

Enlightenment in an Imperial Context: Local Science in the Late-Eighteenth- Century Hispanic World

*Antonio Lafuente**

ABSTRACT

This paper aims to assess the figuration of local and metropolitan scientific practices and theories in the eighteenth-century Hispanic Empire by focusing on two colonies: New Spain (Mexico) and New Granada (Colombia). In New Spain, Creole and metropolitan scientists negotiated the assimilation of old local wisdom with new European knowledge in their botanical studies of native plants. Through the openness of both groups of scientists to new ideas, the naturalization of standardized procedures, and the verbalization of old problems in new terminology, the globalization process of scientific practices was successfully integrated there at the local level. In New Granada, less favorably, the Royal Botanical Expedition (1783–1816) provoked disagreement between representatives of the viceroy and of the colony's Creole intelligentsia not only about plant classification systems, but about the proper relationship between scientific and political interests.

OVER THE LAST TWO DECADES, MUCH RESEARCH HAS BEEN dedicated to the study of the scientific and technological exchanges between different cultures and civilizations.¹ Within the framework of this literature, several models have been proposed.² In one of the earliest attempts to describe the expansion of Western science, George Basalla suggested that, in order for countries to reach a third phase of “independent science,” they must pass through a phase of “colonial

* Centro de Estudios Históricos, Consejo Superior de Investigaciones Científicas (CSIC), Departamento de Historia de la Ciencia, Duque de Medinaceli 6, 28014 Madrid, Spain.

¹ Nathan Reingold and Marc Rothenberg, eds., *Scientific Colonialism: A Cross-Cultural Comparison* (Washington, D.C.: Smithsonian Institution Press, 1987); Patrick Petitjean, Catherine Jami, and Anne Marie Moulin, eds., *Science and Empires: Historical Studies about Scientific Development and European Expansion* (Dordrecht/Boston/London: Kluwer Academic Publishers, 1992); Antonio Lafuente, Alberto Elena, and María Luisa Ortega, eds., *Mundialización de la ciencia y cultura nacional* (Aranjuez: Doce Calles, 1993).

² Roy MacLeod, “On Visiting the ‘Moving Metropolis’: Reflections on the Architecture of Imperial Science,” in Reingold and Rothenberg, *Scientific Colonialism* (cit. n. 1), pp. 217–49, David W. Chambers, “Period and Process in Colonial and National Science,” in *ibid.*, pp. 297–321; Antonio Lafuente and María Luisa Ortega, “Modelos de mundialización de la ciencia,” *Arbor*, 1992, 142:93–117.

science.”³ In this phase, small groups of scientists carry out activities that follow programs laid down by the metropolitan centers.⁴

This model has been widely discussed and, in general terms, superseded. The reasons for this lie in its tacit identification of metropolitan science with science itself, thus implicitly accepting that science is universalized knowledge. Today, a clearer understanding of colonial science calls for a recognition of the unequal distribution of knowledge, both in space and time, as well as its concentration in a limited number of institutions and localization in a small number of countries.⁵ Basalla also ignored the fact that exchange or communication of ideas may not simply be one-way but may take place between colonial centers without the intervention of the metropolis.⁶ Besides, recent scholarship shows the importance of emphasizing local contexts, independent of their place within the structure of an empire.

In this essay, we take the colony as the focus of colonial history. From this point of view, the globalization of science not only involves the dissemination of scientific methods but also the transmission of ideas and scientific values. The process succeeds when the recipient has some means to reproduce these elements and become an independent center of scientific activity. This new center joins a network of scientific centers and their satellites.

In any process of globalization of science the receiver, far from being merely passive, selects fragments of the transmitter’s broadcast and adapts them to its own circumstances. From the point of view of the transmitter, the reception is an incomplete and/or mediocre copy of what was broadcast. But seen from the point of view of the receiver, the phenomenon is much more complex: a preexisting cultural base has been enriched (and deformed) by something different and external. This means that a tradition must be “invented” in such a way that it can interface with a new element. Only through this interactive model of mutual renewal can novelty be accepted and—most of all—used to advantage. Thus the analysis of local acclimatiza-

³ On independent science, see MacLeod, “On Visiting” (cit. n. 2), p. 224; Chambers, “Period and Process” (cit. n. 2), p. 310. George Basalla, “The Spread of Western Science,” *Science*, 1967, 156:611–22; George Basalla, “The Spread of Western Science Revisited,” in Lafuente, Elena, and Ortega, *Mundialización de la ciencia* (cit. n. 1), pp. 599–603.

⁴ Latour distinguished metropolitan centers from peripheral or colonial centers in that their institutions are more efficient and better equipped to concentrate, organize, distribute, and, in short, take full advantage of information received, thus to complete what he calls the “cycle of accumulation.” See Bruno Latour, *Science in Action* (Cambridge, Mass.: Harvard Univ. Press, 1987), p. 219.

⁵ Xavier Polanco, “Science in the Developing Countries: An Epistemological Approach on the Theory of Science in Context,” *Quipu*, 1985, 2:303–18; Christopher Vanderpool, “Center and Periphery in Science: Conceptions of a Stratification of Nations and Its Consequences,” in *Comparative Studies in Science and Society*, eds. Sal Restivo and Christopher Vanderpool (Columbus, Ohio: n.p., 1974), pp. 432–42.

⁶ In recent years, other models for the globalization of science have been developed in order to solve the problem of the linearity of Basalla’s model, and to give greater consideration to scientific and technical exchanges among the peripheral areas of the “science-world.” Xavier Polanco has made progress in this direction. Polanco has stressed modern science’s resemblance to a worldwide, multinational company, and its function in terms of regularizing borders. This science-world is organized hierarchically between a center and its peripheral and semiperipheral regions. Xavier Polanco, “Une science-monde: La Mondialisation de la science européenne et la création de traditions scientifiques locales,” in *Naissance et développement de la science-monde*, ed. Xavier Polanco (Paris: Editions La Découverte/Conseil de l’Europe/UNESCO, 1990), pp. 10–52; Xavier Polanco, “World-Science: How is the History of World-Science to be Written?” in Petitjean, Jami, and Moulin, *Science and Empires* (cit. n. 1), pp. 225–42.

tion may be considered fundamental to the study of the mechanisms of international transmission of ideas and institutions.

We have selected two case studies, all taken from the eighteenth-century Hispanic world, a complex and rich colonial scenario in which modern science underwent grafts, mutations, resistance to innovation, and controversy. We make no secret of our wish to avoid current reductionist explanations. "Diffusionist" theories, the automatic identification of science with emancipation, or radical contrasts such as "Creoles versus metropolitans" or "ancient versus modern" obscure rather than shed light on the topic. They oversimplify processes that seem to us more dynamic, more obvious and, above all, more pluralistic. On the contrary, we feel it is necessary to highlight a series of phenomena that afford a less mechanical but more organic view, a less geometric but more historical view of the movements and metamorphoses experienced and described by science in the course of its chronological and spatial development.

In this connection it is not unreasonable to criticize the extrapolation of events that took place in the British Empire and their generalization to other colonial situations. Descriptions that may initially be considered appropriate for "settler societies" (British colonies in America, Australia and, for some, in Argentina and Chile) may be overly simplistic for societies with a high level of social complexity, like those in India, New Spain, Peru or even, in the opinion of Richard Jarrell, in Ireland and Canada.⁷ Generally speaking, Basalla's model may be said to share the flaws of "modernization theory" that, in the mid-1960s, dominated North American approaches to the problems of developing countries.

From studying the movements and changes of science in Hispanic culture during the Enlightenment, one can draw a number of conclusions. First, modern science did not land on barren terrain but on separate centers—each with deeply rooted local scientific traditions—where it settled and regenerated.⁸ Second, at least in the case of Spain's colonies in Latin America, modern science did not expand throughout the viceroalties in spite of the metropolis or in defiance of it. Overuse of this argument has given rise to Basalla's assumption that modern science and political independence are the same thing. Third, neither Creoles (people born in the colonies to Spanish parents) nor metropolitans were as homogeneous as they are usually depicted.⁹ Fourth, the criteria imposed by Western scientific culture to determine

⁷ Louis Hartz, *The Founding of New Societies* (New York: Harcourt, Brace and World, 1964); Richard A. Jarrell, "Differential National Development and Science in the Nineteenth Century: The Problems of Quebec and Ireland," in Reingold and Rothenberg, *Scientific Colonialism* (cit. n. 1), pp. 323–50.

