

History of Science in Non-Western Traditions: Latin America

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Introduction

As the first colonial outpost of the early-modern European world, Latin America has long witnessed complex processes of cultural cross-pollination, suppression, and adaptation. Beginning in the fifteenth century, millenarian Amerindian civilizations, heirs to rich local “scientific” traditions, seemingly gave way to European institutions of learning and to new dominant forms of representing the natural world. What happened to the earlier modes of learning? How do subordinate cultures resist and adapt to new forms of knowledge? Latin America has long been a laboratory where the “West” has sought to domesticate and civilize “non-Western” forms of Amerindian and African knowledge.

Given Latin America’s rich history of cultural adaptations, suppressions, and hybridizations, it cannot be labeled non-Western without serious qualifications. From the fifteenth century, Western modes and styles of apprehending the natural world have influenced all learned elite institutions in the region. Latin America has witnessed different periods of Western scientific dominance; Iberian, French, British, German and USA scientific traditions and institutions have left indelible marks.

Many scholars have attempted to account for the diffusion of Western scientific knowledge in Latin America and the Third World. Negative interpretations have overemphasized Latin America’s passivity and patterns of cultural and economic dependency to explain the region’s stunted scientific development. They have also used the history of science in Latin America as a foil for the technological and scientific successes of the West—identifying conditions that have purportedly made scientific and technological successes possible in other parts of the world (e.g., the Puritan Reformation and vigorous industrial development).

But a more positive point of view can yield strikingly different historical narratives. Latin Americans have been able to create rich and complex national scientific traditions in conditions of adversity that include shortages of funds for salaries and equipment, small libraries, inadequate supplies, and political instability disrupting the continuity of scientific work. Overcoming these difficulties, Latin Americans have contributed significantly to the world’s store of knowledge. Tropical medicine and physiology at the turn of the twentieth century illustrate this: Carlos Chagas, a microbiologist in Rio de Janeiro, discovered the parasite trypanosome responsible for a disease affecting Brazilian peasants that now bears his name. The Cuban Carlos Finlay identified the vector of yellow fever. The Peruvian Carlos Monge studied the effects of high-altitude in human beings and animals. The Argentine physiologist Bernardo Houssay related hypophysis with diabetes mellitus and received a Nobel Prize in 1947. Though “pure” science has not attracted large numbers of devotees and patrons in the region, rich traditions have emerged in “applied” fields of natural history, medicine (including public health and technology).

This chapter’s positive approach to the history of science in Latin America examines the institutional and social contexts in which scientific ideas and practices have evolved. Given the rich colonial and post-colonial history of the area, this chapter also explores the history of transference, adaptation, and hybridization of knowledge. It delves into a multiplicity of topics, including the scientific and technical legacies of Amerindian civilizations; the dynamic and traumatic cultural encounter of

conflicting representations of nature; and the arrival and creative assimilation of Western knowledge and institutions in colonial (1492-1820s) and post-colonial (1820s-1990s) societies.

A survey of the history of science and technology in Latin America should first come to grips with the remarkable contributions to arithmetic, botany, astronomy, and metallurgy of the ancient Mesoamerican and Andean civilizations. Unfortunately, the scientific and technical accomplishments of these civilizations, as well as their continuity, adaptation, and mutation in the wake of European colonization, are incompletely understood and require further investigation.

The history of science in colonial Latin America also deserves greater study. A secular-liberal reading of the colonial past widely accepted during the early nineteenth-century still influences many scholars. According to this view, even though Spain instituted vigorous colonial cultural policies that included the early creation of universities (which opened some one hundred years earlier than North America's Harvard), Spain's commitment to religious intolerance (Inquisition) and to an old-fashioned scholastic mentality stifled scientific institutions and methods. But it is becoming increasingly clear that Western scientific ideas, institutions, and activities significantly affected the Iberian colonies. Initially they legitimized European colonialist practices. Later they became central to imperial policies of economic renewal. By the end of the colonial period they would play a major role in creating discourses of national identity among the local elites.

