Laboratory Styles in Argentine Physiology

*By Marcos Cueto**

RECENT STUDIES HAVE SUGGESTED that science in Latin American countries cannot be described solely in terms of inferiority, control, or hegemony. These studies have analyzed cases of excellence in the so-called periphery, the dialectics between dominance and resistance, and the local transformation of research agendas and institutional models imported from abroad. One way to further our understanding of how science operates in Latin America is to identify the elements that might distinguish its local dynamics: the analysis of laboratory styles, for example, could be illuminating. The aim of this article is to study the characteristics and vicissitudes of a style of physiological research that emerged in response to adverse conditions.[1]

My story deals with a remarkable field within Latin American life sciences in the early twentieth century: Argentine physiology. Its main character is the Nobel laureate Bernardo A. Houssay, who overcame unfavorable conditions—including a chronic lack of funds and overcrowded universities—by creating a distinctive laboratory style in a number of Argentine physiology institutes. Some of the elements of this style were the use of a low-technology, labor-intensive, assembly-line-like system of experimentation, a holistic approach to physiology, and the deliberate choice of endocrinological areas of research where international competition was scarce. I will also study the impact of the Rockefeller Foundation and of military authoritarianism on Houssay's laboratory style.

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[1] Some examples of the literature are Nancy Leys Stepan, *"The Hour of Eugenics": Race, Gender, and Nation in Latin America* (Ithaca, N.Y.: Cornell Univ. Press, 1991); Juan José Saldaña, ed., *Los orígenes de la ciencia nacional* (Mexico: Cuadernos de Quipu, 1992); Marcos Cueto, "Andean Biology in Peru: Scientific Styles in the Periphery," *Isis*, 1989, *80*:640–658; Antonio Lafuente and José Sala Catalá, eds., *Ciencia colonial en América* (Madrid: Alianza Editorial, 1992); and Thomas Glick, "The Rockefeller Foundation and the Emergence of Genetics in Brazil, 1943–1960," in *Missionaries of Science: The Rockefeller Foundation and Latin America*, ed. Cueto (Bloomington: Indiana Univ. Press, 1994), pp. 154–169. Studies on research and institutional styles in physiology include Alejandra C. Laszlo, "Physiology of the Future: Institutional Styles at Columbia and Harvard," in *Physiology in the American Context, 1850–1940*, ed. Gerald Geison (Bethesda, Md.: American Physiological Society, 1987), pp. 97–115; and Ton Van Helvoort, "Bacteriological and Physiological Research Styles in the Early Controversies on the Nature of the Bacteriophage Phenomenon," *Medical History*, 1992, *36*:243–270.

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I. ARGENTINA AND HOUSSAY

During the first decades of the twentieth century Argentina was the Latin American country most ready to join the developed nations of the world. The factors responsible for this development included a fast-growing economy based on the exportation of beef, wool, and grain; high levels of education and literacy; the massive influx of European immigrants, who by 1914 constituted 50 percent of the inhabitants of Buenos Aires; absence of the widespread infectious disease problems typical of other Latin American countries; and a relative degree of political and social stability. Much of Argentina's progress benefited only the capital city of Buenos Aires, which according to James Scobie outgrew the rest of the country during these years.[2] The new metropolis became the site of a rich cultural life reflected in a feverish editorial activity, a vibrant café life, and a population of writers and artists attracted from all parts of the world.

These developments combined to create among Argentineans an extreme confidence in their own worth. The centennial celebrations of Argentine independence, in and around 1910, encouraged nationalist fervor and a belief in Argentina's predestined role in civilizing the rest of South America. The influential writer José Ingenieros was convinced that the country's predominantly white racial composition and its economic strength would launch Argentina as the hegemonic force in South America.[3] The belief in a manifest destiny also emphasized the ability of Argentineans to make significant contributions of worldwide value. The clearest example of the impact of these ideas on medical science was the career of Bernardo A. Houssay.

Born in 1887 in Buenos Aires to French immigrant parents, Houssay studied first pharmacy and then medicine at the University of Buenos Aires.[4] The curriculum at the prestigious Facultad de Medicina took seven years to complete: it emphasized anatomy during the premedical years and clinics during the last three years. These characteristics were derived in part from the strong French influence, which was also illustrated by the generalized use of French textbooks in instruction.[5] The great majority of the medical professors were in active practice and gave but a few hours per week to teaching and research. Even in the basic sciences, laboratory chairs were

[2] James R. Scobie, *Argentina: A City and a Nation* (New York: Oxford Univ. Press, 1971), p. 7. The best history of Argentina is David Rock, *Argentina, 1516–1987: From Spanish Colonization to Alfonsin* (Berkeley: Univ. California Press, 1987).

[3] See José Ingenieros, *Sociología argentina* (Madrid: D. Jorro Editor, 1913). On nationalism in Argentina see Arthur Whitaker, *Nationalism in Latin America: Past and Present* (Gainesville: Univ. Florida Press, 1962), pp. 38–54.

[4] I have drawn biographical information on Houssay from Virgilio G. Foglia, "Bernardo Alberto Houssay," *Acta Physiologica Latinoamericana*, 1971, *21*:267–285; Juan T. Lewis, "Bernardo Alberto Houssay," in *Perspectives in Biology: A Collection of Papers Dedicated to Bernardo A. Houssay on the Occasion of His Seventy-fifth Birthday*, ed. C. F. Cori *et al.* (Amsterdam/London: Elsevier, 1963), pp. vii–xiv; and Ariel Barrios Medina, "Bernardo Alberto Houssay (1887–1971): Un esbozo biográfico," *Interciencia*, 1987, *12*:290–299. Houssay graduated from the Facultad de Medicina in 1911.

Argentine universities were divided into individual schools called faculties; the term refers not only to the teaching staff but to the basic academic units of the university. There were, as well, a few semi-autonomous institutes that were formally connected to one or another faculty. See Richard J. Walter, *Student Politics in Argentina: The University Reform and Its Effects* (New York: Basic, 1968), pp. 5–9.

[5] In 1911 50 percent of the forty-eight thousand volumes checked out from the Faculty of Medicine library were written in French: "Medical Education in Argentina, by Dr. Richard M. Pearce 1917, and Dr. R. A. Lambert 1925," p. 141, Rockefeller Foundation Archives (RFA), Record Group (RG) 1.1, Series 301, Box 2, Folder 18, Rockefeller Archive Center (RAC), North Tarrytown, New York.

frequently held by practicing physicians. Instruction in these fields suffered from a subdivision of classes; and even though classes had to run in small sections, facilities were insufficient to serve the number of students enrolled.

Overcrowding was intensified in and after 1918, when Argentine universities were the site of the so-called University Reform. Reflecting the aspirations of middle-class groups to gain access to an elitist institution, the reform allowed for the participation of students and alumni in the selection of faculty, permitted unrestricted enrollment in the university, and made class attendance optional. When Houssay became a professor he resented student participation in faculty appointments because it increased the insecurity of professorial positions (individual professors were subject to recall, and personal popularity often mattered more than research production), disapproved of optional attendance because it endangered laboratory instruction, and rejected unrestricted class enrollment because it increased the gap between available facilities and students.[6]

Houssay's attitude had been shaped by his own educational experience. During his medical studies he met two people who oriented his career toward medical science. The first was Horacio Piñero, the charismatic professor of physiology who used philosophical arguments to support the priority of physiology over anatomy for medical studies. Houssay came to know Piñero well when, as an instructor of physiology, he published Piñero's lectures. Partly thanks to Piñero's influence, Houssay was appointed to the chair of physiology at the School of Veterinary Medicine at the University of Buenos Aires in 1909.[7]

A second scientist who influenced the young Houssay was the Austrian Rudolf Kraus, who organized and directed the non-university-related Institute of Bacteriology of Buenos Aires along European lines.[8] The institute prepared serums and vaccines, undertook studies of autochthonous diseases, and controlled the use of insecticides and disinfectants. Kraus was one of the few European "contract scientists," hired in Argentina and other Latin American countries at the turn of the twentieth century, who actually received a good salary and adequate resources. Between 1915 and 1919 Houssay worked at Kraus's institute, where he became acquainted with the idea of research as an exclusive activity.