⁸ A revised historiography can be found in Juan J. Saldaña, "Teatro científico americano: Geografía y cultura en la historiografía latinoamericana de la ciencia," in *Historia social de las ciencias en América Latina*, ed. Juan J. Saldaña (Mexico City: Porrúa Ediciones, 1996), pp. 7–41.

⁹ At least towards the end of the century, many learned people in the Americas and in the Iberian Peninsula vacillated between their loyalty to a liberating scientific rationalism and loyalty to the king. They were forced to adopt an eclectic approach, since they had to choose between salvation or liberty—a difficult choice that rendered the Creoles a less-unified group than is usually admitted. There is a copious literature opposing traditional, uncritical historical interpretations based on the tension between Creoles and mainland Spaniards. Horst Pietschmann opposed this reductionist view in "Protoliberalismo, reformas borbónicas y revolución: La Nueva España en el último tercio del siglo XVIII," in *Interpretaciones del siglo XVIII mexicano: El Impacto de las reformas borbónicas*, ed. Josefina Zoraida Vázquez (Mexico City: Ed. Nueva Imagen, 1992), pp. 27–65. See also Horst Pietschmann, "Los Principios rectores de la organización estatal en las Indias," in *De los imperios a*

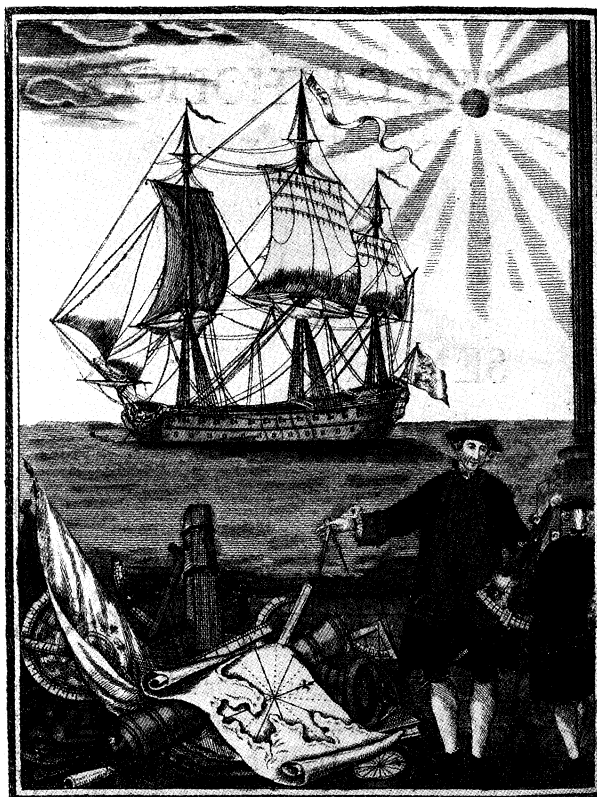


Figure 1. Science, Monarchy, and Expeditions. From Augustín de Zuloaga, Tratado instructivo y práctico de maniobras militares (Cádiz, 1766).

whether something was modern were the criteria of a victorious culture and, as such, tended to underestimate and ignore alternative ways of understanding and experiencing modernity.

NATURAL SCIENCES AND BOURBON IMPERIAL AMBITIONS

The introduction of new disciplines such as astronomy, mechanics, chemistry, or botany into the viceroyalties was inextricably linked to the political program pursued by Bourbon reformism during the second half of the eighteenth century. After the Seven Years' War (1756–1763), when England defeated both the French and the Spanish, Carlos III launched an offensive to regain control of colonial territories, because most Spanish reformist politicians thought of the Americas as being not only the monarchy's main problem but also its remedy.¹⁰ The ultimate aim was

las naciones: Iberoamérica, eds. Antonio Annino, Luis Castro Leiva, and François-Xavier Guerra (Saragossa: IberCaja, 1994), pp. 75–103.

¹⁰ There were few major politicians or intellectuals of the Spanish Enlightenment who, in order to deal with the problems of the metropolis, did not rack their brains to find imperialistic solutions. The two were inextricably linked, for the empire provided not only the opportunity to promote a national policy, but also the major threat to Spain's international stability, due to the rise of nationalist move-

to transform the old Universal Monarchy into a colonial empire. It was an attempt to update an obsolete structure, typical of the seventeenth century and successful then, but unable to resist the pressure that transatlantic commerce was putting on modern international relations. The longed-for regeneration to stop the crown's decline (the topic par excellence of seventeenth-century Spain) involved closer ties with the American territories and more extensive exploitation of their fiscal, political, and natural resources. Within this context of political and social reform, science was employed as a suitable instrument to fulfill imperial ambitions. Thus, the program of scientific expeditions to America promoted by the crown from the 1760s onwards was the clearest sign of the dynamic of Enlightenment Spanish science.¹¹ To create natural history collections and botanical gardens, to set up astronomical observatories and seminars on mining, to chart coasts and classify plants were all initiatives that, from the metropolitan perspective, constituted different parts of the same new policy.

However, effective implementation of this ambitious program entailed many tasks that significantly exceeded the program's original parameters. Those who thought that the American territories could be regained, and that their profitability could be increased a hundredfold, miscalculated the consequences. To begin with, the immediate outcome of this large-scale politicization of science was the politicization of scientists themselves. In a few decades, these new protagonists went from being mere savants, versed in the works of Newton or Linnaeus, to being agents of an international corporation serving a despotic monarchy. If at first scientists were content to play the part of warriors against the baroque, with their fight presented as a struggle between ancient and modern, they were soon to discover that such a bond with the new Bourbon dynasty limited their potential for institutional action. After becoming institutionalized as agents of the crown, they went on to ask for greater influence in government decisions. They soon began to consider themselves indispensable, and even dared to demand continuous funding for their activities. Since these approaches were not always accepted, they ceased to be unconditional allies and began to question the rationality of the crown's decisions, as well as the interest of its ministers in advancing the Enlightenment. The power struggle among the me-

ments in the colonies and the competition for trade control between European metropolises. See Pedro Pérez Herrero, "El México borbónico: ¿Un éxito fracasado?", in Vázquez, *Interpretaciones del siglo XVIII* (cit. n. 9), pp. 109–151. In the same book, see also Brian R. Hamnett, "Absolutismo ilustrado y crisis multidimensional en el período colonial tardío, 1760–1808," pp. 67–108. This inevitable linkage had its reasons: the metropolis was profoundly dependent on its colonies, and Britain, France, and Russia were disputing the Spanish hegemony in America and on its sea routes with renewed aggression. These considerations tend to shift the focus of research on the modern age of Spain away from explorations of Spain's influence on its empire, and towards study of the empire as the driving force of peninsular politics. This concept may well have influenced the work and intellectual career of J. H. Elliott: "I therefore felt that it might be more valuable to take a rather different approach, and look at the history of Spanish imperialism from the standpoint of its impact on the colonizing power, rather than on the colonized." See John H. Elliott, *Spain and its World 1500–1700* (New Haven: Yale Univ. Press, 1989), p. 3.

¹¹ Literature on the expeditions is so abundant that we will limit ourselves to citing a few books in which numerous references are to be found. For an overview, see Fermín del Pino, ed., *Ciencia y contexto histórico nacional en las expediciones ilustradas a América* (Madrid: CSIC, 1988); and the minutes of the two conferences held by the Ateneo of Madrid on "España y las Expediciones Científicas en América." See also Alejandro R. Díez Torre *et al.*, *La ciencia española en Ultramar* (Aranjuez: Doce Calles, 1991), and Alejandro R. Díez Torre *et al.*, *De la ciencia ilustrada a la ciencia romántica* (Aranjuez: Doce Calles, 1995).

tropolis, the viceroy, and the scientists grew, with each lobby laying claim to the patriotic and utilitarian ideals of Enlightenment science, and with each waving the banner in its own way.¹²

Alongside these protagonists emerged new institutions, new languages, and new ways in which the scientists interfaced with the ruling elites. Over and above the international recognition science achieved in the peripheral territories was its ability to make statements about the colony's physical or social environment. What interests us is how the Creole scientific elite shaped and appropriated the political imagery, an ability that was evident everywhere, though with differences in emphasis and often with contradictory outcomes.¹³ The introduction of Linnaeus's classification, Lavoisier's chemistry, or Newton's physics, nurtured with equal zeal in all the kingdoms of the monarchy, gave rise to a different set of institutions in each place, whose protagonists and set objectives differed.