After independence, scientific institutions and practices declined in the wake of destruction brought about by the wars. Nevertheless, medical doctors, naturalists, military engineers, and savants assumed important sociopolitical roles. They became leading figures in the state bureaucracy, identified raw materials of possible commercial value for the non-industrialized export economies, used scientific rhetoric to settle political debates (by the second half of the nineteenth century Positivism became the leading elite ideology), and deployed scientific knowledge and imagery to consolidate national ideologies.

As the new nation-states began slowly to consolidate, scientific institutions and practices recovered their prominence. Many European scientists (particularly naturalists) arrived in Latin America in the second half of the nineteenth century and along with local scientific communities helped to map and catalog national resources. They also created the technical and financial conditions for extending the reach of the state through developments of railroads, telegraphs, mining, export agriculture, and public health. In the twentieth century, scientific discourses and their accompanying ideological and socio-economic practices have continued to evolve through periods of profound social, political, and economic change.

Students need to be aware that this introduction to the region's rich history of science is considerably limited by the available resources in English secondary literature we review. A large corpus of knowledge in Spanish, Portuguese, and French beckons those with the linguistic skills to exploit them.

Important themes highlighted in the following are:

1. the scholarship on the history of science and medicine of an important region of the "Third World"
2. contemporary debates on the implications of scientific and technical change from the perspective of the so-called periphery

3. the complex and often conflicting relationship between the scientific and professional elites of “underdeveloped” countries and those of North America and Europe
4. the independent and interacting influence of national and international factors on the development of science in Latin America
5. the indigenous reactions to scientific programs and ideas of progress

For a one volume history of Latin America, see:

1. Benjamin Keen, *A History of Latin America*, 5th ed. (Boston: Houghton Mifflin, 1996).

No single volume covers the entire history of science in Latin America. However, the following items provide coverage of specific historical periods:

1. Thomas P. Glick, “History of Science in Latin America,” *The Cambridge Encyclopedia of Latin America and the Caribbean*, 2nd ed. (Cambridge: Cambridge Univ. Press, 1992), pp. 451-457.
2. John Tate Lanning, *The Royal Protomedicato: The Regulation of the Medical Profession in the Spanish Empire*, John Jay (ed.) (Tepaske, Durham: Duke Univ. Press, 1985).
3. Marcos Cueto, ed. *Missionaries of Science: The Rockefeller Foundation and Latin America* (Bloomington: Indiana Univ. Press, 1994).

The two most significant journals published in Latin America are:

1. *Historia, Ciencias, Saúde-Manguinhos*

Address: Casa Oswaldo Cruz, Prédio do Relógio, Av. Brasil, 4365, Rio de Janeiro, RJ Brasil 21040-360. Telf. (021) 280-9241, Fax (021) 598-4437.

1. *Quipu, Revista Latinoamericana de Historia de las Ciencias y la Tecnología*

Address: Apartado postal 21-873, 04000 Mexico D.F., Mexico.

Day 1

Non-Western Sciences

The literature on the history of science of native American societies is scarce, in contrast with the rich scholarship available on non-Western scientific traditions in China, India, and the Middle East. A research program on Mesoamerican and Andean science comparable to that developed by Joseph Needham on China has yet to appear. For too many scholars, Amerindian representations of nature and forms of knowledge become valuable only when they parallel Western learned disciplines. For example, we know more about Mesoamerican calendrical systems than other scientific areas, because arguments about whether native Americans were “civilized” were believed to hinge upon the inferiority, equality, or superiority of their astronomical assumptions to those of the West.

Ethnohistorians and archeologists have managed to increase our understanding of ancient Amerindian systems of knowledge without prying them out of their cultural matrices. Anthropologists, for example, have successfully and methodically reconstructed ancient Amerindian views of nature and the body.