In 1919, after Piñero's death, the chair of physiology in the medical faculty was opened for contest. Appointment to any faculty position was by a competition in which candidates were examined by a faculty committee. Houssay applied, promising that if appointed he would work solely in the university. The contest ended in a tie, and a progressive dean appointed Houssay to the chair of physiology as the first full-time professor of the university. Shortly after his appointment, Houssay organized a full-fledged Institute of Physiology that emphasized laboratory work and incorporated the chairs of physiology, biochemistry, and biophysics under his di-

[6] Houssay's papers on these subjects are collected in Ariel Barrios Medina and Alejandro C. Paladini, comps., *Escritos y discursos del Dr. Bernardo A. Houssay* (Buenos Aires: Editorial Univ., 1989). The best work on University Reform in Argentina is Walter, *Student Politics in Argentina* (cit. n. 4).

[7] During his student years Houssay read the classic work of Claude Bernard and decided to commit his career to physiology: Bernardo Houssay, "Claude Bernard y el método experimental," *Boletín de la Academia Nacional de Medicina*, 1962, *40*:577–592, on p. 581. For a history of physiology in Argentina see Bernardo Houssay, "La enseñanza de la fisiología," *Prensa Médica Argentina*, 1920, *6*:296–299.

[8] On Kraus's institute see "Scientific Institutions in Latin America: The Bacteriological Institute of the National Department of Health of Argentina," *Boletín de la Oficina Sanitaria Panamericana*, 1940, *19*:249–253.

rection. Given the small number of life scientists in Argentina, the concentration of several disciplines helped to strengthen the initial position of the institute. In the late 1920s the institute moved to a four-floor building and received support from both the university and the Argentine government. Its laboratory equipment included modern instruments such as centrifuges, kymographs, and Van Slyke apparatuses. The institute's library received seventy journals, including the mainstream publications in physiology, biochemistry, and pharmacology.[9]

Institutional stability was possible because Argentina enjoyed political stability between the late nineteenth century and 1930. The two major parties of the period, the Unión Cívica Radical—supported by the middle class—and the Partido Conservador—representing the landed aristocracy—had many points in common and never sought drastic changes in the country's social and economic structure.[10] Radicals and Conservatives alike supported the Faculty of Medicine of the University of Buenos Aires and Houssay's institute because they were seen as investments that would increase the number of locally trained physicians; it was a matter of national prestige to offer medical education according to European standards.

The Institute of Physiology achieved a prominent position in part because of Houssay's promotion of physiology as the basic science that would most effectively improve the professional standing of Argentine medicine and because he was able to undertake a heavier teaching load in exchange for more staff and support for research. In 1921 the physiology course provided instruction for 1,250 students (50 percent more than had been enrolled before Houssay's appointment).[11] Houssay divided the class into 25 sections of 48 students in order to accommodate them with the limited laboratory facilities.

The burden of instruction to overcrowded classes was lessened thanks to one feature of Houssay's laboratory style: the *monitores* system. Well-prepared student *monitores* worked for low pay or on a voluntary basis, organizing laboratory demonstrations, alleviating the teaching load of professors, supervising experiments of younger students, and assisting older laboratory members with research. Many *monitores* were offered positions as paid assistants when they were available and followed scientific careers. Houssay selected *monitores* from the most talented students in the large physiology classes and recruited his closest disciples from among them.[12] He took advantage of his overcrowded classes, finding within them a group of low-paid but skilled operatives.

[9] Bernardo Houssay, "Institute of Physiology, Faculty of Medical Sciences, University of Buenos Aires," in *Methods and Problems of Medical Education*, ed. Rockefeller Foundation (New York: Rockefeller Foundation, 1932), pp. 1–11.

[10] See Richard J. Walter, *The Province of Buenos Aires and Argentine Politics, 1912–1943* (Cambridge/London: Cambridge Univ. Press, 1985).

[11] Houssay's defense of physiology was typical of that offered by many physiologists; see Gerald L. Geison, "Divided We Stand: Physiologists and Clinicians in the American Context," in *The Therapeutic Revolution: Essays in the Social History of American Medicine*, ed. Morris J. Vogel and Charles E. Rosenberg (Philadelphia: Univ. Pennsylvania Press, 1979), pp. 67–107. For enrollments in the physiology course see Archivo de la Facultad de Ciencias Médicas de Buenos Aires (AFCM), Dossier Bernardo Houssay, Vol. 1, 1901–1931.

[12] Virgilio G. Foglia, "Prefacio," in *Bernardo Houssay: Su vida y su obra, 1887–1971*, ed. Foglia and Venancio Deulofeu (Buenos Aires: Academia Nacional de Ciencias Exactas, Físicas y Naturales, 1981), p. 21. The system was explained by a Rockefeller Foundation officer: "The best students get the attention of the chiefs; the masses are not bothered about. Houssay picks 25 out of 400 and gives them a special course. It is from this selected group that his pupils come." Robert A. Lambert Diary, 6 Aug. 1940, RFA, RG 2 (stacks), Series 300, Box 560, Folder 3806.

Another characteristic of Houssay's laboratory style, related to the *monitores*, was his system of performing experiments in assembly-line fashion. This system saved time, multiplied the number and variety of animals operated on, and produced significant yields in terms of publications. At one time Houssay directed and supervised nearly a hundred associates working on different research problems. Vivid illustrations of the assembly-line feature of Houssay's style were provided by his students. One recalled that when Houssay operated on toads in "series in a long table, one [researcher] applied anesthesia and passed [the toad] to the next researcher, who made the incision in the skin; then Houssay extracted the pancreas and passed [the animal] to the one who sutured." A disciple who studied at Harvard "smiled in silence" when contrasting Houssay's "wholesale experiments" with the American practice of operating on "one cat" at a time; another, who studied in Italy and France, confessed that it was difficult to find a European laboratory where time was used to such complete advantage as in Buenos Aires.[13] This style of work reinforced Houssay's control of laboratory life and increased his professional visibility, since his name appeared on almost all of the publications.

Houssay's laboratory style was facilitated by the municipality and slaughterhouses of Buenos Aires, which captured and butchered thousands of animals per week and donated dogs and glands to Houssay's laboratory. The toad (*Bufo arenarum*), the other preferred animal for Houssay's laboratory experiments, was also abundant and cheap (it was also easy to operate on, resisted trauma, and developed clear symptoms). The availability of inexpensive animal material contributed to Houssay's emphasis on the advantages of working with small budgets and little equipment; he considered wealth and excessive instrumentation unpropitious for the development of intellectual powers. (Houssay's method for teaching his pupils to be economical included leaving messages on minute pieces of paper during his daily laboratory rounds.) The *monitores* system, the massive scale of experiments, and the belief in technological poverty as an asset combined to create a distinct laboratory style that would enable Argentine physiology to compete with European and American physiological laboratories characterized by well-paid staffs, specialized investigations, and sophisticated and expensive equipment.[14]

Houssay's laboratory style was instrumental for progress in what became the main

[13] Robert M. Hawthorne, Jr., "Bernardo Alberto Houssay, 1947," in *The Nobel Prize Winners: Physiology or Medicine*, Vol. 2, ed. Frank N. Magill (Pasadena, Calif.: Salem, 1991), pp. 562–571, on p. 569 (supervising nearly a hundred associates); Foglia, "Prefacio," p. 37 (toad operation); Juan T. Lewis to Bernardo Houssay, 28 Apr. 1925, Museo Bernardo Houssay of Buenos Aires (MBH), Box Juan Lewis Correspondence 1926–1969, Folder Beca Lewis 1926 ("one cat"); and Enrique Hug to Houssay, 27 May 1925, MBH, Box Enrique Hug 1924–1961, Folder Hug 1924–1941 (use of time).

