cambridge Encyclopedia of Latin America and the Caribbean</i>, second ed. (Cambridge, United Kingdom: Cambridge University Press, 1992), 451-457.</p> <p>Jorge Cañizares-Esguerra and Marcos Cueto, "Latin American Science: The Long View," <i>NACLA Report On The Americas</i> 35, no. 5 (March-April 2002): 18-22.</p> <p>Hebe M. C. Vessuri, "Science in Latin America," in <i>Science in the Twentieth Century</i>, ed. John Krige and Dominique Pestre (Amsterdam, Netherlands: Harwood Academic Publishers, 1997), 839-858.</p>
<u>Week 2:</u> Assignments or Discussion	<p>Can the students name any Latin American scientists? Create a list of Latinx scientists from the past 150 years, and randomly assign one or more scientist to each student. The student must write a mini-biography for the scientist(s) to present to the class.</p> <p>The list of scientists could include (but should not be limited to): Alfonso Caso y Andrade, Idelisa Bonnelly, Franklin Chang-Díaz, Jacinto Convit, Alicia Dickenstein, Bernardo Alberto Houssay, Carlos Juan Finlay, Luis Federico Leloir, César Milstein, Mario J. Molina, Carlos Ismael Noriega, Antonia Novello, Adriana Ocampo, Ángela Restrepo.</p>

Indigenous Science and Knowledge	
<u>Week 3:</u> Common Reading	Gabriela Ramos and Yanna Yannakakis, eds., <i>Indigenous Intellectuals: Knowledge, Power, and Colonial Culture in Mexico and the Andes</i> (Durham, NC: Duke University Press, 2014).
<u>Week 3:</u> Individual Readings	<p>Thomas E. Gilsdorf, "Inca Mathematics," in <i>Mathematics Across Cultures: The History of Non-Western Mathematics</i>, ed. Helaine Selin (Dordrecht, Netherlands: Kluwer Academic, 2000), 189-203; and Michael P. Closs, "Mesoamerican Mathematics," in <i>Mathematics Across Cultures: The History of Non-Western Mathematics</i>, ed. Helaine Selin (Dordrecht, Netherlands: Kluwer Academic, 2000), 205-238.</p> <p>John North, "Pre-Columbian America," in <i>Cosmos: An Illustrated History of Astronomy and Cosmology</i> (Chicago, IL: The University of Chicago Press, 2008), 161-168.</p> <p>Karen Olsen Bruhns, <i>Ancient South America</i> (Cambridge, United Kingdom: Cambridge University Press, 1994). [Chapters on agriculture, textiles, metallurgy, and transport.]</p>
<u>Week 3:</u> Assignments or Discussion	<p>What is an "intellectual," and who gets to decide? How were indigenous sciences reflected in Spanish maps created by Amerindian cartographers? In what ways was mathematics integral to ancient Amerindian cultures? How were mathematics and religion intertwined in Incan and Mesoamerican cultures? How does this compare to the modern Western perception of mathematics?</p> <p>Have students write about the importance of Venus to ancient Amerindians, choosing either the Mayan <i>Dresden Codex</i> or the Aztec <i>Codex Mendoza</i> on which to focus their essay. For an outside activity, first collectively read about the astronomical significance of the Mesoamerican ball game. Then take students outside and have them attempt to keep a ball (any size, the heavier the better) in play by using only their hips and elbows.</p>

Imperial Science and Knowledge	
<u>Week 4:</u> Common Reading	Daniela Bleichmar, Paula De Vos, Kristen Huffine, and Kevin Sheehan, eds., <i>Science in the Spanish and Portuguese Empires, 1500-1800</i> (Stanford, CA: Stanford University Press, 2009).
<u>Week 4:</u> Individual Readings	<p>Antonio Lafuente, "Enlightenment in an Imperial Context: Local Science in the Late-Eighteenth-Century Hispanic World," in <i>Osiris</i> 15, no. 1 (2000): 155-173.</p> <p>Jorge Cañizares-Esguerra, "The Colonial Iberian Roots of the Scientific Revolution," in <i>Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World</i> (Stanford, CA: Stanford University Press, 2006), 14-45.</p>
<u>Week 4:</u> Assignments or Discussion	<p>How did the Spanish and Portuguese empires contribute to the production of science in Europe and the Americas in the early modern period? How was Spain's science and technology impacted by its long history of Moorish rule? Who was Carlos de Sigüenza y Góngora, and why was he important to science in the Americas? Was there a difference between Peninsular and Creole approaches to science in the Americas?</p> <p>Have the students write a mini-history of a Western scientific practice from the perspective of an indigenous culture. What unconscious biases make this challenging?</p>