We have much to learn about the impact of the European conquest and colonization on Amerindian systems of knowledge. During the colonial and post-colonial periods, the literate Amerindian elites—keepers of learned traditions—either disappeared or were acculturated. Amerindian systems of knowledge moved thus to the margins of Latin American societies where they changed, adapted, and merged with forms of folk Catholicism. Most of today’s suggested readings explore the subject of indigenous representations of the body and their interaction with Western views.

Student Reading

1. Joseph W. Bastien, “Qollahuaya-Andean Body Concepts: A Topographical-Hydraulic Model of Physiology.” *American Anthropologist* 87 (1985): 595-611.
2. George M. Foster, “On the Origin of Humoral Medicine in Latin America,” *Medical Anthropology Quarterly* 1 (1987): 355-393.
3. Joseph W. Bastien, “Differences between Kallawaa-Andean and Greek-European Humoral Theory,” *Social Science and Medicine* 28 (1989): 45-51.

Extended Reading

1. David Hess, *Spirits and Scientists: Ideology, Spiritism, and Brazilian Culture* (Pennsylvania State University Press, 1991).
2. Constance Classen, *Inca Cosmology and the Human Body* (University of Utah Press, 1993) Alfredo Lopez-Austin, *The Human Body and Ideology: Concepts of the Ancient Nahuas*, 2 vols. (Salt Lake City: University of Utah Press, 1988).
3. Michael Taussig, *Shamanism, Colonialism, and the Wild Man: A Study in Terror and Healing* (University of Chicago Press, 1987).

Videos

1. *Birth and Belief in the Andes of Ecuador* (1995), 28 min. Available through University of California Extension, Center for Media and Independent Learning (Phone 510-642-0460). It explores contemporary beliefs and practices surrounding childbirth and infant care in the northern Andes.
2. *The Chinampas* (1990), 31 min. Also available through Univ. of California Extension. The video “examines an ecologically sustainable system of agriculture that has flourished in Mexico for some 2,000 years.”
3. *The Maya Pompeii* (1996), 47 min. Also available through Univ. of California Extension. This documentary is a good introduction to Maya achievements in agriculture, architecture, astronomy, and art.

Suggested Student Research Topics

1. Taking your cues from Benjamin Keen's *The Aztec Image in Western Thought*, trace how western scholars (including Mexicans) have understood and studied Mesoamerican calendars and astronomy over the centuries. Have the religious and political agendas of these scholars contributed to shape their understanding of indigenous astronomy? If so, how?
2. Using Marcia and Robert Ascher's *Code of the Quipu* as your springboard for further research, trace the basic outlines of Inca arithmetic and mathematics and the cultural matrix in which they emerged.
3. "Landscapes and economic and political systems seem to have shaped the ways most cultures have understood the workings of the body." To determine whether this statement is true, compare Andean representations of the body with readings on Chinese-Confucian, Hindu-Ayurvedic, and Greek-Humoral views in *Knowledge and the Scholarly Medical Traditions* edited by Don Bates.

Day 2

Colonial Traditions: Baroque Science (1500-1750)

Spaniards and Portuguese brought to the New World their own forms of Western science and did not attempt to assimilate local learned traditions. Europeans incorporated the New World's plants into their therapeutic arsenal mainly because they thought that nature had been wondrously designed by a God who had distributed the plants of the world to match and cure each region's endemic diseases. In the sixteenth century the Spanish Crown sought to map the New World and its rich botanical resources. For example, the Crown distributed questionnaires to local authorities who collected valuable information on plants and geography known as the *Relaciones Geográficas*. The expedition of Francisco Hernández to Mexico in the 1570s was supported by royal patronage.

As universities and courts mushroomed in the colonies, European scientific traditions thrived: Medieval, Renaissance, and Baroque discourses and practices often overlapped and coexisted. Colonial universities trained theologians, lawyers, and a few physicians in neo-scholastic paradigms that helped sustain a society organized on corporatist principles and hierarchical social and racial estates.