Political language soon reflected publicly what had been widely rumored, and the idea of separate kingdoms under the same sovereign gave way to that of colonies with one metropolis. And naturally these changes had their correlation in colonial scientific institutions. It could not be otherwise, since the institutions had always been viewed as instruments of reform at the service of the state. Events only served to reinforce their statist nature; indeed, the changes that were introduced could be perceived as a process of *metropolitanization* of the scientific activities of the Spanish Enlightenment.¹⁴

In the following discussion, scientific practices in New Spain (Mexico) and New Granada (Colombia) are of particular interest. We shall confine our comments to the debates concerning the projects undertaken by José Mariano Mociño (1757–1819) and Luis José Montaña (1755–1820) in Mexico City, and by Francisco José Caldas or Francisco Antonio Zea (1766–1822) in Bogotá.¹⁵

NEW SPAIN: MOTHERLAND AND CULTURAL HERITAGE

Within the Spanish Empire, New Spain was economically the most profitable of the colonial dominions, and culturally the most dynamic. During the eighteenth century its prosperity, linked mainly to silver mining, increased considerably. Mexico City

¹² It was inevitable that this should happen, and on this point enlightened Spaniards and Americans were little different from their European contemporaries. Should we wish to draw further conclusions, it would be necessary to consider to what extent the design of policies for science affected the manners and measures of imperial policy. Our belief is that this process can be documented, and it will confirm that science policy served as both example and experiment for imperial policies. Antonio Lafuente and Leoncio López-Ocón, "Tradiciones científicas y expediciones ilustradas en la América hispana del siglo XVIII," in Saldaña, *Historia social de las ciencias* (cit. n. 8), pp. 247–81.

¹³ Juan Pimentel has devoted two books to exploring the transposition of images from science to colonial policies. Using the case of the Malaspina expedition, he has established links between the two vernaculars and shown the impact of this relationship on the metropolis. Juan Pimentel and Manuel Lucena, *Los axiomas políticos de Alejandro Malaspina* (Aranjuez: Doce Calles, 1993). We particularly recommend Juan Pimentel, *La física de la Monarquía: Ciencia y política en el pensamiento colonial de Alejandro Malaspina (1754–1810)* (Aranjuez: Doce Calles, 1998).

¹⁴ Antonio Lafuente, "Institucionalización metropolitana de la ciencia española en el siglo XVIII," in *Ciencia colonial en América*, eds. Antonio Lafuente and José Sala Catalá (Madrid: Alianza Ediciones, 1992), pp. 91–120.

¹⁵ The biographies of these and other American scientists quoted in the text may be found in José M. López Piñero, Thomas F. Glick, Victor Navarro Brotóns, and Eugenio Portela, eds., *Diccionario histórico de la ciencia moderna en España*, 2 vols. (Barcelona: Ediciones Península, 1983).

was the second-largest urban settlement in America, and had the good fortune to be governed by viceroys who were strongly committed to the ideals of the Enlightenment. Patriotic and nationalist feeling took root among the Creole intelligentsia there and, although they complained unendingly of their isolation from Europe or of being ignored by the metropolis, they began to realize that they could achieve a culture that, while still modern, could also have roots in native traditions. Their efforts to claim a more important cultural role were replete with innovative proposals. For its part, Madrid imposed modernization on a scale that encompassed all sectors of the economy, in an attempt to strengthen political control and profitability. Mexico City was the jewel in the crown, a city in the midst of frenzied cultural activity that played host to a variety of scientific institutions, the most outstanding of which were the Real Colegio de Cirugía (Royal College of Surgery, established in 1768), the Real Jardín Botánico (Royal Botanical Garden, 1788) and the Real Seminario de Minería (Royal Mining Seminary, 1792). The metropolis was decisively involved with all of them, and they all had controversial beginnings, for local scientists wanted to play a greater role and were unwilling to be merely “extras.” While fighting for greater institutional recognition, the scientists insisted on occupying the managerial posts, arguing not only that they knew as much science as the members of the scientific expeditions coming from Madrid but also that they were more familiar with the geographical, floral, and mineral peculiarities of the territory. These claims were backed by patriotic speeches, and they created an atmosphere favorable to intellectual initiatives that were sensitive to native cultural traditions. There are many examples, but perhaps none are more representative than those that assert the importance of native herbal lore.

The studies of Mexican plants conducted by Mariano Mocino and Luis Montaña in the Royal Native Hospital and the San Andrés Hospital, starting in 1801, are among the most innovative episodes of the new Creole science. They reveal a dual process: *negotiation* between Creole and metropolitan scientists regarding the conditions under which Linnaeus’s botany was received; and the local *appropriation* of such ideas through the emergence of scientific procedures that stemmed from a European cultural tradition.¹⁶ The wards of these hospitals became sites where the medical effectiveness of plants—prescribed by native tradition for centuries—was tested.¹⁷ This required the exercise of some caution, given the vocal animosity towards these native practices, which were branded as primitive or superstitious. While respecting scientific rigor, however, a *scientific pragmatism* emerged that, apart from being endorsed by daily experience, was given legitimacy by contemporary studies by William Cullen and John Brown in Edinburgh.¹⁸ In José Antonio

¹⁶ José J. Izquierdo, *Montaña y los orígenes del movimiento social y científico de México* (Mexico: Ediciones Ciencia, 1955), pp. 200–5. See Donald B. Cooper, *Epidemic Disease in Mexico City 1761–1813: An Administrative, Social, and Medical Study* (Austin: Univ. of Texas Press, 1965).

¹⁷ The Royal Native Hospital was founded in 1531 by the Franciscan Fray Pedro de Gante, leader of the first group of twelve Franciscans. It formed part of the cultural and evangelical complex that the first generation of Franciscans set up among the Indians as a forerunner to the creation of a utopian Mexican nation. In any case, it should be pointed out that in 1545 the Council of Trent established that all hospitals must answer to the Church, even if they were administered by laymen. See Josefina Muriel, *Hospitales de la Nueva España* (Mexico City: Ediciones Jus, 1959), pp. 80–5; Guenter B. Risse, “Medicine in New Spain,” in *Medicine in the New World: New Spain, New France, and New England*, ed. Ronald L. Numbers (Knoxville: Univ. of Tennessee Press, 1987), pp. 12–63.

¹⁸ In Edinburgh, great importance was given to the plant pharmacopoeia as well as to the clinical monitoring of the virtues of plants, following a process in which, according to Alzate, physicians

Alzate's (1737–1799) formulations of 1786, the method employed to test the validity of remedies was “to describe their natural history and pharmaceutical preparation,” that is, to link their climatic conditions for growth and geographical origin with the mixture and dosage of plants employed in each case. The work program differed, according to Montaña, from “the circle of classification and nomenclature typical of cabinet physicists, overloaded with quotations from different authors and always contingent on a definite ‘maybe.’” It was necessary to “ask again for the advice of the herbalist and the *ranchero* and rely on their information.”¹⁹

During the nearly three years that the study lasted, three overlapping traditions converged. One of them, the medical tradition described in the writings of Cruz and Badiano, Sahagún, Hernández, Jiménez, and López emerged with the first contacts between Mexicans and settlers. The second, already mentioned, entailed the re-creation, in the periphery, of techniques stemming from Europe via Edinburgh; and the last one intended to explore the capacity of Linnaeus's binary model to make predictions.²⁰ It was, then, an effort to vindicate a medical heritage “dictated by pure tradition” (as Montaña fittingly puts it), on the one hand, and, simultaneously, to do the only thing that Alzate considered important: to see alleged healing properties with one's own eyes.²¹