[14] According to Louise Marshall, new techniques used to register physiological functions were crucial for American prominence in neurophysiology; see Louise H. Marshall, "Instruments, Techniques, and Social Units in American Neurophysiology," in *Physiology in the American Context*, ed. Geison (cit. n. 1), pp. 351–370. For the development of physiology during the late nineteenth and early twentieth centuries see *ibid.*; Geison, *Michael Foster and the Cambridge School of Physiology: The Scientific Enterprise in Late Victorian Society* (Princeton, N.J.: Princeton Univ. Press, 1978); Saul Benison, A. Clifford Barger, and Elin L. Wolfe, *Walter B. Cannon: The Life and Times of a Young Scientist* (Cambridge, Mass.: Harvard Univ. Press, 1987); John Harley Warner, "Physiology," in *The Education of American Physicians: Historical Essays*, ed. Ronald L. Numbers (Berkeley: Univ. California Press, 1979), pp. 48–71; Arthur F. W. Hughes, "A History of Endocrinology," *Journal of the History of Medicine and Allied Sciences*, 1977, *32*:292–313: Frederic L. Holmes, "Joseph Barcroft and the Fixity of the Internal Environment," *Journal of the History of Biology*, 1969, *2*:89–122; and Merriley Borell, "Setting the Standards for a New Science: Edward Schafer and Endocrinology," *Med. Hist.*, 1978, *22*:282–290.

research subject at the Institute of Physiology during its early years. Before he was appointed to the chair of physiology Houssay's research interests were varied. His main focus (and the topic of his medical thesis) was the action of the hypophysis—the two-lobed gland located at the base of the brain—but he also studied venous pulse, hormonal stimulants found in milk, the physiological action of curare, and the action of venom from snakes, spiders, and scorpions on horses, cattle, and dogs.[15] From the 1920s Houssay concentrated on the hypophysis. His study of this gland focused on its link with diabetes mellitus, a disorder characterized by the body's inability to metabolize carbohydrates.

Houssay's contribution furthered the work of European and North American investigators who had demonstrated that diabetes was related to the pancreas. Among these were Charles E. Brown-Séquard, who suggested the relationship between the disease and the absence of certain internal secretions; Paul Langerhans, who described the islet cells in the pancreas; William M. Bayliss and Ernest H. Starling, who demonstrated the chemical mechanism of pancreatic juice secretion; and Joseph von Mering and Oskar Minkowski, who clarified the link between the pancreas and diabetes (when they removed the pancreas to observe its effects on digestion, their experimental animals developed diabetes). This work prompted studies focused on extraction of the pancreatic substance that controlled diabetes, in order to use it to fight the disease. In 1921 scientists at Toronto isolated what they called insulin, the secretion from the Langerhans islets. This new material reinforced the idea that the pancreas was the only organ involved in diabetes, an idea that Houssay would challenge. Administration of insulin controlled but did not cure the disease; still, its success encouraged the belief that diseases of endocrine origin could be treated through compensatory mechanisms and raised high hopes for the therapeutic possibilities of physiology. Expectations favored the rapid dissemination of insulin all over the world, including Buenos Aires.[16]

From 1923 on Houssay and members of his institute experimented with insulin in dogs from which the hypophysis had been removed. They found that these dogs were extremely sensitive to insulin. Later they removed the pancreas as well (the pancreatectomized-hypophysectomized dogs came to be known as Houssay animals). The depancreatized dogs became diabetic, but when only the anterior lobe of the hypophysis was removed the disease was considerably less severe. In contrast, dogs with no pancreas but with the hypophysis intact presented more severe symptoms of diabetes. The doubly operated animals survived for six to nine months without insulin, whereas depancreatized dogs seldom survived more than three weeks without insulin. Finally, Houssay proved that diabetes could be produced by injecting dogs with growth hormone isolated from the hypophysis.[17]

In demonstrating that more than one organ was involved, Houssay reconceptual-

[15] The thesis was published as a book: Bernardo A. Houssay, *Estudios sobre la acción de los extractos hipofisiarios: Ensayos sobre la fisiología del lóbulo posterior* (Buenos Aires: La Ciencia Médica, 1911). An update of research on the topic was Houssay, *La acción fisiológica de los extractos hipofisiarios* (Buenos Aires: Talleres Gráficos A. Flaiban, 1918).

[16] See Michael Bliss, *The Discovery of Insulin* (Toronto: McClelland & Stewart, 1982). Insulin was isolated at Buenos Aires as early as 1923; see Alfredo Sordelli and Juan T. Lewis, *Insulina* (Buenos Aires: El Ateneo, 1924).

[17] An account of Houssay's work appears in Bernardo A. Houssay, "History of Hypophysial Diabetes," in *Essays in Biology in Honor of Herbert M. Evans* (Berkeley: Univ. California Press, 1943), pp. 247–256.

ized diabetes mellitus as a metabolic disease of endocrine equilibrium. He also suggested that control of carbohydrate metabolism rested not simply in the presence of insulin but, rather, in its balance with other hormones, produced by the hypophysis, which in a sense oppose the physiological effects of insulin. More generally, Houssay's laboratory style made it possible to identify a biological phenomenon common to many animal species. During the 1930s Houssay and the members of his institute repeated the study in mammals, fish, amphibians, and reptiles and confirmed that the absence of the hypophysis lessens the severity of all manifestations of diabetes mellitus. Houssay could make such observations across species lines because his laboratory style made the most of the labor resources offered by the overcrowded Argentine system of higher education.

Houssay's work was part of the general attention being paid to the internal secretions of ductless glands, such as the thyroid, the adrenal glands, the ovaries, and the hypophysis, that released chemical substances, known as hormones, directly into the bloodstream. The new specialty dealing with the physiological and regulatory functions of these glands was called endocrinology. From the 1920s U.S. scientists began to rise to international leadership in the new field, partly thanks to the support of the Committee for Research in Problems of Sex of the National Research Council and the Rockefeller Foundation, which were interested in studies of the ductless glands and hormones that could illuminate issues of growth, body activities, behavior, old age, and sexuality.[18]

Houssay's findings about multiorgan involvement in diabetes were coincident with the ideas of European and American physiologists, such as Walter B. Cannon of Harvard University, about the importance of hormonal balance and about the overaction of a gland in upsetting that balance.[19] Part of Houssay's talent was to illustrate these ideas by working on topics about which little was known and where international competition was scarce. In the early 1920s physiological knowledge regarding the relationship between the ductless glands and metabolic processes was deficient, and the deeply placed hypophysis was considered the most difficult ductless gland to approach. Houssay opened new avenues for research by focusing on the anterior hypophysis and other endocrine glands that were found to play a role in diabetes.

Houssay's work in endocrinology was instrumental in fostering his international reputation as an outstanding scientist and in the growth of the Institute of Physiology of Buenos Aires. By 1940 the institute was a central part of the Faculty of Medicine, with a staff of 130 instructors who taught physiology, biochemistry, and biophysics to 891 medical, pharmacy, and dental students.[20] Houssay's disciples worked on the

[18] See Humphry Davy Rolleston, *The Endocrine Glands in Health and Disease* (Oxford: Oxford Univ. Press, 1936); and the special section on endocrinology of the *Journal of the History of Biology*, 1976, *9*. The creation of the Endocrine Society and of its journal *Endocrinology* can be traced to 1917; see Hans Lisser, "The Endocrine Society: The First Forty Years (1917–1957)," *Endocrinology*, 1967, *80*:5–28, on p. 16. Houssay's English version of his findings that hypophysectomy greatly reduced the severity of experimentally induced diabetes appeared in *Endocrinology* after being rejected by other U.S. journals, which considered his findings "surprising": Bernardo A. Houssay and Alberto Biasotti, "The Hypophysis, Carbohydrate Metabolism, and Diabetes," *Endocrinology*, 1931, *15*:511–523.