Colonial courts, private libraries, pharmacies, and cloisters often became alternative institutional channels to the universities and helped spawn more 'modern' scientific practices. Baroque polymaths such as Diego Rodríguez, Carlos Sigüenza, and Sor Juna Inés de la Cruz kept cabinets of curiosities, maintained alchemical laboratories, and worked with microscopes, telescopes, and astrolabes. They were summoned by the state to cast horoscopes and produce maps, machines, and courtly mechanical toys. Baroque science was closely linked to symbolic rituals that affirmed church and dynastic powers in religious and civic public ceremonies. Artists and scientists collaborated to uncover the underlying hidden signatures of nature in order to manipulate its forces.

Student Reading

1. Guenther B. Risse, "Medicine in New Spain," *Medicine in the New World, New Spain, New France and New England*, Ronald Numbers, ed. (Knoxville: The University of Tennessee Press, 1987), pp. 12-63.

2. Irving Leonard, "A Baroque Scholar," in *Baroque Times in Old Mexico Seventeenth-Century Persons, Places, and Practices* (Ann Arbor: The University of Michigan Press, 1959), pp. 193-214.

Extended Reading

1. Anthony Pagden, *The Fall of Natural Man: The American Indian and the Origins of Comparative Ethnology* (Cambridge: Cambridge University Press, 1986).
2. John Tate Lanning, *The Royal Protomedicato: The Regulation of the Medical Profession in the Spanish Empire*, John Jay (ed.) (Tepaske, Durham: Duke Univ. Press, 1985).
3. Luis Martin, *The Intellectual Conquest of Peru: The Jesuit College of San Pablo 1568-1767* (New York: Fordham University Press, 1968).
4. Octavio Paz, *Sor Juana: Or, The Traps of Faith*, Margaret Sayers Peden (trans.) (Cambridge: Harvard University Press, 1989), pp. 155-168, 174-179, 238-260, 357-386.

Suggested Student Research Topics

1. Building upon Pagden's *The Fall of Natural Man*, explore the connections between the social sciences and colonialism in Spanish America.
2. Using Paz's *Sor Juana* and Leonard's *Baroque Times*, explore how the sciences of optics, music, astrology, alchemy, and mechanics helped bolster and legitimize colonial authorities.

Day 3

Colonial Traditions: Bourbon Science (1750-1820)

Some new currents of the Scientific Revolution arrived in the colonies in the period 1750-1820. They were accompanied by a program of economic and cultural renewal launched by Charles III in Spain and the Marquis of Pombal in Portugal that dramatically changed Iberia and its colonies in the second half of the eighteenth century. The mechanical philosophy of Descartes and Newton was made widely available by colonial physicians who embraced the iatromechanical views of Boerhaave. On the other hand, the heliocentric models of Galileo and Newton were not introduced in most of the newly reformed colonial universities (the Jesuits were expelled from Portuguese and Spanish territories, and the schools and universities they controlled were reorganized by a Jansenist and royalist secular church from the 1770s on).

Spain and France sponsored numerous scientific expeditions to their colonial outposts. As Spain launched economic reforms to turn its colonies into dependent, specialized mining and agro-export producers, the state supported many expeditions to chart, catalog, and map the hitherto untapped botanical resources of the New World (woods for shipbuilding, plant drugs, minerals, organic dyes, and agricultural produce). Authorities also generously patronized naturalists as part of the Spanish crown's patriotic campaign to disabuse Europe of the view of Spain as an ignorant country whose glories lay in the past.

Interestingly, the local colonial elites (Creoles) also embraced the new science in efforts to create alternative proto-national discourses. As Creoles faced discrimination from the new Bourbon regime, they sought to separate their identities from Spain. This coincided with the spread in Europe of

(French naturalist) Buffon's claim that the American continent was a humid and degenerating land. Creole scientists—including Hipolito Unanue from Peru and Antonio de Alzate from Mexico, among many others—opposed Buffon's views by exalting the natural wonders of the colonies. They attempted to build a patriotic science on the premise that America did not abide by “natural laws” expounded by Europeans.