Public discussion of the study began on the very same day that the Royal Botanical Expedition, led by the physician Martín Sessé, was announced. The expedition had been organized in Madrid without taking into account the colony's scientific merits and needs. Not only were the Creole scientists achievements ignored but their knowledge was scorned. The Creoles, meanwhile, regarded the metropolitan imposition of Linnaean botany as an arrogant gesture. We know that the pharmacist, and later professor of botany, Vicente Cervantes had in mind the new classificatory sys-

would “carry out trials and test new remedies . . . Before starting treatment, classify the illness and specify the various names under which authors had described it . . . List different opinions on its cause and healing, and devise a treatment plan suitable for the age, temperament, sex etc., determining the reasons on which it is based and the purpose it should serve . . . In order to verify the effectiveness of any remedy, take account of its natural history and pharmaceutical preparation, and show the grounds for trying it, and whether or not the persons present expect good or bad results from the tests . . . Take notes on all this, adding day by day changes experienced by the patient, and if the treatment is changed in any way record the reasons for doing so . . . General comparison to decide for or against the use of such a remedy in such an illness.” Cf. José Antonio Alzate (1790), “Carta de Edimburgo, 10 de Mayo de 1786,” *Gacetas de literatura de México*, 4 vols. (Puebla, 1831), vol. 1.

¹⁹ Speech by Montaña in 1802. Cf. Luis José Montaña, *Anales de ciencias naturales de Madrid*, 1802, 6:214–21.

²⁰ José J. Izquierdo, *Montaña y los orígenes* (cit. n. 16), p. 201.

²¹ From a speech made by Mociño in 1801, we know that Mexican native plants tested in the hospitals were divided into fifteen groups according to their principal healing quality. For example, among the astringents we find Texcalamatl (*Ficus nymphaelifolia*) and the celebrated Ezpatli, or blood medicine (*Lignum nephriticum*) (Kircher, Grimaldi, and Newton experimented with color diffraction of this plant.) Of the narcotics, Picietl or tobacco and the dangerous Toloatzin (*Datura stramonium*). And of the Diaphoretics, Guayacán or *Lignum vitae*. Cf. Mariano Mociño (1801), *Ensayo para la materia médica mexicana* (Puebla, 1832), pp. 98–101. The herbalist tradition had been revived by the exiled Jesuit Javier Clavijero in his *Historia antigua de México*, published in 1780–1781 (Mexico City: Porrúa, 1945). Embroiled in the debates about the New World's “inferior” nature since his exile in Italy, in this important work Clavijero unleashed not only the great chroniclers and jurists of Renaissance and baroque New Spain, such as Las Casas, Acosta, Sahagún, Solórzano, García, Siguenza, etc., but the encyclopaedic knowledge of natural and moral history of Francisco Hernández, Philip II's physician-in-chief for Spanish America. Cf. Jaime Vilchis, “Recepción y mundialización de la historia natural de Francisco Hernández: S.XVI–XVIII,” in *The World of Francisco Hernández*, eds. Simon Varey and Rafael Chabrán (Stanford Univ. Press, in press); A. Gerbi, *La disputa del Nuevo Mundo* (México: FCE, 1982).

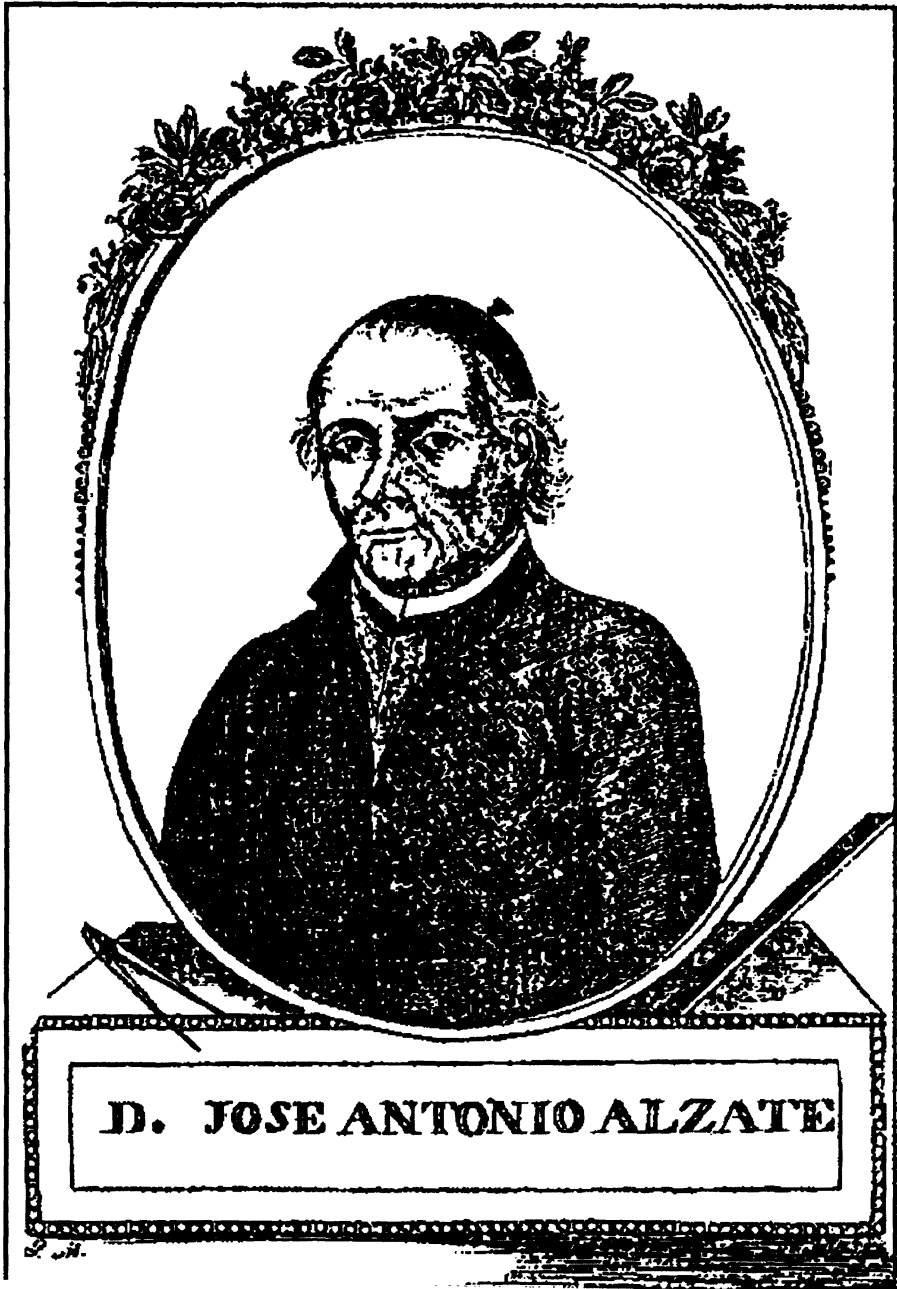


Figure 2. José Antonio Alzate y Ramirez (Ozumba, 1737–México, 1799).

tem of Carl Linnaeus. He had been commissioned to impose it upon the viceroyalty by Gómez Ortega (director of Madrid's Botanical Gardens) and, at the latter's behest, he fulfilled his task swiftly.²² What, however, was initially a legitimate difference in scientific opinion would soon become a deep political and institutional clash of interests after Cervantes's involvement in creating the botany chair in Mexico's newly founded Real Jardín Botánico.²³