Cartography, Geography, and Cosmography	
<u>Week 5:</u> Common Reading	Jordana Dym and Karl Offen, eds., <i>Mapping Latin America: A Cartographic Reader</i> (Chicago, IL: The University of Chicago Press, 2011).
<u>Week 5:</u> Individual Readings	<p>Neil Safier, <i>Measuring the New World: Enlightenment Science and South America</i> (Chicago, IL: The University of Chicago Press, 2008).</p> <p>María M. Portuondo, “Cosmography at the Casa, Consejo, and Corte During the Century of Discovery,” in <i>Science in the Spanish and Portuguese Empires, 1500-1800</i>, ed. Daniela Bleichmar, Paula De Vos, Kristen Huffine, and Kevin Sheehan (Stanford, CA: Stanford University Press, 2009), 57-77.</p> <p>María M. Portuondo, <i>Secret Science: Spanish Cosmography and the New World</i> (Chicago, IL: The University of Chicago Press, 2009).</p>
<u>Week 5:</u> Assignments or Discussion	<p>Present the class with Uruguayan artist Joaquín Torres-García’s “Inverted Map of South America” (1943) as well as Chilean artist Alfredo Jaar’s short video, “Logo for America” (1987). [See Jennifer A. Jolly, “Chapter 36: Reordering Our World” in <i>Mapping Latin America: A Cartographic Reader</i>, ed. Jordana Dym and Karl Offen (Chicago, IL: The University of Chicago Press, 2011), 198-202.]</p> <p>Ask the class: What does “America” mean, to whom, and why? What does it mean to have a national, or even a continental identity? Who creates maps? What are the political (or other) purposes for making and using maps? What mapmaking conventions are we accustomed to in the United States, and how might that affect our perspectives?</p>

Environment and Natural Resources (Part 1: Early Contact)	
<u>Week 6:</u> Common Reading	Alfred W. Crosby, <i>The Columbian Exchange: Biological and Cultural Consequences of 1492</i> (Westport, CT: Praeger, 2003).
<u>Week 6:</u> Individual Readings	Elinor Melville, <i>A Plague of Sheep: Environmental Consequences of the Conquest of Mexico</i> (Cambridge, United Kingdom: Cambridge University Press, 1997). William M. Denevan, "The Pristine Myth : The Landscape of the Americas in 1492," <i>Annals of the Association of American Geographers</i> 82, no. 3 (September 1992): 369-385.
<u>Week 6:</u> Assignments or Discussion	When it was first published in 1972, <i>The Columbian Exchange</i> was a novel type of environmental history. Each student should select one New World item (such as cacao, corn, chili pepper, vanilla, tobacco, pineapple, avocado, rubber, potato, or turkey) and one Old World item (such as onion, garlic, wheat, apple, carrot, orange, oat, rice, horse, or goat) and analyze the ways in which each item influenced multiple cultures across the Atlantic.