Student Reading

1. Thomas Glick, “Science and Independence in Latin America,” *Hispanic American Historical Review* 71 (1991): 307-334.
2. H. W. Engstrand, *Spanish Scientists in the New World: The Eighteenth Century Expeditions* (Seattle: University of Washington Press, 1981).

Extended Reading

1. Robert R. Steele, *Flowers for the King: The Expedition of Ruiz and Pavon and the Flora of Peru* (Durham: Duke Univ. Press, 1982).
2. John Tate Lanning, *The Eighteenth-Century Enlightenment in the University of San Carlos Guatemala* (Cornell University Press, 1956).
3. Donald B. Cooper, *Epidemic Disease in Mexico City, 1817-1813: An Administrative, Social and Medical Study* (Austin: University of Texas Press, 1965).
4. James E. McClellan III, *Colonialism and Science: Saint Domingue in the Old Regime* (Baltimore: The John Hopkins University Press, 1992).

Suggested Student Paper Topics

1. Taking your leads from the article by Glick, study the ways in which Spanish American Creoles sought to create distinct local sciences and how these attempts helped foster nationalist and secessionist forces in the colonies.
2. Using Steele's and Engstrand's texts as springboards for further research, reconstruct the ties between the Bourbon colonial reforms and the avalanche of scientific expeditions that followed in the wake of the reforms. Compare the results of your investigation with the conclusions reached by McClellan on French scientific activities in Haiti.
3. Taking your cues from Lanning's and Cooper's books, build an argument to challenge those who have sustained that colonial Spanish America was scientifically and intellectually backward.

Day 4

Science and the State during the 19th century (1820-1880)

During the 19th century, science did not develop in an autonomous public sphere but under the shadow of the emergent republics of Latin America. This occurred because local scientific communities were fragile, the colonial legacy persisted, and the governments monopolized resources. In addition, the states encouraged a view that science was a source of modern professional education, economic benefits, and public entertainment.

As European scientists advanced ever more comprehensive scientific theories, new levels of international scientific cooperation developed. The number and scope of international scientific expeditions to Latin America increased. These new international scientific networks lent their support to local political leaders and savants who were implanting scientific and technical education in their countries. The formation or reorganization of professional universities followed the French model of higher education which had little regard for the experimental dimension of science. Local scientific traditions emerged in different cities and a number of scientific institutions began to appear such as botanical gardens, specialized libraries, museums of natural history, physiology laboratories, and scientific chairs in medical schools.

Darwinism had some influence in Latin America. With few exceptions, Darwinian theory was brought to Latin America by physicians, politicians, and social scientists as a new ideological resource to settle debates over social order and material progress.

Student Reading

1. Lewis Pyenson, "Functionaries and Seekers in Latin America: Missionary Diffusion of the Exact Sciences, 1850-1930," *Quiju* 2 (1985): 387-420
2. Julyan Peard, "Tropical Disorders and the Forging of a Brazilian Medical Identity, 1860-1890," *Hispanic American Historical Review* 77(1997): 1-44.

Extended Reading

1. Frank Safford, *The Ideal of the Practical: Colombia's Struggle to Form a Technical Elite* (Austin and London: University of Texas Press, 1976).
2. Roberto Moreno, "Mexico," in *The Comparative Reception of Darwinism*, Thomas Glick, ed. (Chicago: The Univ. Of Chicago Press, 1988).
3. R. R. Miller, *For Science and National Glory: The Spanish Scientific Expedition to America, 1862-1866* (Norman: Oklahoma Univ. Press, 1968).
4. Sidney Chalhoub, "The Politics of Disease Control: Yellow Fever and Race in 19th Century Brazil," *The Journal of Latin American Studies* 25 (1993): 441-464.
5. Daniel R. Headrick, *The Tentacles of Progress: Technology Transfer in the Age of Imperialism, 1850-1940* (New York: Oxford University Press, 1988).
6. Lucille Brockway, *Science and Colonial Expansion: The Role of the British Royal Botanic Gardens* (New York: Academic Press, 1979).