[19] See Carl Wiggers, "Physiology from 1900 to 1920: Incidents, Accidents, and Advances," *Annual Review of Physiology*, 1951, *13*:547–566; and the chapter on general physiology in Garland Allen, *Life Science in the Twentieth Century* (Cambridge: Cambridge Univ. Press, 1975).

[20] Houssay to R. A. Lambert, 7 Nov. 1940, RFA, RG 1.1, Series 301, Box 3, Folder 31; and "Scientific Institutions in Latin America" (cit. n. 8).

hypophysis, carbohydrate metabolism, and related topics such as the role played by the adrenals and the thyroid in carbohydrate metabolism, the relation of the kidneys and adrenals to blood pressure, and, more broadly, the part played by endocrine glands in the interrelated mechanisms that regulate different bodily functions.

At Houssay's institute, overworked and underpaid researchers were inspired and rallied by a severe and strict chief who was proud of never taking a vacation, who supervised the resolution of laboratory problems, who taught his staff not to squander time, and whose response to an apology was "Qui s'excuse, s'accuse." Houssay hoped that his institute and his faculty would head the reform of South American medical science and that Spanish would become an international scientific language. In 1924 he shared his hope with the dean of the Faculty of Medicine: "the moment has come when our faculty can become a scientific center of South America and later of the world."[21] Like many Argentineans, Houssay believed in a manifest destiny for his country.

Research and institutional work were not the only sources of Houssay's prominence. He was engaged in a crusade to redefine academic life in Argentina and wrote articles that advocated research as the primary function of the university, limiting the number of students admitted into medicine, and the importance of laboratory work and full-time positions in the basic sciences. In addition, as president of the Argentine Society of Biology, an umbrella organization created in 1919, and of the Society for the Advancement of Science, a nonprofit private foundation created in 1934, he became the foremost spokesman for Argentine science.[22]

Houssay maintained his prominent position as a spokesman for science during the 1930s, when the legitimacy of the Argentine political system began to erode. The Depression affected an economy that was critically vulnerable to fluctuations in world markets and made it evident that the benefits of the export economy did not trickle down to the lower class and to the interior provinces. In 1930 a military coup supported by the Conservatives ousted a Radical president and opened a thirteen-year period of controlled elections and economic policies favorable to the landholders and to the British. According to a 1933 treaty that many considered anti-industrial, Argentina had to buy British manufactures as the alternative to losing its agricultural outlets to Australian and Canadian exports.[23] These events did not directly affect Houssay's institute, which continued to receive support from the state.

Nonetheless, and in spite of all their accomplishments, Argentine physiologists faced difficulties, especially in terms of the heavy teaching load, the acquisition of equipment and supplies, which came from abroad, and the opportunities for postgraduate training.[24] These problems began to be partially solved by the association of Argentine physiology with the Rockefeller Foundation.

[21] Foglia, "Prefacio" (cit. n. 12), p. 20 (response to apology); and Houssay to Julio Iribarne, 4 Mar. 1925, AFCM, Dossier Bernardo Houssay, Vol. 1, 1901–1931.

[22] "The Argentine Association for the Progress of Science (AAPC), 22 Jan. 1942," RFA, RG 1.1, Series 301, Box 4, Folder 40. Houssay's articles on academic reform appear in Barrios Medina and Paladini, comps., *Escritos y discursos* (cit. n. 6).

[23] The period from 1930 to 1943 is also known as the "Infamous Decade." See Darío Cantón, José L. Moreno, and Alberto Ciria, *Argentina: La democracia constitucional y su crisis* (Buenos Aires: Editorial Paidos, 1990).

[24] Houssay to Rafael Bullrich, 14 Nov. 1932, AFCM, Dossier Bernardo Houssay, Vol. 2, 1931–1937.

II. THE AMERICAN FOUNDATION

In the late 1920s Houssay initiated an active relationship with the Rockefeller Foundation (RF) in order to train Argentineans in the United States. The first disciple of Houssay who received an RF fellowship was Juan T. Lewis, who in 1925 went to Harvard to work with Walter B. Cannon. Cannon and Lewis studied the influence of emotional excitement on adrenal secretion and the denervated heart as an indicator of sympathetic activity. These investigations reinforced Cannon's view that the main function of the autonomic nervous system was the maintenance of a uniform condition, or "homeostasis," in the body, an idea that Houssay shared.[25]

In 1928 Lewis was back in Buenos Aires, working in a temporary position at the Institute of Physiology. The process of adjustment was daunting, as it is for many scientists from developing countries who return home after being trained in a modern laboratory. Lewis's difficulties included a small library, the envy of colleagues, and little recognition, outside of Houssay's laboratory, for research.[26] In addition, there was no job security because no expansion of the full-time staff of the Buenos Aires institute was expected.

Lewis and other disciples of Houssay found a remarkable solution to their problems in provincial diversification. This trend was unusual for Latin America in the 1930s, where major intellectual activities were concentrated in the capital cities. In 1931, after a competition, Lewis was appointed the first full-time professor of physiology of the medical faculty of the Universidad Nacional del Litoral and the director of its new Institute of Physiology. The faculty was located in Rosario, the second-largest city in Argentina, about 180 miles northwest of Buenos Aires. RF grants helped the Rosario institute to buy equipment, subscribe to journals, and hire assistants; just as important, the international recognition signaled by Rockefeller involvement helped justify demands for more local support. Lewis's optimism in these years is clear in a letter to Cannon: "Our country will soon begin to count in the scientific world."[27]

In the following years Lewis attracted more support from the RF, the government, and Rosario's elite. With this aid the Institute of Physiology of Rosario was able to maintain a small but permanent staff, which by 1940 grew to twenty-one people. They studied adrenocortical function in pregnancy, the relationship between the lymphocytes and the thymus, the pharmacological action of *yerba mate* (a regional drink

[25] Lewis worked with Houssay at the Institute of Physiology after graduating from the Faculty of Medicine in 1920 with a thesis on the adrenals. See Juan T. Lewis, *Antecedentes, títulos y trabajos presentados a la Universidad Nacional del Litoral al hacerse cargo de la Cátedra de Fisiología en la Escuela de Medicina de Rosario* (Buenos Aires: Imprenta Frascoli y Bindi, 1929). The concept of homeostasis is summarized in Walter B. Cannon, *The Wisdom of the Body* (New York: Norton, 1932). On Cannon see Benison *et al.*, *Walter B. Cannon* (cit. n. 14). Cannon and Lewis's collaborations included Walter B. Cannon, Juan T. Lewis, and S. W. Britton, "Studies on the Conditions of Activity in Endocrine Glands, XVII: A Lasting Preparation of the Denervated Heart for Detecting Internal Secretion, with Evidence for Accessory Accelerator Fibers from the Thoracic Sympathetic Chain," *American Journal of Physiology*, 1926, *77*:326–352.

[26] Lewis wrote a dramatic letter to Cannon describing the obstacles that he and other Argentineans encountered in a society where "the place of the scientist . . . is still to be made": Lewis to Walter B. Cannon, 22 Jan. 1932, Cannon Papers, Box 65, Folder 863, Francis Countway Library, Harvard Medical School, Boston, Massachusetts.

[27] "John T. Lewis," Rockefeller Fellowship Cards, RAC (on Lewis's appointment in Rosario); and Lewis to Cannon, 24 Jan. 1935, Cannon Papers, Box 65, Folder 864. The first grant to Lewis's institute was awarded in 1935 by the Congress of Argentina; see Lewis to Alan Gregg, 27 Feb. 1935, RFA, RG 1.1, Series 301, Box 1, Folder 12.

containing caffeine), and general aspects of the thyroid and parathyroid. Like the Buenos Aires Institute of Physiology, Lewis's institute offered instruction in physiology, biochemistry, and biophysics.[28] Despite his achievements, Lewis faced difficulties such as delays in the payment of his salary, quarrels with deans who considered receiving foreign donations improper, and the opposition of students who resisted strict academic requirements.