Environment and Natural Resources (Part 2: Industrialization and Conservation)	
<u>Week 7:</u> Common Reading	Kendall W. Brown, <i>A History of Mining in Latin America: From the Colonial Era to the Present</i> (Albuquerque, NM: University of New Mexico Press, 2012).
<u>Week 7:</u> Individual Readings	<p>Lane Simonian, <i>Defending the Land of the Jaguar: A History of Conservation in Mexico</i> (Austin, TX: University of Texas Press, 1995).</p> <p>Reinaldo Funes Monzote, <i>From Rainforest to Cane Field in Cuba: An Environmental History Since 1492</i> (Chapel Hill, NC: The University of North Carolina Press, 2008).</p>
<u>Week 7:</u> Assignments or Discussion	<p>Read the very short chapters CIX and CX concerning the silver mine at Potosí in Pedro de Cieza de León’s work, <i>The Travels of Pedro de Cieza de León, A.D. 1532-50, Contained in the First Part of his Chronicle of Peru</i> [available through Project Gutenberg: <https://www.gutenberg.org/ebooks/48770>].</p> <p>Explain the indigenous technology of <i>guayras</i> in the extraction of silver from ore. Why was this technology so important to both the Spaniards and the Amerindians? Who was Cieza de León? How did he describe the market at Potosí? What did Cieza de León note was being bought and sold, and why do you think that he pointed out these things in particular? How did the author present the indigenous Amerindians in these two selections? What is being left out of the discussion?</p>

Beyond “Big Man” Biography (Part 1: Alexander von Humboldt)	
<u>Week 8:</u> Common Reading	Jorge Cañizares-Esguerra, “How Derivative was Humboldt? Microcosmic Narratives in Early Modern Spanish America and the (Other) Origins of Humboldt’s Ecological Sensibilities,” in <i>Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World</i> (Stanford, CA: Stanford University Press, 2006), 112-128.
<u>Week 8:</u> Individual Readings	Gerald Helferich, <i>Humboldt’s Cosmos: Alexander von Humboldt and the Latin American Journey that Changed the Way We See the World</i> (New York: Gotham Books, 2004). Alexander von Humboldt, <i>Personal Narrative of a Journey to the Equinoctial Regions of the New Continent: Abridged Edition</i> (London, United Kingdom: Penguin Books, 1996). C. A. Browne, “Alexander von Humboldt as Historian of Science in Latin America,” <i>Isis</i> 35, no. 2 (Spring 1944): 134-139.
<u>Week 8:</u> Assignments or Discussion	Who did Humboldt encounter in the New World and how did these interactions shape Humboldt’s experiences and writings? What was the Edenic myth and in what ways did it influence European travels to the New World? How did the appropriation of scientific knowledge in the New World advance the scientific practices of Iberian and other European nations in the early modern period? How was Humboldt different from previous European travelers?

Beyond “Big Man” Biography (Part 2: Charles Darwin, Herbert Spencer, and Eugenics)	
<u>Week 9:</u> Common Reading	Adriana Novoa and Alex Levine, <i>From Man to Ape: Darwinism in Argentina, 1870-1920</i> (Chicago, IL: The University of Chicago Press, 2010).
<u>Week 9:</u> Individual Readings	<p>Roberto Moreno, “Mexico,” in <i>The Comparative Reception of Darwinism</i>, ed. Thomas F. Glick (Austin, TX: University of Texas Press, 1974), 346-374.</p> <p>Charles Darwin, <i>Geological Observations on South America</i>, reissue ed. (Cambridge, United Kingdom: Cambridge University Press, 2010).</p> <p>Nancy Leys Stepan, <i>The Hour of Eugenics: Race, Gender, and Nation in Latin America</i> (Ithaca, NY: Cornell University Press, 1991).</p> <p>Jorge Cañizares-Esguerra, “New World, New Stars: Patriotic Astrology and the Invention of Amerindian and Creole Bodies in Colonial Spanish America, 1600-1650,” in <i>Nature, Empire, and Nation: Explorations of the History of Science in the Iberian World</i> (Stanford, CA: Stanford University Press, 2006), 64-95.</p>
<u>Week 9:</u> Assignments or Discussion	<p>How was Darwin’s theory of evolution received in different localities within Latin America? Was Darwin’s work conflated with Herbert Spencer’s, and why/why not? Cañizares-Esguerra argued that the concept of racialized bodies occurred much earlier than Spencer’s “social Darwinism” in Ibero-America. What prompted Creoles in the Americas to develop a pseudo-scientific/religious conception of “race” in the seventeenth century?</p>