Local journalism fueled the deployment of arguments based upon empirical and utilitarian convictions. The journalists were already mature enough to divide readers into apparently irreconcilable camps. Polemicists, boasting of their persuasive skills, created a newsprint "drama" that, although cloaked in scientific language, was actually personal. On one side, members of the expedition played the role of supporters of Linnaeus; on the opposite, a sect of rough and pedantic quack doctors appeared: it was Cervantes vs. Alzate, Linnaeus vs. Hernández, New Spain vs. Mexico, science vs. experience, botany vs. natural history. In sum, there were Manicheans in search of rhetorical legitimacy.²⁴ Anyone wishing to savor a perfect example of incisive, scathing, and insightful prose (baroque in style but enlightened in content) should read the works reflecting this literary and scientific antagonism. It would, however, be inappropriate to make too much of it, as the antagonists coincided in their mockery of and diatribes against the futile egotism of the academics. Moreover, they also agreed in their patriotic and patrician zeal. Something, however, separated one from the other: Creoles studied the new botanical knowledge in the crucible of the Mexican medical corpus. So Alzate exclaimed ironically, "What is the use of including this or that plant in such-and-such a genus, in such-and-such a species, if it has properties very different from those that, because of their similarities, must be included in a given category? In Europe, they conduct ill-fated experiments as a result of which parsley and hemlock are viewed as similar as far as their organisation is concerned. In New Spain, on the other hand, we eat plants and fruits reputedly poisonous, if Linnaeus' botanical laws were true. . . ."²⁵

²² The great reforming and reorganizing impulse encouraged by King Carlos III (1716–1788), aimed at the recovery of colonial power and the appropriation through science of Spanish and American territory, converted Madrid's Royal Botanical Garden into a center for the organization of American botanical expeditions in the latter decades of the eighteenth century. Politician-scientist-in-waiting Casimiro Gómez Ortega served as the garden's director. See Xavier Lozoya, *Plantas y luces en México* (Barcelona: El Serbal, 1984); Javier Puerto, *Ciencia de cámara: Casimiro Gómez Ortega (1741–1818): El Científico cortesano* (Madrid: CSIC, 1992); and Miguel A. Puig-Samper, "Difusión e institucionalización del sistema linneano en España y América," in Lafuente, Elena, and Ortega, *Mundialización de la ciencia* (cit. n. 1), pp. 349–59.

²³ This was not the only battlefield on which the struggle between scientists from the metropolis and those in the colony took place. Cf. Renán Silva, *Saber, cultura y sociedad en el Nuevo Reino de Granada: Siglos XVII–XVIII* (Bogotá: Universidad Pedagógica Nacional, 1984); José Torre Revello, *El libro, la imprenta y el periodismo en América durante la dominación española* (Mexico City: Universidad Nacional Autónoma de México, 1991); Juan J. Saldaña, "Ciencia y felicidad pública en la ilustración americana", in Saldaña, *Historia social de las ciencias* (cit. n. 8), pp. 151–207.

²⁴ Rogers McVaugh, "Botanical Results of the Sessé & Mocino Expedition (1787–1803)" (pt. 3, "The Impact of This and Other Expeditions on Contemporary Botany in Europe"), *Contributions of the University of Michigan Herbarium*, 1987, 16:155–71; José L. Peset, *Ciencia y libertad: El papel del científico ante la independencia americana* (Madrid: CSIC, 1987); Roberto Moreno, *La primera cátedra de botánica en México* (Mexico City, 1988); Graciela Zamudio, "El Jardín Botánico de la Nueva España y la institucionalización de la botánica en México", in *Los orígenes de la ciencia nacional*, ed. Juan José Saldaña (Mexico City: Cuadernos Quipu 4, 1992), pp. 55–98.

²⁵ Alzate (1788), *Gacetas de literatura de México* (cit. n. 18), vol. 1, pp. 20–2. On Alzate, see Roberto Moreno, *Un Eclesiástico criollo frente al estado Borbón* (Mexico City: Academia Mexicana

Right from the beginning, the dispute (sprinkled with references to the new chemical nomenclature) was tainted with an unpleasant antimetropolitan aftertaste or, as revolutionary leader José María Morelos pointed out, with nationalist feeling. The dissemination of new values shaping what Clifford Geertz has called an “integrating ideology” was the most important event. It helped to create a self-governing political entity endowed with authority and legitimacy; it combined the political virtues of the Aztec “civilization” and the juridical possibilities spawned by the “sovereignty of sovereignties” of the baroque period.²⁶ It was a return to primeval antiquity, an attempt to recreate an individual identity combining Catholic orthodoxy with the omens of astrology, healthy herbalism, and the Anáhuac region’s fertile agriculture. Summing up, a new rhetoric was developed which, in contrast to that employed by Fausto Elhuyar, Vicente Cervantes, or other missionaries from the metropolis, did not limit itself to serving as propaganda on the usefulness of modernization: it was also aimed at blending the new motherland territory with the protagonists’ cultural heritage so they could be taken as a single reality.

We have alluded to the priest Alzate, not because he was the wisest or most conspicuous of Creole polemicists, but rather because he assumed the role of spokesman. As a whole, the ideas published by Juan Díaz Gamarra, Antonio León y Gama, Juan Santalices, José Bartolache, Nicolás Guadalajara, Francisco Gamboa and others worked a sort of Orphic charm, a persistent and melodious murmur capable of filling the gap between sages and laymen and of mixing old knowledge with new disciplines—ethnography, archeology, medical geography, cartography, and anthropology—in pursuit of a national memory that was soon to become nationalist.²⁷

The concessions made by both metropolitan and Creole scientists were astonishing. For instance, in the Real Jardín Bótanico school’s graduation examinations of 1793, Cervantes maintained that a student, apart from distinguishing plants by judging from their gender, must also “describe their virtues and . . . uphold the opinion, in opposition to the claims of Linnaeus and others, that accurate data on their properties can be obtained through well-supervised chemistry.” Alzate, in his attempt to reach a new consensus, acted in the same way with regard to Lavoisier’s nomenclature. In 1791, he admitted without hesitation (even using the same arguments previously employed by Cervantes himself), “I would not dare describe [Lavoisier’s] system as entirely false.”²⁸ Did he perhaps notice the similarity between the nomenclature of chemistry (the name assigned to a substance describes its process of synthesis) and that of the Nahuatl native medical tradition (the name of the medicine describes its healing properties)? Perhaps, indeed, in both cases we are dealing with

de la Historia, 1980). It is interesting to note that Alzate was not only the focus of a stream of public opinion in New Spain but also the center of a network of international correspondence.

²⁶ Clifford Geertz, *The Interpretation of Cultures* (New York: Basic Books, 1973), pp. 190–218.

²⁷ James R. Jacob, “*Por encanto órfico: La ciencia y las dos culturas en la Inglaterra del siglo XVII*,” in *La ciencia y su público*, eds. Javier Ordoñez and Alberto Elena (Madrid, CSIC, 1990), pp. 43–69. See J. A. Ruedas de la Serna, *Los Orígenes de la visión paradisiaca de la naturaleza mexicana* (Mexico City: Universidad Nacional Autónoma de México, 1987), and José Luis Peset, “La Naturaleza como símbolo en la obra de José Antonio de Alzate,” *Asclepio*, 1987, 39, 2:285–95.

²⁸ Referring to Lavoisier’s statement that vitriolic ether cannot be manufactured in places where the barometer reads between 20 and 24 inches, Alzate points out his error by citing that his adversary Vicente Cervantes manufactured and sold the ether at his pharmacy in Mexico City, where the barometer shows 21 inches. See Alberto Saladino, “La Química divulgada por la prensa ilustrada del Nuevo Mundo,” in *La Química en Europa y América (siglos XVIII y XIX)*, ed. Patricia Aceves (Mexico City, Universidad Autónoma de México, 1994), pp. 177–99.

a nomenclature based on what is considered intrinsic to the nature of a given substance.²⁹

The mixture of old local wisdom with new European knowledge (not in spite of, but actually thanks to the imperial dynamics of Bourbon despotism) favored the emergence of a social movement that advocated more autonomy and the spread of a type of creativity that envisioned itself as sovereign.³⁰ Creole initiatives towards assimilation (without giving up a sense of belonging to tradition), and towards re-creation of scientific knowledge and procedures, refuse to conform to the pattern of simple automatism characteristic of diffusionism, nor to that of inevitable antagonism between Europeans and Americans.

Thus, in Mexico, Creole scientists tried to merge the native scientific heritage and European practices and knowledge into a single discursive reality. In this way, the motherland would be politically categorized as a defender of tradition as well as of modernity. As we shall see in the next section, Creole scientists in New Grenada were less emphatic about their glorious native past. All their efforts went to show that their country was a promised land that would offer up its treasures only when it had been measured, inventoried, and mapped.