The other remarkable example of provincial diversification in Argentine physiology occurred under Oscar Orías, who graduated in 1928 from the Buenos Aires Faculty of Medicine. In 1930 he received an RF fellowship to work with Carl J. Wiggers of Case Western Reserve on the use of graphic recording devices to register heart activities.[29] When his fellowship was extended for a second year, Orías studied for a term with Cannon, spent the summer at Woods Hole, and then, for the rest of 1931, worked with Herbert S. Gasser at Washington University in St. Louis. In January 1933 Orías was back in Buenos Aires, working as the director of research in circulation at Houssay's institute: an RF grant enabled him to equip a laboratory for graphic recording of cardiac activity and venous arterial pulse. The technique, which was a novelty in Argentina, allowed Orías to form a new line of research on the heart sounds in pathological conditions; his work also served to promote the use of modern cardiologic appliances and, more broadly, to reinforce the belief that physiology would improve clinical medicine.[30]

In 1934 the chair of physiology at the provincial University of Córdoba, located 240 miles northwest of Rosario, became vacant. When university authorities asked Houssay to suggest a candidate, he recommended the young Orías in the highest terms. In supporting Orías's candidacy, Houssay fought against the assumption that, as usual, a European scientist would be hired (the professors of physiology in Córdoba and, before Lewis, in Rosario had been Italians and Germans). It was standard practice in Argentine universities to offer teaching contracts in the basic sciences to European professors. Houssay argued that foreigners saw these engagements as temporary dislocations from their European careers and that such appointments demoralized Argentine scientists willing to make more permanent commitments. Houssay's efforts succeeded, and Orías was offered a five-year contract to direct the Córdoba Institute of Physiology. After these years he became a full professor.

At Córdoba Orías surrounded himself with eight enthusiastic full-time researchers who worked primarily on cardiology and the physiology of circulation. Like Lewis, Orías confronted envy, bureaucratic indifference, and complaints from the students who failed his course. Like Houssay, he used his salary to pay for some scientific publications that were not acquired by the university library. There was also a dra-

[28] "Grant-in-Aid, Aid to research in physiology and pharmacology in the Faculty of Medicine of the National University of the Litoral, Rosario, Argentina, under the direction of Professors Juan T. Lewis and Enrique Hug," 6 Aug. 1941, RFA, RG 1.1, Series 301, Box 1, Folder 15.

[29] Carl J. Wiggers and Oscar Orías coauthored "The Circulatory Changes during Hyperthermia Produced by Short Radio Waves Radiothermia," *Amer. J. Physiol.*, 1932, *100*:614–628. Information on Orías is drawn from Eduardo Braun Menéndez, "Professor Oscar Orías (1905–1955)," *Acta Physiol. Latinoamer.*, 1955, *5*:52–56; and Orías, *Antecedentes, títulos y trabajos presentados a la Universidad Nacional de Córdoba al hacerse cargo de la Cátedra de Fisiología en la Facultad de Ciencias Médicas* (Buenos Aires: Imprenta Amorrotu, 1935).

[30] Orías wrote a book that aroused great interest in graphic recording: Oscar Orías, *Registro e interpretación de la actividad cardíaca* (Buenos Aires: El Ateneo, 1933). See also Orías and Eduardo Braun Menéndez, *Los ruidos cardíacos en condiciones normales y patológicas* (Buenos Aires: El Ateneo, 1937), which was translated into English in 1939.

matic shortage of space at Córdoba: Orías's office served as the library and staff room, and the laboratory accommodated 30 students per session for a class of 200. An American visitor to the institute was impressed that "so much research can be carried on under such poor physical conditions."[31]

The 1930s were crucial for the institutional development and the consolidation of a laboratory style in Argentine physiology. The institutes that achieved a prominent place in Argentine science were those headed by Houssay in Buenos Aires, Lewis in Rosario, and Orías in Córdoba; thanks to them, Argentine physiology was well regarded by scientists around the world. The new perception appeared clear in 1935, when Houssay visited the United States to receive an honorary degree from Harvard and to deliver the prestigious Dunham Lecture. During the visit he gave additional lectures in various U.S. universities. A few years later an article published by Cannon in *Science* celebrated Houssay's "achievements" as a sign of the "capacity of Latin Americans . . . to bring to fruition studies of first-rate importance."[32]

This sanguine American view of Argentine science was based in part on the assumption that Argentine physiology was following American and European scientific patterns. The hope of promoting American-style scientific development in Argentina was at the heart of the RF's interest and support; in Argentina, as in a number of Latin American countries, the RF was concerned with the transplantation of the American academic model.

After a major reorganization in 1928 and during the 1930s, the RF practiced a system of scientific patronage that tried to identify and promote specific disciplines within the life sciences.[33] Prominent practitioners in these fields, from the United States and around the world, began to receive RF grants, especially from the Division of Natural Sciences. Until the 1940s research grants to Latin Americans were awarded through the Division of Medical Science, which supported general programs in the Latin American medical schools. Grants to Latin American physiologists were given under the assumption that good physiological research would set an example for other laboratory workers and would promote the reform of the Latin American medical schools.

The RF assumption that Argentine physiology should follow an American pattern was to some extent shared by Argentineans. The inclination of Argentine physiologists toward the United States also grew out of their awareness of the impact that World War II would have on world science. In 1940 Orías urged Houssay to increase contacts with the United States and the RF; he foresaw that France would lose its scientific influence after the war, and he recognized that the rapport of Houssay and his disciples with the United States was "greater every day."[34]

It is interesting to note that when discussing the matter among themselves Argentine physiologists combined the idea of replicating American practices with an over-

[31] Oscar Orías to Houssay, 19 Apr. 1936, MBH, Box Correspondencia Oscar Orías 1935–1948, Folder Oscar Orías—Cátedra de Fisiología 1933–1936 (envy, indifference, complaints); and Robert A. Lambert Diary, 5 Aug. 1940, RFA, RG 2 (stacks), Series 300, Box 560, Folder 3806 (quotation). The space problems were alleviated after Orías received RF grants.

[32] Walter B. Cannon, "Problems Confronting Medical Investigators," *Science*, 1941, *94*:171–179, on p. 171.

[33] See Robert E. Kohler, *Partners in Science: Foundations and Natural Scientists, 1900–1945* (Chicago: Univ. Chicago Press, 1991), pp. 233, 265–302.

[34] Orías to Houssay, 2 Aug. 1940, MBH, Box Correspondencia Oscar Orías 1935–1948, Folder Oscar Orías 1938–1941.

confidence in their own prospects. Imitation was not understood as passive identification with the American academic model. Comparison of his Harvard and Buenos Aires experiences led Lewis to believe that Argentineans practiced a more "extensive" laboratory style of physiology that allowed comparative work whose insights would reach and even surpass those of U.S. physiology. Lewis considered the Argentine style "potentially superior" to American medical science, which he found pampered by sophisticated equipment, overspecialized, hindered by excessive rules, lacking a global vision, and affording little time for "creative leisure." With the self-confidence often attributed to Argentineans, Lewis confessed to Houssay: "I am still convinced that we will go farther [than the Americans]."[35] Not surprisingly, however, this belief in the superiority of Argentine laboratory style was never shared with the RF.