Medicine, Public Health, and Disease (Part 1: Imperial and New World Approaches)	
<u>Week 10:</u> Common Reading	Marcos Cueto, <i>Medicine and Public Health in Latin America: A History</i> (Cambridge, United Kingdom: Cambridge University Press, 2014).
<u>Week 10:</u> Individual Readings	<p>Suzanne Austin Alchon, <i>A Pest in the Land: New World Epidemics in a Global Perspective</i> (Albuquerque, NM: University of New Mexico Press, 2003).</p> <p>John Tate Lanning, <i>The Royal Protomedicato: The Regulation of the Medical Profession in the Spanish Empire</i> (Durham, NC: Duke University Press, 1985).</p> <p>Guenther B. Risse, "Medicine in New Spain," in <i>Medicine in the New World: New Spain, New France, and New England</i>, ed. Ronald Numbers (Knoxville, TN: The University of Tennessee Press, 1987), 12-63.</p>
<u>Week 10:</u> Assignments or Discussion	<p>What is the "imperial gaze" and how did it influence Western countries' medical initiatives in Latin America? In what ways were medicine, public health, and hygiene linked with nationalism? How was the development of academic medicine and clinical medicine different among the countries in Latin America?</p>

Medicine, Public Health, and Disease (Part 2: African and African/Latin American Approaches)	
<u>Week 11:</u> Common Reading	Pablo Gomez, <i>The Experiential Caribbean: Creating Knowledge and Healing in the Early Modern Atlantic</i> (Chapel Hill, NC: The University of North Carolina Press, 2017).
<u>Week 11:</u> Individual Readings	<p>José R. Martín, <i>The Black Doctors of Colonial Lima: Science, Race, and Writing in Colonial and Early Republican Peru</i> (Montreal, Canada: McGill-Queen’s University Press, 2014).</p> <p>Londa Schiebinger, <i>Secret Cures of Slaves: People, Plants, and Medicine in the Eighteenth-Century Atlantic World</i> (Stanford, CA: Stanford University Press, 2017). [Primarily British and French West Indies, but relevant for its sensitive analysis on African bodies within colonial medical practices.]</p>
<u>Week 11:</u> Assignments or Discussion	<p>Explain the contributions of Africans and Afro-Latinx people to the field of medicine, both voluntary and involuntary. What does it mean to talk about a scientific “discovery” when it comes at the expense of people who have had their rights stripped away? How did people of African descent adapt their medicine to the different plants and materials available in the Caribbean and elsewhere in Latin America?</p>

Medicine, Public Health, and Disease (Part 3: Modern Latin America)	
<u>Week 12:</u> Common Reading	Marcos Cueto, ed., <i>Missionaries of Science: The Rockefeller Foundation and Latin America</i> (Bloomington, IN: Indiana University Press, 1994).
<u>Week 12:</u> Individual Readings	Diego Armus, ed., <i>Disease in the History of Modern Latin America: From Malaria to AIDS</i> (Durham, NC: Duke University Press, 2003). Claudia Agostini, “Material Culture, Public Health, and the Technologies of Hygiene in Modern Mexico, 1890s-1940s,” in <i>Technology and Culture in Twentieth-Century Mexico</i> , ed. J. Brian Freeman and Araceli Tinajero (Tuscaloosa, AL: The University of Alabama Press, 2013), 25-42.
<u>Week 12:</u> Assignments or Discussion	How do this week’s readings challenge the idea of a “value-free” science? How were politics and medicine inextricably intertwined in Latin America? In what cases did Latin American countries reject Western medical interventions and why? What structural initiatives might have better served the people of countries that received Western medical aid?

Technology and Industrialization	
<u>Week 13:</u> Common Reading	Eden Medina, Ivan da Costa Marques, and Christina Holmes, eds., <i>Beyond Imported Magic: Essays on Science, Technology, and Society in Latin America</i> (Cambridge, MA: The MIT Press, 2014).
<u>Week 13:</u> Individual Readings	Richard Schweid, <i>Che's Chevrolet, Fidel's Oldsmobile: On the Road in Cuba</i> (Chapel Hill, NC: The University of North Carolina Press, 2008). Michael Matthews, <i>The Civilizing Machine: A Cultural History of Mexican Railroads, 1876-1910</i> (Lincoln, NE: University of Nebraska Press, 2014). David McCullough, <i>The Path Between the Seas: The Creation of the Panama Canal, 1870-1914</i> (New York: Simon & Schuster, 1978).
<u>Week 13:</u> Assignments or Discussion	What is technological colonialism? What is technological adaptation? What is technological diffusion? How did each of these three concepts materialize in the Americas? Are technology and politics connected, and if so, how? In what ways were Latin American peoples active participants in the technological change occurring in their localities?