NEW GRENADA: MUTIS AND HIS CRITICS

Colombian historiography has traditionally interpreted the Enlightenment in New Granada as a continuous thread, beginning with the arrival of José Celestino Mutis (1732–1808) in Santa Fé in 1760, ending with the political clampdown by General Pablo Morillo, and reaching its climax at the turn of the century.

Historians have pointed to Mutis's influence on the cultural life of the colony. Arriving in Bogotá in 1760 as physician to the new viceroy, he soon found favor as a practical administrator and a symbol of Bourbon reformism. His ambition increased as he received support from the authorities, and reached its height with the approval of his proposal to organize an expedition to survey the mineral and vegetable wealth of the viceroyalty of New Granada. Such was Mutis's influence that from 1783, there was no scientific or cultural project that did not pass through his hands, and he was called the "Oracle of New Granada."

Mutis's death in 1808, however, heralded a reappraisal of the aims of the Royal Botanical Expedition as commanded by Mutis, as well as of its alleged achievements.³¹ By then, conditions had changed radically: now, criticism of Mutis came

²⁹ *Ejercicios Públicos de Botánica . . . presidiéndolos Don Vicente Cervantes catedrático de Botánica* . . . (Mexico City: Herederos de Don Felipe de Zúñiga y Ontiveros, 1793), pp. 8–9.

³⁰ The contemporary literary essay is where the Creole concept has been most clearly and brilliantly defined. After the influence—intangible but powerful—of Jorge Luis Borges in *El tamaño de mi esperanza* (1926) and of José Vasconcelos, who wrote *Ulises criollo* (1935), the post-1960s brought a crescendo of other bold meditations on the Creole issue. We note the most important: Lezama Lima in *La Expresión americana* (cf. *idem*, *Confluencias* [La Habana, 1988], pp. 263–77) elevates "Creole" to a hermeneutic category of American modernity. Octavio Paz in his essay *Sor Juana Inés de la Cruz o las trampas de la fe* (Barcelona: Seix Barral, 1982, pp. 55–67) sees the awakening of the Creole spirit in the syncretism that brings indigenous culture into the mainstream. And more recently, Victor Farías in *La Metafísica del arrabal* (Madrid: Muchnik, 1992, pp. 125–43) sees in the work of the young Borges the urgent and yearning expression of a "Creole logos" that comes to form part of the human heritage in its own right.

³¹ An indispensable reference on Spanish botanical expeditions to America is Javier Puerto, *La Ilusión quebrada: Botánica, sanidad y política científica en la España ilustrada* (Barcelona: El Serbal/CSIC, 1988). See also Antonio González Bueno and Raúl Rodríguez Nozal, *Plantas americanas*

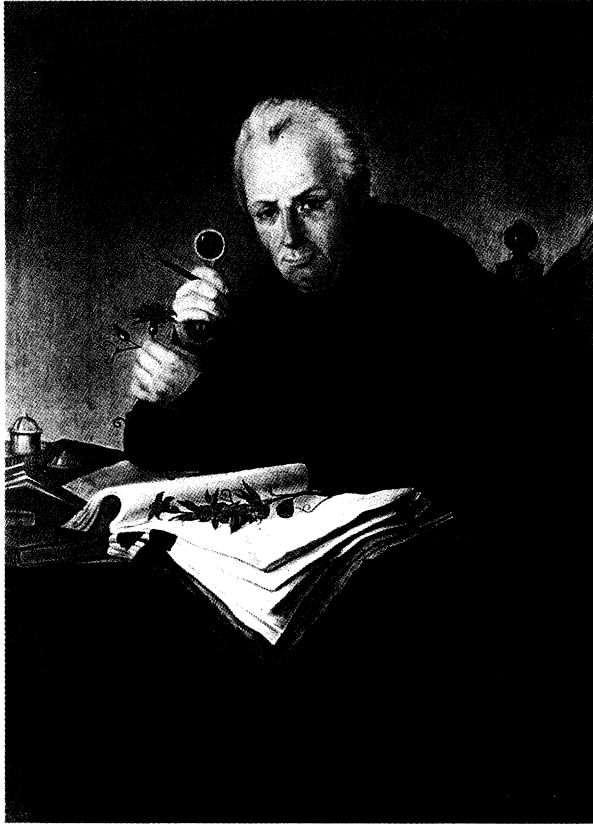


Figure 3. José Celestino Mutis y Bosio (Cádiz, 1732–Bogotá, 1808).

from moderns, and no longer from reactionaries. One of his chief critics was self-taught scholar Francisco José Caldas (1768–1816).³² In September 1808, after examining the writings left by Mutis in the *House of Botany*, Caldas wrote, “now that I have managed to detect the lacunae and gaps it contains . . . I wish to save at least my botanical writings on the Southern part of the viceroyalty from the ruin that

para la España ilustrada: Génesis, desarrollo y ocaso del proyecto español de expediciones botánicas (Madrid: Editorial Complutense, 2000). Great efforts have been made to present a balanced picture of the successes and failures of Mutis and his milieu. Among them, we would recommend José Antonio Amaya, *Celestino Mutis y la Expedición Botánica* (Madrid: Ediciones Debate/Itaca, 1986). This book excuses Mutis’s failures on the grounds of “the uncertainty of the environment in which he planned his mission as spreader and ideologist of science, rather than as a systematic scientist” (p. 66). Nevertheless, the man whom Alexander von Humboldt called the “Father of the Botanists” showed shortcomings in his traditionalism (p. 46) and paternalism (p. 42), his weakness for iconography and contempt for systematic botany—his “iconism” (pp. 42, 43, 53, 56), his authoritarianism (p. 42), ambition for wealth (p. 37), and his mediocre scientific training (p. 66).

³² Caldas is a prime example of Creole science. Brought up in the colonies (Popayán, Colombia) and frustrated by his isolation, he asked Mutis to include him in the expedition he was leading through the New Kingdom of Granada. Caldas discovered that the boiling point of water changed with altitude, a discovery that Humboldt acknowledged in 1801 during his stay in the province of Quito. After Humboldt’s refusal to include Caldas in his American journey, and in view of the difficulties he had with Mutis’s circle, Caldas’s politics became more radical. He openly championed a

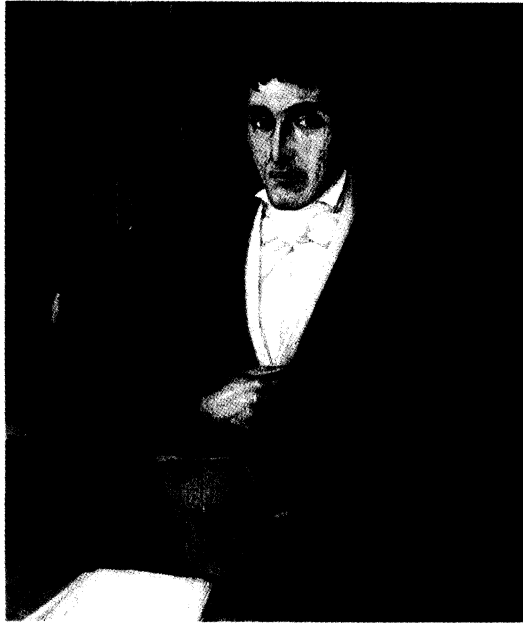


Figure 4. Francisco José de Caldas (Popayán, 1768–Bogotá, 1816).

threatens the Flora of Bogotá. . . .”³³ This criticism of the expedition was compelling, since it not only bemoaned the lack of attention to the vital work of classification but also criticized the poor relationship between the viceregal territory and the regions whose plant life had been studied. For Caldas, territory—in the sense of a homeland, the land supporting a civilization—was the sole object of study, with all

culture and science rooted in native traditions and committed to the interests of the colony. His patriotic preaching led him to defend the originality of American culture and to support biogeography as a field that both encompassed the virtues of European science and addressed the urgent economic policy needs of New Granada. In his work *Del influjo del clima sobre los seres organizados* (1808), Caldas argued that regional variations in cultures originated from climatic differences, a hypothesis that gave scientific backing to his proposals for the federalist organization of the American states after their independence.