The process of imitative development became a central issue for the RF. Great hopes were at stake: in the early 1940s the foundation considered Argentina a leader in South America, a nation able to invest its resources for the betterment of science and education. In 1941 the RF established in Buenos Aires the Rio de la Plata and Andean Regional Office of the International Health Division, which was responsible for work in seven South American countries. During the early 1940s little happened in Argentine science and even less was done by the RF in Argentina without the involvement of Houssay. When Argentineans applied for fellowships or submitted papers to U.S. journals without his consent or approval, Houssay warned the RF that fellowships were "not always offered to well selected candidates" and that some U.S. medical journals were accepting papers from South American scientists "that would be refused by us."[36]

In 1940 the RF awarded a three-year grant of $25,000 to the Institute of Physiology of Buenos Aires for equipment purchases and salaries for assistants. This was, to that point, the biggest grant ever awarded to Argentine physiology by an otherwise cautious foundation (see Table 1). It is paradoxical that Houssay's generalist and low-technology laboratory style received significant support from an American foundation at a time when various sources of U.S. support for the life sciences were favoring specialization and expensive and sophisticated instrumentation in the American life sciences. It was probably Houssay's dominant position in Argentine science and the potential of that science to promote more general reform along American lines that led the foundation to overlook the fact that Houssay's generalist style in endocrinology would be considered obsolete by many, especially by physiologists well versed in biochemistry. Houssay stuck to a holistic understanding of physiology for years. In a 1956 article he defined biochemistry as a branch of physiology: "After the analytical study of the chemical process has been completed it is necessary to investigate the part it plays in the functioning of the organism, its integration with other functions, and homeostasis. Thus we are back in physiology."[37]

[35] Lewis to Houssay, 11 Aug. 1925, 28 Apr. 1925, MBH, Box Juan Lewis Correspondence 1926–1969, Folder Beca Lewis 1926.

[36] Houssay to Lambert, 10 May 1944, RFA, RG 1.2, Series 301, Box 1, Folder 3; and Houssay to Cannon, 22 Nov. 1943, Cannon Papers, Box 65, Folder 86. All but one of the RF fellowships awarded to Argentine scientists and physicians went to candidates recommended by Houssay: "Project Research in Cardiology at the Faculty of Medicine in Buenos Aires, 13 February 1940," RFA, RG 1.1, Series 301, Box 3, Folder 26.

[37] Bernardo Houssay, "Trends in Physiology as Seen from South America," *Annu. Rev. Physiol.*, 1956, *18*:1–12; rpt. in Barrios Medina and Paladini, comps., *Escritos y discursos* (cit. n. 6), pp. 199–211, on p. 206. For the $25,000 RF grant see Lambert to Houssay, 6 Nov. 1940, RFA, RG 1.1, Series 301, Box 3, Folder 31. For a sketch of the beginnings of biochemistry in Buenos Aires see note 44.

Table 1. *Rockefeller Foundation Grants to Argentine Physiology by Location, 1933–1960*

Years	Buenos Aires	Rosario	Córdoba	Other	Total
1933–1935	–	$3,000	$600	0	$3,600
1936–1940	$25,000	0	0	0	$25,000
1941–1945	$49,801	$4,000	$5,000	0	$58,801
1946–1950	$20,000	$6,000	$7,500	0	$33,500
1951–1955	$6,635	0	$8,000	0	$14,635
1956–1960	$32,000	0	0	$25,800	$57,800
Totals	$133,436	$13,000	$21,100	$25,800	$193,336

NOTE: Before 1943 RF grants to Buenos Aires, Rosario, and Córdoba were appropriated to the institutes of physiology. After 1943 the donations were given to the private institutes of Houssay, Orías, and Lewis.

SOURCE: Rockefeller Foundation Archives, "Oscar Orías," "John T. Lewis," Fellowships Cards, RG 1.1, Series 301, Boxes 1, 2, 3, 4; RG 1.2, Series 301, Boxes 1, 2, 3, 5, 8, Rockefeller Archive Center, North Tarrytown, New York.

Argentine physiology and the challenges it faced shifted dramatically in 1943, when a military coup censored the press, outlawed political parties, and took control of the universities. This marked the end of the period of fraudulent democracy inaugurated in 1930 and the beginning of authoritarianism.

III. THE LAUREATE AND THE DICTATOR

The event that led to the coup was triggered by the position adopted by Argentina during most of World War II. At the beginning of the war Argentina continued selling foodstuffs to Britain and the United States but refused to join the Allies' military effort, choosing instead to maintain a policy of neutrality. This policy, which was unique in Latin America, reflected the German influence among the Prussian-style Argentine military. In June 1943 a nationalist army group organized a coup, arguing that the government was about to reject neutrality and join the Allies.

The policy of neutrality was opposed by Houssay and other intellectuals who in October 1943 signed a manifesto demanding the return of a democratic government, the breaking of diplomatic relations with the Axis, and the support of the Allies. Shortly afterward the government dismissed the university professors who signed the manifesto, including Houssay, Lewis, and Orías. Although Houssay received offers from Chile, Uruguay, Brazil, and the United States, he was determined to "struggle to the end" and "to go on working in physiology" in his country.[38]

After their dismissal Houssay and his associates decided to create a private research center, the Instituto de Biología y Medicina Experimental (IBME) (Figure 1). During its early years significant support came from the private Argentine Sauberán Foundation and from friends of Houssay. Between 1944 and 1947 the RF appro-

[38] Houssay to Lambert, 10 May 1944, RFA, RG 1.2, Series 301, Box 1, Folder 3; and Houssay to Cannon, 22 Nov. 1943, Cannon Papers, Box 65, Folder 86. The "Declaración sobre Democracia Efectiva y Solidaridad Latinoamericana" appeared in the newspapers *La Prensa* and *La Nación* on 15 Oct. 1943. Houssay continued to receive offers from abroad. In 1949 he was asked to become director of the Laboratory of Endocrinology and Nutrition at the U.S. National Institutes of Health; the offer included hiring Houssay's staff: Houssay to Dr. C. Chandes, 10 Feb. 1949, Memorial Hurtado, Instituto de Investigaciones de Altura, Universidad Peruana Cayetano Heredia, Lima.

Figure 1. *Houssay and staff at the Instituto de Biología y Medicina Experimental. Front row from left to right: Eduardo Braun Menéndez, Oscar Orías, Bernardo A. Houssay, and Juan T. Lewis. (Courtesy of the Rockefeller Archive Center.)*

priated $29,800 to the IBME and an international committee provided subscriptions to journals.[39] Ironically, during a period when highly sophisticated instrumentation increasingly dominated the most advanced laboratories of the world, Houssay's frugal investigative style got a new lease on life when he was forced to retreat into private research with limited facilities and resources. The international publicity that Houssay received as a symbol of academic resistance against authoritarianism tended

[39] The Sauberán Foundation's initial contribution was $21,000: Robert A. Lambert Diary, 25 Apr. 1947, RFA, RG 1.2, Series 301, Box 1, Folder 6. Data on RF appropriations appear in "Institute of Biology and Experimental Medicine—Buenos Aires, 13 June 1947," *ibid.*, Folder 2; and "A Laboratory Grows in Argentina," *ibid.*, Folder 4.

to obscure the fact that his laboratory style would be perceived by many physiologists as outdated.

The IBME was inaugurated with a small staff that included Orías, Lewis, and two younger men: Virgilio Foglia and Eduardo Braun Menéndez. The latter belonged to a wealthy family that provided the IBME with a house, adapted every inch to laboratory space. Research at the IBME during the first years of its existence was limited but diverse. In endocrinology, the problems studied included pancreatic diabetes, fat metabolism, and arterial hypertension (Braun Menéndez became internationally known for his contribution to the discovery of renin and its impact on arterial hypertension of renal origin). During these years Houssay and his group took advantage of their general approach to physiology to put together the textbook *Fisiología humana*, which was translated into several languages and received worldwide distribution.[40]

The relationship between the IBME and the military regime was tense. The authoritarian nature of the regime was consolidated with the ascendancy of army colonel Juan D. Perón, the leader of a group of pro-Axis officers.[41] As secretary of labor and social welfare in the 1943 military regime, Perón promoted the formation of new unions whose members supported his views and demanded social-security legislation. With the support of the working class, he launched a successful campaign in the 1946 presidential election.