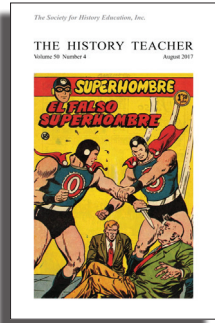
Media (Part 1: Early Indigenous Inventions)	
<u>Week 14:</u> Common Reading	Elizabeth Hill Boone and Walter Mignolo, <i>Writing Without Words: Alternative Literacies in Mesoamerica and the Andes</i> (Durham, NC: Duke University Press, 1994).
<u>Week 14:</u> Individual Readings	<p>Angel Rama, <i>The Lettered City</i>, trans. John Charles Chasteen (Durham, NC: Duke University Press, 1996).</p> <p>Charles C. Mann, “Unraveling Khipu’s Secrets,” <i>Science</i> 309, no. 5737 (August 12, 2005): 1008-1009.</p> <p>Gary Urton, <i>Signs of the Inka Khipu: Binary Coding in the Andean Knotted-String Records</i> (Austin, TX: University of Texas Press, 2003).</p> <p>Ralph Bauer, “Writing as ‘Khipu’: Titu Cusi Yupanqui’s Account of the Conquest of Peru,” in <i>Colonial Mediascapes: Sensory Worlds of the Early Americas</i>, ed. Matt Cohen and Jeffrey Glover (Lincoln, NE: University of Nebraska Press, 2014), 325-356; and Birgit Brander Rasmussen, “The Manuscript, the <i>Quipu</i>, and the Early American Book: Don Felipe Guaman Poma de Ayala’s <i>Nueva Corónica y Buen Gobierno</i>,” in <i>Colonial Mediascapes: Sensory Worlds of the Early Americas</i>, ed. Matt Cohen and Jeffrey Glover (Lincoln, NE: University of Nebraska Press, 2014), 141-165.</p>
<u>Week 14:</u> Assignments or Discussion	<p>What are the diversity of methods that indigenous cultures utilized to record information? Are there any analogous systems in use in the modern era? How did the colonial introduction of alphabetic writing alter these indigenous recording practices?</p> <p>Using several colors of inexpensive yarn or embroidery floss, have each student attempt to create a <i>quipu</i> of their own that encodes a simple piece of information using either the binary or decimal system. This helps to demonstrate the complexity and sophistication of such semasiographic systems of communication.</p>

Media (Part 2: Electronic Age and Science Fiction Era)	
<u>Week 15:</u> Common Reading	See J. Brian Freeman and Araceli Tinajero, eds., <i>Technology and Culture in Twentieth-Century Mexico</i> (Tuscaloosa, AL: The University of Alabama Press, 2013), specifically Section II: “Photography, Television, and the Internet,” Section III: “Radio and Music,” and Section V: “Literature, Art, and Architecture.”
<u>Week 15:</u> Individual Readings	<p>Sarah Montross, <i>Past Futures: Science Fiction, Space Travel, and Postwar Art of the Americas</i> (Brunswick, ME: Bowdoin College, 2015).</p> <p>J. Justin Castro, <i>Radio in Revolution: Wireless Technology and State Power in Mexico, 1897-1938</i> (Lincoln, NE: University of Nebraska Press, 2016).</p> <p>Joanne Hershfield, <i>Imagining La Chica Moderna: Women, Nation, and Visual Culture in Mexico, 1917-1936</i> (Durham, NC: Duke University Press, 2008).</p>
<u>Week 15:</u> Assignments or Discussion	<p>In what ways do the art, literature, and even advertising of a particular place and time reflect its science and technology? How is science represented in works of Latin American science fiction? How does science fiction and other media reflect Latin America’s colonial past (and neocolonial present)? What is the importance of the radio in modern indigenous cultures?</p>



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