It is very difficult to find texts dealing with the reported student-teacher relationship between Caldas and Mutis, or the differences that led them to fight on opposite sides—Caldas as a federalist and Mutis’s nephew Sinforoso Mutis, Jorge Lozano, and Antonio Nariño as centralists—during the so-called First Republic (1810–1816). However, there is a steady trickle of publications talking of tensions between factions of the Creole elite and even among royalist officials. Contrary to the usual laudatory propaganda, the commitment of the insurgents (some of whom came from Mutis’s circle) to science is neither obvious nor automatic. Proof of this, for example, is the suspension of the 1812 expedition by the Constitution of Cundinamarca, or the gradual disappearance of instruments and maps from the Bogotá Observatory, which were dispersed to military commanders for war purposes. A balanced assessment of the involvement of scientists in the independence movement can be found in Thomas F. Glick, “Science and Independence in Latin America (with Special Reference to New Granada),” *Hispanic American Historical Review*, 1991, 71:306–34.

³³ It is worth quoting the reasons for Caldas’s pessimism: “. . . now that I have seen that there [are] not even two or three palm trees, that the section on cryptogamy is almost entirely blank, that the unnumbered pages, in no order, have not a single copy; that more than half of the sketches for the engravings are missing; that many anatomies are missing; that the manuscripts are in total disorder; that they are no more than inkblots; that the whole wealth of the Flora of Bogotá consists of 48 small notebooks; that the rest of the works that he has undertaken during his life have been mere summaries; that the treatise on cinchona has not been completed, save for the medical section; that the

due respect to far-ranging geographic or botanical explorations. Unlike Mutis, he felt that science should be subordinate to political interests.³⁴ In fact, Caldas, José Pombo, Juan Valenzuela, Jorge Lozano, and later Zea (all important members of the intellectual elite of the colony) would submit their own separate expeditionary projects as pragmatic alternatives to the academic strategy adopted by Mutis. Mutis's more or less theoretical or speculative approach was not the only subject under discussion, but also (and above all), as Restrepo has remarked, the public or private nature of scientific enterprise.³⁵ Numerous testimonies show the difficulties Mutis experienced when trying to determine just where his vision of the expedition as a personal endeavor should end (with regard, for example, to the Casa de la Bótanica he established in Mariquita, or to the appointment of expedition members), and where the scientific mission, financed with viceregal or metropolitan funds, should begin.

By the end of the eighteenth century, a new form of patriotism began to take shape, giving priority to the useful and public dimensions of knowledge. Priorities shifted in the scientific disciplines: from astronomy to geodesy, from botanical taxonomy to the geography of plants, and from exploration of territories to regional econometrics. In short, having identified New Grenada with a new technical standard, the Creole elite fought to substitute more integrated views for classificatory practices; to replace observation with measurement, and the university chair with

descriptions of these important plants are in deplorable scrap-books. . . ." Quoted in Santiago Diaz-Piedrahita, "Caldas y la historia natural," in *Francisco José de Caldas* (Bogotá: Molinos Velásquez Editores, 1994), pp. 111–23, quotation on p. 115. However, this condemnation should be qualified, since in fact Caldas changed his opinion after 1812, when he chose to collaborate with Sinforoso Mutis, who became the new expedition director after the death of his uncle, and to contribute to spreading the work done in the preceding two decades.

³⁴ In order to understand this difference, a special point should be made about the scathing criticisms that Caldas, Lozano, and Zea made of the way in which Mutis handled the affairs regarding his expedition, including the building of the Bogotá Observatory itself. In the latter case, Mutis's arrogance drove him to commission a building that, in imitation of the outdated models first erected in Greenwich and Paris, was already obsolete by the time of its construction. It seemed as if Mutis, who had served as an adviser on so many and such different matters, was too proud to ask for advice and thus erected a monument to the past, rather than a useful building for the present. He ordered the construction of a building whose internal layout of empty spaces and observation rooms so closely followed the European originals that it proved totally useless in Bogotá, since celestial bodies do not reach their highest point in the same position in tropical areas that they do in the northern hemisphere. Caldas's complaints show that the error cannot be put down to "the tyranny of distance." David Wade Chambers, "Does Distance Tyrannize Science?" in *International Science and National Scientific Identity*, eds. Roderick W. Home and Sally Gregory Kohlsted (Boston: Kluwer, 1991), pp. 31–3; *idem*, "Locality and Science: Myths of Centre and Periphery," in Lafuente, Elena, and Ortega, *Mundialización de la ciencia* (cit. n. 1), pp. 605–17. Arias de Greiff ridicules this case of "inadequate technology transfer," since the observatory was designed with side openings "in order to observe from within, through the windows, the progress of the bodies of the solar system from their rising in the East to their setting in the West, with their maximum height or apogee not overhead but towards the South, when they could be seen through the windows on this side. But this is not the case in equatorial regions, where these stars reach their apogee almost at the zenith. Moreover, there is not even a window facing South, since this is where the stairs are located." Jorge Arias de Greiff, "Caldas: Inquietudes, proyectos y tragedias," in *Francisco José de Caldas* (cit. n. 33), pp. 37–54, quotation on p. 40.

³⁵ Olga Restrepo Forero, "El tránsito de la historia natural a la biología en Colombia (1784–1936)," *Ciencia, Tecnología y Desarrollo* (Bogotá), 1969, 10:181–275. This was later expanded and published in "Naturalistas, saber y sociedad en Colombia," in *Historia social de la ciencia en Colombia*, eds. Olga Restrepo, Luis Carlos Arboleda, and José A. Bejarano, 9 vols. (Bogotá: Colciencias, 1993), vol. 3, *Historia natural y ciencias agropecuarias*, pp. 13–327. On Mutis's secretiveness, see p. 101 *et seq.*

the laboratory.³⁶ Such drastic changes were implemented in a way that would have been unthinkable a decade earlier. To illustrate this point, it will suffice to quote part of Caldas's article in the *Semanario del Nuevo Reino*, of which he was editor between 1808–1811: "To observe the skies for the sake of observation would be a legitimate activity, but it would be nothing but a fruitless activity . . . This observer would be useless and the Motherland would regard him as a consumer from whom nothing is expected. *We do not wish to play this role in society*: We want our astronomical studies to improve our geography, our roads and our commerce."³⁷ Doubtless, this and similar texts from which we may quote hinted at the need to strengthen the role of local government in deciding political and scientific priorities. Drawing a distinction between the two types of knowledge—one, that of the "republic of letters," more susceptible to logic, and the other responding to the needs of the "civil republic"—entails a new configuration of what Bourdieu calls the "scientific field." The Creole elite aspired to occupy a central place in the public arena, arguing that science was subordinate to politics, as history was subordinate to geography: novelties that contributed noticeably to the substitution of the Kantian "rhetoric of emancipation" for the "rhetoric of patriotism" of the American and French Revolutions.³⁸

Such ideas contained a fundamental criticism of the Mutisian model of science. Other criticisms had appeared earlier in the *Proposal for the Re-organisation of the Botanical Expedition* (1802), written by Zea during his exile in Europe.³⁹ The new

³⁶ This entailed a program of action that paralleled the language they chose to use. Along with conventional references to public welfare, the program called upon the elite to put its knowledge of the geography and environment of New Granada into quantitative terms. Caldas complained that the inhabitants of New Granada knew more about the situation in China than about their own, since "we do not know the size of the country where we were born." Quoted in Hans-Joachim König, *En el camino hacia la nación: Nacionalismo en el proceso de formación del estado y de la nación de la Nueva Granada, 1750–1856* (Bogotá: Banco de la República, 1994), p. 91. Caldas identified the new patriotism with the desire to "measure how far we are from prosperity." *Ibid.*, p. 88.