Under Perón, Argentina's economy experienced a greater reduction in imports and an expansion of local industry to fill the gap (a process that had begun in the 1930s). Local industry grew as a result of the de facto protectionism provided by World War II and Argentina's shortage of foreign exchange with which to purchase European products. These developments weakened the landed aristocracy and enlarged the working class, which supported Perón. According to Perón, the export agricultural model, the aristocracy, and British economic domination were the causes of Argentina's weak industry. He believed that a strong state was needed to curb foreign control over national resources, to reorient agriculture toward the internal market, and to encourage the growth of national industry.

Perón demonstrated little regard for the universities. Government-appointed "intervenors" purged the faculties; Perón also created a mandatory course on his ideology, called *justicialismo*. By 1947 the intervenors had done their work: 1,073 professors were dismissed, were forced to retire, or chose to resign.[42] The IBME

[40] The group of researchers at the IBME initially numbered twelve; by 1947 it had increased to twenty-four. See Virgilio G. Foglia, "The History of Bernardo A. Houssay's Research Laboratory, Instituto de Biología y Medicina Experimental: The First Twenty Years, 1944–1963," *J. Hist. Med.*, 1980, *35*:380–397. For the textbook see Bernardo A. Houssay *et al.*, *Fisiología humana* (Buenos Aires: El Ateneo, 1945). Later editions were in French (1950), English (1951, 1955), Portuguese (1951), Greek (1961), and Italian (1965). On Braun Menéndez see Bernardo A. Houssay, "Vida y obra científica de Eduardo Braun Menéndez (1903–1959)," *Ciencia e Investigación*, 1959, *15*:97–104; and Juan T. Lewis, "Eduardo Braun Menéndez," *Acta Physiol. Latinoamer.*, 1959, *9*:1–4.

[41] Relations between the IBME and the government were difficult, even though the government decreed a short reinstatement of the dismissed professors. A retirement decree forced the fifty-eight-year-old Houssay to leave the university again in 1946 and to return to the IBME. Lewis, Orías, and Braun Menéndez followed him: Houssay to Lambert, 6 Mar. 1945, RFA, RG 1.1, Series 301, Box 3, Folder 36. Material on Perón is drawn from Joseph A. Page, *Perón: A Biography* (New York: Random House, 1983); and Tulio Halperín Donghi, *Historia argentina: La democracia de masas* (Buenos Aires: Editorial Paidos, 1991).

[42] The figure represented 40 percent of the university professors in the country: Houssay to E. K. Wickman, 21 Feb. 1947, Commonwealth Fund Collection, Box 77—Latin American Program, Folder

researchers endured police vigilance, anonymous threats, the campaign of the League against Vivisection encouraged by the government, and delays created by Argentine customs in deliveries of equipment addressed to the institute. In 1945 Lewis, three other IBME researchers, and two of Houssay's sons were briefly imprisoned.[43]

Even during the Perón years, however, Argentine physiology continued to grow and to exert worldwide influence. Houssay's disciples decided to extend the IBME experience to the provinces. In 1948 Orías inaugurated the Instituto de Investigación Médica Mercedes y Martín Ferreyra in Córdoba and Lewis created a private Institute of Medical Research in Rosario. Hugo Chiodi, a younger disciple, continued the pattern of provincial diversification: in 1949 he became the director of the Institute of High-Altitude Biology of the University of Tucumán (located about 665 miles northwest of Buenos Aires), where he studied the mechanisms of long-term acclimatization to high altitude.[44]

During the late 1940s and early 1950s scientists from Europe, Japan, and North and South America worked at the IBME for short periods. Its regional influence increased in the 1950s, when it housed the main editorial office of *Acta Physiologica Latinoamericana* (the journal of the Latin American Society of Physiological Sciences) and with the request by Brazil's Ministry of Education that Houssay and the IBME help to reorganize Brazilian physiology in a provincial university.[45]

The most significant international recognition for Argentine physiology, however, came in 1947, when Houssay received the Nobel Prize in Physiology and Medicine for his finding that the anterior lobe of the hypophysis produces a hormone that blocks the effect of insulin in glucose metabolism. That year's prize was awarded jointly; Houssay shared the honor with Carl and Gerty Cori of the United States. He was the first Latin American ever to receive a Nobel Prize in science.

After the award Perón's supporters intensified their accusations against Houssay: he was charged with displaying a cosmopolitan attitude, practicing an elitist style of teaching (the *monitores* system), neglecting the study of local public health problems, and recruiting his disciples from aristocratic families. These complaints reflected the strident nationalism and populism of Perón's followers; they also arose

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Miscellaneous—Latin American Fellowship Program, RAC. See also Harry Grundfest, "The Situation in Argentine Universities," *Science*, 1948, *107*:167–168; and William L. Munger, "Academic Freedom under Peron," *Antioch Review*, 1947, *7*:275–290.

[43] Only Houssay's closest disciples followed him to the IBME: John Janney to RBF (unidentified RF officer), 9 Dec. 1943, RFA, RG 1.2, Series 301, Box 1, Folder 2.

[44] The RF supported the new Córdoba institute: Orías to Lambert, 31 May 1948, RFA, RG 1.1, Series 301, Box 1, Folder 6. In 1956 Chiodi received a $10,000 RF grant: "Grant in aid, University of Tucumán, Argentina (Institute of High-Altitude Biology), 28 December 1956," *ibid.*, RG 1.2, Series 301, Box 5, Folder 40. Chiodi's line of work was begun in South America by Peruvian physiologists; see Cueto, "Andean Biology in Peru" (cit. n. 1).

Another success story, in a related field, was that of the biochemist Luis Leloir, who in 1946 formed the Instituto de Investigaciones Bioquímicas Fundación Campomar. In a manner reminiscent of Houssay's laboratory style, Leloir and his staff constructed a fraction collector using a toy train and chose to work on a relatively unexplored topic, the biosynthesis of saccharides. Leloir found an enzyme that catalyzed the reversible synthesis of lactose and discovered uridinediphosphate glucose (UDPG) and its role in galactose metabolism. Leloir received the Nobel Prize in chemistry for this work in 1970. Thus he became, after Houssay, the second Argentine scientist to receive the award. See Luis F. Leloir, "Far Away and Long Ago," *Annual Review of Biochemistry*, 1983, *52*:1–15; and Severo Ochoa, "Luis Federico Leloir, Nobel Prize in Chemistry 1970," *Acta Physiol. Latinoamer.*, 1970, *21*:172–176.

[45] An illuminating study of the first years of *Acta* is Hebe Vessuri, "Una estrategia de publicación científica para la fisiología latinoamericana: *Acta Physiologica Latinoamericana*, 1950–1971," *Interciencia*, 1989, *14*:9–13.

because Houssay's strict and rigid personality was at odds with the generally slack academic environment.[46] Another accusation was that Houssay supported the Allies and the United States because he received U.S. grants. This accusation worried the RF, all the more because the Eva Perón Foundation (created by the charismatic wife of the dictator) was seen as working in competition with the RF.[47]

Throughout Perón's rule (1946–1955), public denigration of the Argentine regime in U.S. newspapers was unrelenting. At one point the United States withdrew its ambassador from Buenos Aires and imposed an export embargo. Conflict increased when Perón nationalized institutions controlled by U.S. and European companies. In this context it was difficult for the RF to justify its support of Houssay, and the foundation leaned toward leaving Argentina. In 1949 the RF decided to close its office in Buenos Aires, where the political situation made its programs difficult to realize.[48] The decision to retrench reveals the RF's belief that "replication" in science was closely linked to political configurations. The RF was reluctant to venture into nations that were hostile to the foundation or to the United States, as was Argentina under Perón.