Suggested Student Research Topics

1. Compare the reception of Darwinism in Argentina, Brazil, and Mexico. Determine the way in which debates over the racial composition of each of these countries affected the reception of Darwinism.
2. Analyze the ways in which state building fostered and/or hampered scientific development.
3. Consider nineteenth-century international scientific networks as engines and/or obstacles for scientific growth in Latin America.

Day 5

The Emergence of National Traditions (1880-1950)

At the turn of the twentieth century, some Latin American countries created laboratories with national visibility and impact. There, cadres of local scientists began to do experimental work that would gain them international notoriety. Among those who won the recognition of their peers abroad were researchers at bacteriological and physiological institutes in Cuba, Brazil (Carlos Chagas), Argentina (Bernardo Houssay), and Peru (Carlos Monge). These institutes emerged in a period marked by nationalism, economic growth, and governmental support for the promotion and reorganization of cultural activities. Moreover, in the wake of the Spanish Civil War (1936-1939), a number of exiled Republican Spanish scientists arrived in various Latin American countries and invigorated experimental science. The new experimental institutes imaginatively adapted to adverse conditions, scarce resources, and low public esteem.

From the 1920s, the Rockefeller Foundation and other private and public agencies from the US and Europe played major roles in the organization of scientific and technical knowledge in Latin America. As Latin America became fully integrated into the global capitalist economy, the US and Europe made it a matter of policy to influence the cultural values of the local elites. Over the course of this century, the US influenced Latin American learned communities through the medical and scientific practices that accompanied the invasions, occupations, and work performed by its armed forces and private companies in the region. More lasting and subtle was the work of North American foundations (such as the Rockefeller and Kellogg Foundations) in the rise of national scientific organizations and nationwide health services. The relationship between American philanthropy and Latin American science was not a case of unilateral diffusion. Latin Americans reacted and adapted to the models of organization of science and higher education exported from the US. But Latin American scientists did not alone accommodate the new models to local circumstances. US scientists and even field officers of the Rockefeller proved in some cases to be more flexible than the Latin Americans themselves. Locals and foreigners engaged in negotiations about how best to replicate institutions across space and culture and whether changes have come primarily from domestic influences or from external stimuli.

Student Reading

1. Teresa Mead, "Cultural Imperialism in Old Republic Rio de Janeiro: The Urban Renewal and Public Health Project," in Teresa Meade and Mark Walker (eds.), *Science, Medicine and Cultural Imperialism* (New York: St. Martin's Press, 1991), pp. 95-119.
2. Marcos Cueto, "Laboratory Styles and Argentine Physiology" *Isis* 85 (1994): 228-246.
3. Lewis Pyenson, "The Incomplete Transmission of European Image: Physics at Greater Buenos Aires and Montreal, 1890-1920," *Proceeding of the American Philosophical Society* 122(1978): 92-114.

Extended Reading

1. Nancy Leys Stepan, *"The Hour of Eugenics": Race, Gender and Nation in Latin America* (New York: Science History Publications, 1996).
2. Nancy Leys Stepan, *The Beginnings of Brazilian Science: Oswaldo Cruz, Medical Research and Policy, 1890-1920* (New York: Science History Publications, 1976).
3. Marcos Cueto, "The Rockefeller Foundation's Medical Policy and Scientific Research in Latin America: The case of Physiology." *Social Studies of Science* 20(1990): 229-254

4. Marcos Cueto, "Indigenismo and Rural Medicine in Peru: The Indian Sanitary Brigade and Manuel Nunez Buitron." *Bulletin of the History of Medicine* 65 (1991): 22-41.
5. Marcos Cueto, "Sanitation from Above: Yellow Fever and Foreign Intervention in Peru, 1919-1922," *Hispanic American Historical Review* 72 (1992): 1-22.
6. Patricio Marquez and Daniel Joly, "A Historical Overview of the Ministries of Public Health Programs of the Social Security in Latin America," *Journal of Public Health Policy* 7 (1986): 378-394.
7. Francois Delaporte, *The History of Yellow Fever: An Essay on the Birth of Tropical Medicine* (Cambridge: The MIT Press, 1991).