³⁷ Quoted in Luis C. Arboleda, "Ciencia y nacionalismo en Nueva Granada en los albores de la revolución de la Independencia", in *Francisco José Caldas* (cit. n. 33), pp. 139–46, quotation on p. 142. The text of Caldas, to which we have added italics, was published in the *Semanario del Nuevo Reino de Granada* in 1811, the first year of independence. There are many texts advancing this new ethos; in 1809, also in the *Semanario*, Caldas attacked the hermetic academicism that was surreptitiously attributed to Mutis when he stated, "How can a nation which has no roads, whose agriculture, industry and trade are in their death throes, spend its time in brilliant ventures, most of which are imaginary? The cultivation of a plant, a good road . . . are more important matters than all those much talked-about projects where it can show off its genius, its erudition and its eloquence" (*ibid.*, p. 145). An analysis of the thoughts of the elite on the situation and needs of their American motherland (as they always called it, rather than "New Granada motherland") is to be found in König, *En el camino* (cit. n. 36); also in José Luis Peset, *Ciencia y libertad: El Papel del científico ante la independencia americana* (Madrid: CSIC, 1987).

³⁸ Caldas seemed to have no doubts on this point, and in his 1807 article "Estado de la geografía del Virreinato de Santafé" he states that "Geography is the basis for all political speculation." Quoted in Restrepo, "Naturalistas" (cit. n. 35), p. 110.

³⁹ Francisco Antonio Zea, born in Medellín, Colombia, was a student of the learned Creole José Francisco Restrepo in Popayán. He joined Mutis's expedition as a botanist in 1791. Since he had been involved in a conspiracy against the metropolis led by Antonio Nariño in 1795, he had to go into exile in Spain. Once there, he worked at the Royal Botanic Garden in Madrid with its director Antonio José Cavanilles, whom he succeeded upon his death. In 1816 Zea sided with Simon Bolívar and became vice-president of Colombia. He died in England while on a diplomatic mission. On Zea and his plans for the renewal of colonial science, see Luis C. Arboleda, "La Ciencia y el ideal de ascenso social de los criollos en el virreinato de Nueva Granada," in Lafuente and Catalá, *Ciencia colonial en América* (cit. n. 14). This was also published in volume 3 of the *Historia social de la ciencia en Colombia* (cit. n. 35), pp. 329–59.

Creole elite could not accept that the work of plant collection within the territory should be entrusted to village scholars (local priests or herbalists) working in the Casa de la Botánica in Mariquita. Nor were they happy that the head of the expedition should concentrate upon strictly taxonomic work, or upon supervising botanical illustrations. This pointed to a need to take greater advantage of native knowledge of the use of local flora. No doubt Mutis's correspondents consulted with the native population, but he was nonetheless branded as a European elitist and denounced for his apparent inability to relate to colonial society outside of his circle of loyal supporters. Mutis's quest for intellectual recognition in Europe and his tendency to shut himself away in an ivory tower were seen as slights to the scientists of New Granada.

These criticisms of the leader of the expedition cast doubt not only on his prestige. As the Creoles advocated a new scientific ethos, they also tended to depict Mutis as an imperial agent, selfish and despotic, rather than as a patrician sensitive to local traditions and in favor of developing New Grenada, the territory they considered their motherland. Political events would not allow the translation of these ideas into action until after Mutis's death, when they eventually prevailed in the negotiation for independence forced upon the viceregal authorities by the new generation of Creoles.

LOCAL BACKGROUND AND IMPERIAL DYNAMICS

In the foregoing pages, we have sketched some of the effects that the Hispanic world's inclusion in an imperial structure had upon the globalization of science. We have taken into consideration the two extremes that imperial reality set in motion: the metropolis and the colony. Indeed, the striving for *aggiornamento* from the end of the seventeenth century onwards in the Iberian Peninsula, stepped up after the accession of the new Bourbon dynasty (1700) to the throne, would soon be subject to tensions that would forge an institutional identity and a professional ethos. The equation, in its Spanish version, is easily stated: a country, opting for regeneration at the expense of old institutions and with new protagonists (scientists), whose social rise was based on talent rather than lineage, and who derived the usefulness of knowledge from its quantifiability, activated a powerful machine for the social validation of scientific activities. We can see that, on the one hand, science crystallized into an essential part of imperial structure. On the other, we find scientific practices informed by the demands of the metropolis and, at the same time, by the patriotic ambitions of the colony.

From the point of view of the colony, there was not just one scientific center but many. Is this a sign of the failure on the part of the ruling elites to develop one consultative body, an academy at the top of the pyramid responsible for decisions on scientific and technical matters? Does this also show scientists' incapacity to gain legitimacy in an autonomous and self-accounting professional environment? The answer is yes. But it is also true that scientific models set up during the seventeenth century, which were easily emulated in such fields as language, history, and fine arts, adapted badly to the requirements imposed by the structuring of the empire (both in the peninsula and in America) in the course of "colonial reconquest." During the eighteenth century, science and technology were envisioned as privileged tools of the new state and imperial policy. Pressing needs on the scientists' part turned them

into government agents, thus providing a foretaste of the strong links between scientists and politicians that are common in our century and were widely forged during the revolutions in the American colonies and in neighboring France.

CONCLUSION

By the end of the 1700s, the conviction that the empire was not viable spread among Hispanic elites. As in the case of many long marriages, it seemed as though the different kingdoms that formed the monarchy could not live with each other, but nor could they bring themselves to separate. Whether the flood of complaints was balanced or not, the end of a world seemed imminent. Accusations of cultural incompatibility were added to the reproaches heaped upon the metropolis for its cruel exploitation of the colonies. In Mexico City and in Bogotá, the modernizing capacity of the communication channels established by the empire began to be questioned. It is undeniable that the metropolis was responsible for the introduction of Newton, Linnaeus, and Lavoisier to the colonies, a success achieved not in spite of, but rather thanks to the imperial link. Nevertheless, Latin American intellectuals who criticized the obsolete nature of most of the institutionalized ideas did emerge. They were partly right since, if such ideas were modern in contrast with the scholasticism pervasive a few decades earlier, they were approaching their expiration date in contemporary Europe. It would be unfair to overlook this point and fail to recognize the justification for part of Alzate's support of "natural" classificatory systems and Caldas's vindication of botanical geography. In short, to reduce the nature of the controversy to a mere confrontation between Creoles and metropolitans is, after all, a contagious simplification.

The scientific credibility of the metropolitan adversaries was not the only question raised. Criticisms also abounded about holding values opposed to those locally prevalent. Suffice it to recall how the metropolis presented the public as opposed to the private, the theoretical as opposed to the pragmatic, the paradigmatic as opposed to the local, academic interest as opposed to patriotic interest, or cabinet study as opposed to field work. The elite proposed not an alternative to modernity, but an alternative way of understanding modernity. If we were to single out a value that encapsulated the new ethos, it would be pragmatism. Creoles did not hesitate to manipulate public opinion to gain social legitimacy, in order to counter the veracity of the ideas endorsed by European scientific academies. Thus, leading members of the colonial elite tried to transfer epistemological validation to Latin America; they did not give up the experimental verification of principles, but rather adopted new principles claiming that this would result in better social outcomes. They introduced, likewise, epistemological criteria of a lesser rank, incompatible therefore with those fostered by the metropolis.

Mociño, Caldas, and Alzate were not part of a backward cultural elite. Certainly they were not the most advanced scientists of their time, but within a few years they had managed to convince themselves that they formed part of the army of modernity. And yet they did not act like converts, but rather presented themselves as critics of the knowledge brought by the expeditionaries from the metropolis. For these Creoles to argue about science was more than merely to question models or experiments. As well as promoting scientific ideas, they wanted to introduce a different way of appropriating Nature. They wanted knowledge more relevant to themselves.

Perhaps they did not fully understand the importance of what they were saying, but, with the help of local journalists, they won the battle for public opinion. And it was a resounding victory, since to the public they won for science, what they said seemed obvious: science and patriotism were inseparable. The Creoles did not promote a nonscientific ideology; rather they wanted it to be accountable and politically committed. That is to say, they globalized their problems, because they managed to express them in the cosmopolitan language of modern science. The decisive thing is not the struggle between tradition and modernity, but the reshaping of tradition in light of the communications received from outside that are considered to be most effective. It can be said that the imperial structure within which colonial science developed offered a clear option to the elites of New Spain and New Granada: alternative science, not an alternative to science.