Two additional factors help to explain the RF's decision to close the Buenos Aires office. First, from the 1940s through the 1970s the foundation's emphasis in Latin America changed from medicine and public health to agriculture, a program that was concentrated in Mexico. Second, the RF held the view that grants to Latin American medical schools should have a regional impact and should establish the foundation for long-range developments to be carried on by locals.[49] A corollary of this view was that funds should not be used toward day-to-day support of recognized institutions or of institutes that had suffered political setbacks.

In 1955 Argentina was again in a state of political unrest. Perón was deposed by the military, which reinstated the professors who had been purged. Houssay returned, as director of the Institute of Physiology of the University of Buenos Aires, to an overcrowded institution; Perón's minimal entrance requirements had produced a great influx of students that was not supported by more infrastructure.[50]

[46] Houssay addressed everyone by the formal *Usted* (instead of the informal *vos* or *tú*), including his closest friends and his children—who addressed him by the very formal "Doctor Houssay." In addition, during oral exams to large classes Houssay used irritating posters, with "Talk" and "Sit down" written on them, to save time; see Marcelino Cerejido, *La nuca de Houssay: La ciencia argentina entre Biliken y el exilio* (Mexico City: Fondo de Cultura Económica, 1990), p. 31.

[47] In 1947 the RF officer in charge of the Buenos Aires office wrote to New York: "Government considers us as definitely anti-Peronista." Lewis W. Hackett to Lambert, 31 Dec. 1947, RFA , RG 1.1, Series 309, Box 5, Folder 48. For worries about the Eva Perón Foundation see Johannes H. Bauer, "Summary of Observation on a Visit to Buenos Aires, August 6 to 26, 1954," *ibid.*, Series 300, Box 1, Folder 3. Although the major activity of the Eva Perón Foundation was charitable work, including food and clothing handouts, it also funded clinics, hospitals, and pharmacies.

[48] See Roger Gravil, "Perón's Standing with the UK and USA after 1955," paper presented at the XVIth International Congress of the Latin American Studies Association, Washington, D.C., 4–6 Apr. 1991; and Joseph S. Tulchin, *Argentina and the United States: A Conflicted Relationship* (Boston: Twayne, 1990). The difficult relations between the RF and Houssay during the Perón regime are described in Marcos Cueto, "The Rockefeller Foundation's Medical Policy and Scientific Research in Latin America," *Social Studies of Science*, 1990, *20*:229–255.

[49] This view is presented as the "thought of the Trustees" in John M. Weir to Janney, 2 Nov. 1956, RFA, RG 1.2. Series 300, Box 2, Folder 16. On the early years of the agricultural program concentrated in Mexico see Joseph Cotter, "The Rockefeller Foundation's Mexican Agricultural Project: A Cross-Cultural Encounter, 1943–1949," in *Missionaries of Science*, ed. Cueto (cit. n. 1), pp. 100–129.

[50] Enrollment in Argentine universities grew from 68,460 students to 142,435 students between 1945 and 1955: Walter, *Student Politics in Argentina* (cit. n. 4), pp. 149, 6. As suggested by the inefficiency of agriculture and the limited growth of industry, Perón did not achieve economic independence for

In the post-Perón era the RF pointed to unstable political conditions to explain its reluctance to support Houssay's institute or to develop a program of any sort in Argentina. Although a democratic government was elected in 1958, the governments of Argentina and the United States were on good terms, and worldwide recognition for Argentine physiology continued (Buenos Aires was chosen as the site of the XXI International Congress of Physiological Sciences), the foundation held firm. In 1958 the IBME was declared a training center of the University of Buenos Aires, and Houssay hoped that the RF would supply some of its needs. The negative response was explained to Braun Menéndez in the following terms: "The arguments of 'need' and 'efforts' cannot, unfortunately, sway Foundation officers."[51]

By the late 1950s some of Houssay's disciples, disenchanted with the situation at home, began to leave Argentina for more stable positions abroad. After the mid 1960s, provoked by worsening political conditions, more life scientists emigrated from Argentina. Houssay—who died in 1971—condemned the "lack of patriotism" of the émigrés and argued that science could be done under any conditions. Writing to a neurophysiologist who had emigrated to a Brazilian university, Houssay urged him to return to "the motherland where you where born and raised, to the Faculty . . . that needs you imperiously."[52] Lacking attractive material conditions to offer, Houssay clung at the end of his career to what he had cherished throughout his life: pride in being an Argentinean.

IV. CONCLUSION

Thanks to their laboratory style and their original contributions to the international endocrinological framework of the early twentieth century, Houssay and his disciples made Argentine physiology an active and visible participant in international science. The construction of institutes of physiology incorporating physiology and biochemistry and the diversification to the provinces were among the strategies these Latin American scientists developed to accommodate to unfavorable conditions. In some respects the dictatorial regime of Perón had a negative impact on Houssay's laboratory style. With the university system under authoritarian control, and after losing his main audience and source of labor for laboratory work—physicians and medical students—it was difficult to maintain key elements of Houssay's laboratory style, such as the *monitores* and the "wholesale" experiments. Loss of the university connection during the Perón years had also damaged the "utilitarian" argument for phys-

Argentina; see Carlos H. Waisman, *Reversal of Development in Argentina: Postwar, Counterrevolutionary Policies, and the Structural Consequences* (Princeton, N.J.: Princeton Univ. Press, 1987).

[51] "XXI International Congress of Physiological Science, Buenos Aires, 9–15 August 1959," International Union of Physiological Sciences Papers, Folder 4, American Philosophical Society, Philadelphia, Pennsylvania; K. J. Franklin, *History of the International Congresses of Physiological Sciences, 1889–1968* (Baltimore: Waverly, 1968), p. 50; and Harry Miller to Braun Menéndez, 18 Mar. 1957, RFA, RG 1.2, Series 301, Box 3, Folder 21 (quotation). Houssay's resentment over the RF decision is described in Cueto, "Rockefeller Foundation's Medical Policy" (cit. n. 48).

[52] Bernardo Houssay, "La emigración de científicos, profesionales y técnicos de la Argentina," *Ciencia Interamericana*, 1966, *7*:6–12; and Houssay to Miguel Covian, 5 Feb. 1959, MBH, Box Miguel Covian (quotation). Between 1950 and 1960 about twenty thousand scientists and technicians emigrated from Argentina, and the country became the classic example of brain drain in the third world. The rate of emigration tripled between 1959 and 1964. See Roger I. M. Glass, "Emigration and the State of Argentine Science: 1946–1966" (B.A. thesis, Harvard Univ., 1967), p. 6.

iology: Houssay and his colleagues could no longer claim that their work was improving the training of Argentine physicians.

Yet Houssay and his school demonstrated a rather surprising long-term viability, partly because of political events. Houssay's almost dictatorial position in Argentine science and academic affairs during the 1930s and the international attention and support that Houssay and his staff received after the clash with Perón help to explain his continuing eminence in a period when his holistic and technologically unsophisticated style of physiological research was increasingly anomalous.

Study of the institutional characteristics and of the emergence of a laboratory style in Argentine physiology suggests some elements that might serve to distinguish the dynamics of Latin American science. Some characteristics, such as a certain degree of nationalism and emphasis on utilitarianism, can help to justify science when cultural esteem is scarce; these are common to the beginnings of scientific institutions in many developed and developing nations. Other institutional and laboratory features—the concentration of human resources and disciplines in one institution, the use of limited instrumentation to maximum advantage, the design of a limited but ingenious series of experiments crossing several disciplines, and the choice of topics less favored by foreign scientists—appear to be distinctive responses to the persistent adverse conditions typical of developing Latin American societies. In spite of economic limitations, inadequate academic infrastructures, "outmoded" approaches to research, and political obstacles, these features can contribute to produce first-class results, as the story of Argentine physiology suggests.