Suggested Student Research Topics

1. Were the institutionalization of experimental science and the coming of age of nationalism in the region in any way connected? Study the cases of Argentina, Peru, and Brazil.
2. Determine the ways in which the growth of institutes for experimental research (especially on tropical medicine) was related to the neocolonial economic prosperity enjoyed by Latin America countries from 1890 to 1930.
3. The Rockefeller Foundation's impact in Latin America: A case of scientific neocolonial dependency or of local appropriation and adaptation of knowledge to adverse conditions?
4. Determine the kinds of scientific institutions and practices encouraged by the US military presence in the region.

Day 6

Struggling to Survive (1950-1990)

Marginality, traditional values, scarce demand from local economic forces, and foreign dependence are considered factors that contribute to the meager societal support for or appreciation of scientists in contemporary Latin America. But during the past fifty years a number of countries have demonstrated that science can evolve under adverse conditions. For example, during the 1950s, Argentina and Brazil created national councils of science and technology. In the following decade Venezuela founded a major center for scientific research called the Instituto Venezolano de Investigaciones Científicas. Argentina has had a consistent nuclear policy since the 1950s and developed a nuclear power potential in the region.

Yet Latin America still must struggle to overcome isolation, lack of international visibility, and absence of a continuous scientific tradition. The public largely fails to appreciate that research is needed to achieve development. Administrative and political structures that encourage scientists to accomplish their work are undeveloped. Moreover, a significant proportion of scientists continue to depend on training abroad, which encourages a brain drain and disrupts the continuity of research.

Student Reading

1. Simon Schwartzman, *A Space for Science: The Development of the Scientific Community in Brazil* (State College, PA: Penn. State University Press, 1991).

Extended Reading

1. Hebe Vessuri, "The Universities, Scientific Research and the National Interest in Latin America," *Minerva* 24 (1986): 1-38
2. Jacqueline Fortes and Larissa Lomintz, *Becoming a Scientist in Mexico, the Challenge of Creating a Scientific Community in an Underdeveloped Country* (University Park, PA: Penn. State University Press, 1994).
3. Emanuel Adler, *The Power of Ideology: The Quest for Technological Autonomy in Argentina and Brazil* (Berkeley: Univ. Of California Press, 1987).
4. Vicente Navarro, "The Underdevelopment of Health or the Health of Underdevelopment: An Analysis of the Distribution of Human Health Resources in Latin America," in V. Navarro (ed.), *Imperialism, Health and Medicine* (Farmingdale, NY: Baywood Publishing Co., 1981), pp. 15-36.
5. Julie M. Feinsilver, *Healing the Masses: Cuban Health Policies at Home and Abroad* (Berkeley: Univ. of California Press, 1993).
6. R. Hilton, *The Scientific Institutions of Latin America* (Stanford: California Institute of International Studies, 1970).
7. Charles V. Kidd (ed.), *Biomedical Research in Latin America: Background Studies* (Washington DC: NIH, Publication No. 80-2051, 1980).
8. N. Patrick Peritore and Ana Karina Galve-Peritore (eds.), *Biotechnology in Latin America: Politics, Impacts, and Risks* (Wilmington, DE: Scholarly Resources Books, 1995).

Videos

1. *Jungle Pharmacy: Protecting the Global Environment* (1989). 53 min. Available through Cinema Guild (phone 212-246-5522). Explores connections between scientists, physicians and environmentalists from the "developed" world and "shamans" from the Amazon reinfrest as they seek to turn the rain forest into a source of new drugs for the world.

Suggested Student Research Paper Topics

1. Current public and popular perceptions of science.
2. Nuclear research in Latin America.
3. Biotechnology in Latin America.
4. Training overseas: a useful solution to offsetting the lack of strong local research institutions?
5. Examine the factors that militate against the growth of science out of an autonomous public sphere. What would it take to end Latin American science's secular pattern of dependency on the State?